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#### VIA HAND DELIVERY & ELECTRONIC MAIL

October 20, 2022

Luly E. Massaro, Commission Clerk Rhode Island Public Utilities Commission 89 Jefferson Boulevard Warwick, RI 02888

RE: Docket No. 22-33-EE – 2023 Annual Energy Efficiency Plan Rhode Island Technical Reference Manual for the 2023 Program Year & Energy Efficiency Program Plan Studies

Dear Ms. Massaro:

On behalf of The Narragansett Electric Company d/b/a Rhode Island Energy ("Rhode Island Energy" or the "Company"), enclosed, please find the Company's Rhode Island Technical Reference Manual for Estimating Savings from Energy Efficiency Measures for the 2023 Program Year ("TRM") and five energy efficiency program measure and appendices as listed below ("EE Studies"). The TRM and EE Studies are being filed in support of the Company's 2023 Annual Energy Efficiency Program Plan as filed in the above-referenced docket.

#### EE Studies:

- Energy Efficiency Measures
- Appendices A through E

Thank you for your attention to this filing. If you have any questions or concerns, please do not hesitate to contact me at 401-709-3337.

Sincerely,

Leticia C. Pimentel

Leticia Pimentel

**Enclosures** 

cc: Docket No. 22-33-EE Service List

Margaret L. Hogan, Esq., Division

#### Certificate of Service

I hereby certify that a copy of the cover letter and any materials accompanying this certificate were electronically transmitted to the individuals listed below.

The paper copies of this filing are being hand delivered to the Rhode Island Public Utilities Commission and to the Rhode Island Division of Public Utilities and Carriers.

Heidi J. Seddon

October 20, 2022

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# Docket No. 22-33-EE – Rhode Island Energy's Energy Efficiency Plan 2023 Service list updated 10/18/22

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# Rhode Island Technical Reference Manual

For Estimating Savings from Energy Efficiency Measures

2023 Program Year

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#### Introduction

This Rhode Island Technical Reference Manual ("TRM") documents for regulatory agencies, customers, and other stakeholders the methodologies and assumptions used by Rhode Island Energy to estimate the savings, including reductions in energy and demand consumption and other resource and non-energy impacts, attributable to its electric and gas energy efficiency programs. This reference manual provides methods, formulas, and default assumptions for estimating energy, peak demand and other resource and non-energy impacts from efficiency measures.

Within this TRM, efficiency measures are organized by the sector for which the measure is eligible and by the primary energy source associated with the measure. The three sectors are Residential, Income Eligible and Commercial & Industrial ("C&I"). The primary energy sources addressed in this TRM are electricity and natural gas.

Each measure is presented as a "measure characterization." The measure characterizations provide mathematical equations for determining savings (algorithms), as well as default assumptions and sources, where applicable. In addition, any descriptions of calculation methods or baselines are provided as appropriate. The parameters for calculating savings are listed in the same order for each measure.

Algorithms are provided for estimating annual energy and peak demand impacts for primary and secondary energy sources if appropriate. In addition, algorithms or calculated results may be provided for other non-energy impacts (such as water savings or operation and maintenance cost savings). Assumptions are based on Rhode Island data where available. Where Rhode Island-specific data is not available, assumptions may be based on: 1) manufacturer and industry data, 2) a combination of the best available data from jurisdictions in the same region, or 3) engineering judgment to develop credible and realistic factors.

The TRM is reviewed and updated annually to reflect changes in technology, baselines, and evaluation results.

# The TRM in the Context of Energy Efficiency Programs

#### Overview

The purpose of this section is to show how the TRM fits into the process of administering energy efficiency programs in Rhode Island. This section explains how the TRM is connected to the following efforts:

- Planning,
- Annual reporting,
- Updates to Rhode Island Energy tracking systems,
- Evolution of program and measure cost effectiveness analysis tools,
- Evaluation, Measurement and Verification ("EM&V"),
- Quality control.

# **Planning and Reporting**

Rhode Island Energy is submitting this version of the RI TRM (the 2023 TRM) to the stakeholders along with its Energy Efficiency Program Plan ("EE Program Plan") for 2023.

The RI TRM provides regulators and stakeholders with documentation of the assumptions and algorithms that Rhode Island Energy will use in planning and reporting its energy savings for 2023. It can also be used to support qualification in ISO-New England Forward Capacity Market Auctions. However, due to the nature of planning, not all planning assumptions — such as those for Commercial and Industrial programs — are documented in this TRM. For these areas, the algorithms used to calculate planned savings are presented.

# **Updates to Program Administrator Tracking Systems**

Rhode Island Energy maintains a tracking system that contains the energy efficiency data that it uses to meet its annual reporting to the RI PUC. The current design of the tracking system influences the types of assumptions and algorithms that appear in this TRM. The current algorithms leverage inputs that Rhode Island Energy collects.

# **Evolution of Program and Measure Cost Effectiveness Analysis Tools**

The program and measure cost effectiveness analysis tools are Microsoft Excel workbooks used by Rhode Island Energy to ensure that the measures and programs that they implement meet the cost effectiveness requirements defined by the filed three year plans, standards, and annual plans. Rhode Island Energy also uses the output from the cost effectiveness analysis tools to develop the input (data, tables, and graphs) for its EE Program Plans and Year-End Reports. Rhode Island Energy envisions aligning the measure names and the categorization of measures in the TRM with the

measure names and categorization of measures in the cost effectiveness analysis tools either directly, or through the use of a translation tool.

#### **Evaluation, Measurement and Verification**

Evaluation, Measurement and Verification ("EM&V") ensures that the programs are evaluated, measured, and verified in a way that provides confidence to the public at large that the savings are real and in a way that enables Rhode Island Energy to report those savings to the EERMC and RI PUC with full confidence.

A secondary goal of creating a TRM is to identify areas where savings calculations can be improved. The TRM will inform future EM&V planning as a means to make these improvements.

For its Rhode Island programs, Rhode Island Energy may use evaluation results from other jurisdictions. For some of these, Rhode Island contributed sites and/or budgets. For others, the application of results from other jurisdictions is considered based on how similar the programs, delivery, and markets are to those in Rhode Island.

### **Quality Control**

Regulators and stakeholders can use the TRM to confirm that savings inputs and calculations are reasonable and reliable. However, the TRM cannot be used by regulators and stakeholders to replicate the Company's reported savings. The TRM does not provide regulators and stakeholders with data inputs at a level that is detailed enough to enable replication of the savings reported by Rhode Island Energy. These calculations occur within tracking systems, within separate Excel workbooks, and within cost effectiveness analysis tools. However, in the event that regulators and stakeholders request that Rhode Island Energy provide tracking system details, the reproduction of reported data will be possible using the TRM.

# **TRM Update Process**

#### Overview

This section describes the process for updating the TRM. The update process is synchronized with the filing of EE Program Plans.

Updates to the TRM can include:

- additions of new measures,
- updates to existing TRM measures due to:
  - o changes in baseline equipment or practices, affecting measure savings
  - o changes in efficient equipment or practices, affecting measure savings
  - o changes to deemed savings due the revised assumptions for algorithm parameter values (e.g., due to new market research or evaluation studies)
  - o other similar types of changes,
- updates to impact factors (e.g., due to new impact evaluation studies),
- · discontinuance of existing TRM measures, and
- updates to the glossary and other background material included in the TRM.

Each TRM is associated with a specific program year, which corresponds to the calendar year. The TRM for each program year is updated over time as needed to both plan for future program savings and to report actual savings.

## **Key Stakeholders and Responsibilities**

Key stakeholders and their responsibilities for the TRM updates are detailed in the following table.

Stakeholder	Responsibilities		
Rhode Island Energy	<ul> <li>Identify and perform needed updates to the TRM</li> <li>Provide TRM to interested stakeholders</li> </ul>		
Rhode Island EERMC and Division of Public Utilities and Carriers	<ul> <li>Review; suggest modifications; and accept TRM</li> <li>Assure coordination with Rhode Island Energy submissions of program plans and reported savings</li> </ul>		
Jointly	<ul> <li>Administrative coordination of TRM activities, including:</li> <li>Assure collaboration and consensus regarding TRM updates</li> <li>Assure updates are compiled and incorporated into the TRM</li> <li>Coordinate with related program activities (e.g., evaluation and program reporting processes)</li> </ul>		

#### **TRM Update Cycle**

The description below indicates the main milestones of the TRM update cycle over a period of two years. The identifier "program year" or "PY" is used to show that this cycle will be repeated every year. For example, for the 2023 Program Year, compilation of updates continues up through September 2022, for submission in the TRM in October 2022.

September PY-2 to September PY-1: The PY TRM will be updated as needed based on evaluation studies and any other updates.

After the PY-1 TRM has been filed, there may be updates to the TRM. The most common updates to the TRM will result from new evaluation studies. Results of evaluation studies will be integrated into the next version of the TRM as the studies are completed. Other updates may include the results of group discussions to adopt latest research or the addition or removal of energy efficiency measures

October/November (PY-1) prior to program year: The PY TRM is filed with Rhode Island Energy's PY EE program plan

The PY TRM is submitted to the PUC jointly with Rhode Island Energy's EE program plan. With regard to the program plans, the TRM is considered a "planning document" in that it provides the documentation for how the Company *plan* to count savings for that program year. The TRM is not intended to fully document how the Company develop their plan estimates for savings.

January PY: Rhode Island Energy begins to track savings based on the PY TRM

Beginning in January PY, Rhode Island Energy will track savings for the PY based on the PY TRM.

#### Measure Characterization Structure

This section describes the common entries or inputs that make up each measure characterization. A formatted template follows the descriptions of each section of the measure characterization.

Source citations: The source of each assumption or default parameter value should be properly referenced in a footnote.

**Applicability:** All Measures shown within the 2023 TRM are active for the 2023 Program Year: from 1/1/2023 to 12/31/2023

#### Measure Description Overview

This section will include a plain text description of the efficient and baseline technology and the benefit(s) of its installation, as well as subfields of supporting information including:

**Fuel:** The fuel against which savings are being claimed, and the program from which EE incentives are being drawn

Sector: Indicates whether measure is Residential, Income Eligible or Commercial and Industrial

Project Type: Indicates if measure is Retrofit or New Construction / Time of Replacement

**Category:** Indicates the measure category, for example: Lighting, HVAC, Hot Water, Products, Food Service, Compressed Air, Motors/Drives, Refrigeration, Behavior, Custom, etc.

Type and Sub-type: Further measure classification for purposes of sorting measures

**Program Name:** The current program name under which the measure is being delivered.

**Measure Name:** A single device or behavior may be analyzed as a range of measures depending on a variety of factors which largely translate to where it is and who is using it. Such factors include hours of use, location, and baseline (equipment replaced or behavior modified). For example, the same screw-in LED lamp will produce different savings if installed in an emergency room waiting area than if installed in a bedside lamp.

**Measure Description:** Description of the energy efficiency measure, its benefits, and applications.

**Baseline Description:** Description of the assumed equipment/operation efficiency in the absence of program intervention. Multiple baselines will be provided as needed, e.g., for different markets. Baselines may refer to reference tables or may be presented as a table for more complex measures)

**Savings Principle:** The means by which the measure saves energy relative to the baseline. Description of the assumed or calculated equipment/operation efficiency from which the energy

and demand savings are determined. The high efficiency case may be based on specific details of the measure installation, minimum requirements for inclusion in the program, or an energy efficiency case based on historical participation. It may refer to tables within the measure characterization or in the appendices or efficiency standards set by organizations such as ENERGY STAR or the Consortium for Energy Efficiency

**Savings Calculation method:** How the savings values are determined; in most cases, values are either deemed or calculated

Savings unit: required minimum unit / characteristic for claiming listed savings values

#### Savings

This section includes various information on the measure savings and how they are determined.

- Summary Average Gross Savings per Unit by Program: This table summarizes the
  resource savings (kWh, kW, MMBtu) of all efficiency offerings within a measure category
  via a weighted average of their savings. This is only for illustrating savings and does not
  correspond to how savings are tracked
  - Program: This describes the programs in which the measures are offered. Some measures are offered in multiple programs

# Sector and Program name mapping will be as follows:

Sector	Fuel	Full Program Name
		EnergyStar® Homes
		EnergyStar® HVAC
	Electric	Energy Wise Single-Family
		EnergyWise Multifamily
		Behavior/Home Energy Reports
Residential		EnergyStar® Products
Residential		Residential ConnectedSolutions
		EnergyStar® Heating System
		EnergyWise Multifamily
	Gas	Behavior/Home Energy Reports
		EnergyWise Single-Family
		Residential New Construction
	Electric	Single Family Appliance Management
Income Eligible		Income Eligible Retrofit Multifamily
Income Engine	Gas	Low Income Retrofit 1-4
		Low Income Multifamily
		Large Commercial New Construction
	Electric	Large C&I Retrofit
		Small Business
Commercial & Industrial		Commercial ConnectedSolutions
Commercial & muustrial		Large Commercial New Construction
	Gas	Large C&I Retrofit
	Gas	Small Business Direct Install
		Commercial & Industrial Multifamily

- Algorithm Type: This section describes which of four methods of savings calculation applies to a measure
  - o Deemed: The same savings are allocated to every unit of a measure
  - Engineering Algorithm with Deemed Inputs: Measure savings are calculated with an engineering formula, the inputs of which are constant for all units of a measure.
  - Engineering Algorithm with Site Specific Inputs: Measure savings are calculated with an engineering formula, the inputs of which depend on data from the installation site.
  - Custom: Each unit of a measure receives a unique savings calculation that depends on site specific data.
- **Units:** This section describes what is installed or affected by an efficiency measure (e.g. a boiler or a participant). It defines the quantity counted for savings.
- Algorithm: This section will describe the method for calculating the primary energy savings in appropriate units, i.e., kWh for electric energy savings or MMBtu for natural gas energy savings. The savings algorithm will be provided in a form similar to the following

 $\Lambda kWh = \Lambda kW \times Hours$ 

Similarly, the method for calculating electric demand savings will be provided in a form similar to the following:

$$\Delta kW = (Watts_{BASE} - Watts_{EE})/1000$$

Below the savings algorithms, a table contains the definitions (and, in some cases, default values) of each input in the equation(s). The inputs for a particular measure may vary and will be reflected as such in this table (see example below).

• Hours: The operating hours for equipment that is either on or off, or equivalent full

ΔkWh	=	gross annual kWh savings from the measure
ΔkW	П	gross connected kW savings from the measure
Hours	=	average hours of use per year
WattsBASE	=	baseline connected kW
WattsEE	=	energy efficient connected kW

technologies that operate at partial loads, or reduced hours for controls. Reference tables will be used as needed to avoid repetitive entries.

Measure Gross Savings per Unit: This table summarizes the unit resource impacts of
each efficiency offering within a measure category (e.g., the savings for boilers of
different efficiencies and ratings in the Boiler measure category). The source for each
value is referenced.

load hours

for

- Non-Energy Impacts: The non-energy impacts are shown for each efficiency measure under Annual and One-Time headings, depending on their recommended application approach. The NEIs are shown with more detail in Appendix B.
- Measure Life: Measure Life includes equipment life and the effects of measure
  persistence. Equipment life is the number of years that a measure is installed and will
  operate until failure. Measure persistence takes into account business turnover, early
  retirement of installed equipment, and other reasons measures might be removed or
  discontinued.

Other impact factors are defined in the next section.

# Impact Factors for Calculating Adjusted Gross and Net Savings

Rhode Island Energy uses the algorithms in the Measure Characterization sections to calculate the gross savings for energy efficiency measures. Impact factors are then applied to make various adjustments to the gross savings estimate to account for the performance of individual measures or energy efficiency programs as a whole in achieving energy reductions as assessed through evaluation studies. Impacts factors address both the technical performance of energy efficiency measures and programs, accounting for the measured energy and demand reductions realized compared to the gross estimated reductions, as well as the programs' effect on the market for energy efficient products and services.

This section describes the types of impact factors used to make such adjustments, and how those impacts are applied to gross savings estimates. Definitions of the impact factors and other terms are also provided in the Glossary (Appendix E).

## **Types of Impact Factors**

The impact factors used to adjust savings fall into one of two categories:

Impact factors used to adjust gross savings:

- In-Service Rate ("ISR")
- Savings Persistence Factor ("SPF")
- Realization Rate ("RR")
- Summer and Winter Peak Demand Coincidence Factors ("CF").

Impact factors used to calculate net savings:

- Free-Ridership ("FR") and Spillover ("SO") Rates
- Net-to-Gross Ratios ("NTG").

The **in-service rate** is the actual portion of efficient units that are installed. For example, efficient lamps may have an in-service rate less than 1.00 since some lamps are purchased as replacement units and are not immediately installed. The ISR is 1.00 for most measures.

The **savings persistence factor** is the portion of first-year energy or demand savings expected to persist over the life of the energy efficiency measure. The SPF is developed by conducting surveys of installed equipment several years after installation to determine the actual operational capability of the equipment. The SPF is 1.00 for most measures.

In contrast to savings persistence, *measure persistence* takes into account business turnover, early retirement of installed equipment, and other reasons the installed equipment might be removed or discontinued. Measure persistence is generally incorporated as part of the measure life, and therefore is not included as a separate impact factor.

The **realization rate** is used to adjust the gross savings (as calculated by the savings algorithms) based on impact evaluation studies. The realization rate is equal to the ratio of measure savings developed from an impact evaluation to the estimated measure savings derived from the savings algorithms. The realization rate does not include the effects of any other impact factors. Depending on the impact evaluation study, there may be separate realization rates for energy (kWh), peak demand (kW), or fossil fuel energy (MMBtu).

A **coincidence factor** adjusts the connected load kW savings derived from the savings algorithm. A coincidence factor represents the fraction of the connected load reduction expected to occur at the same time as a particular system peak period. The coincidence factor includes both coincidence and diversity factors combined into one number, thus there is no need for a separate diversity factor in this TRM.

Coincidence factors are provided for the on-peak period as defined by the ISO New England for the Forward Capacity Market ("FCM") and are calculated consistently with the FCM methodology. Electric demand reduction during the ISO New England peak periods is defined as follows:

- <u>Summer On-Peak</u>: average demand reduction from 1:00-5:00 PM on non-holiday weekdays in June July, and August
- <u>Winter On-Peak</u>: average demand reduction from 5:00-7:00 PM on non-holiday weekdays in December and January

The values described as Coincidence Factors in the TRM are not always consistent with the strict definition of a Coincidence Factor (CF). It would be more accurate to define the Coincidence Factor as "the value that is multiplied by the Gross kW value to calculate the average kW reduction coincident with the on-peak periods." A coincidence factor of 1.00 may be used because the coincidence is already included in the estimate of Gross kW; this is often the case when the "Max kW Reduction" is not calculated and instead the "Gross kW" is estimated using the annual kWh reduction estimate and a load shape model.

A **free-rider** is a customer who participates in an energy efficiency program (and gets an incentive) but who would have installed some or all of the same measure(s) on their own, with no change in timing of the installation, if the program had not been available. The **free-ridership rate** is the percentage of savings attributable to participants who would have installed the measures in the absence of program intervention.

The **spillover rate** is the percentage of savings attributable to a measure or program, but additional to the gross (tracked) savings of a program. Spillover includes the effects of 1) participants in the program who install additional energy efficient measures outside of the program as a result of participating in the program, and 2) non-participants who install or influence the installation of energy efficient measures as a result of being aware of the program. These two components are the **participant spillover** (SOP) and **non-participant spillover** (SONP).

The **net savings** value is the final value of savings that is attributable to a measure or program. Net savings differs from gross savings because it includes the effects of the free-ridership and/or spillover rates.

The **net-to-gross** ratio is the ratio of net savings to the gross savings adjusted by any impact factors (i.e., the "adjusted" gross savings). Depending on the evaluation study, the NTG ratio may be determined from the free-ridership and spillover rates, if available, or it may be a distinct value with no separate specification of FR and SO values.

#### Standard Net-to-Gross Formulas

The TRM measure entries provide algorithms or methodologies for calculating the gross energy and demand savings for each category of efficiency measures. The following standard formulas show how the impact factors are applied to calculate the net savings. These are the calculations used by Rhode Island Energy to track and report gross and net savings for its energy efficiency programs in Rhode Island.

• Calculation of Net Annual Electric Energy Savings

 $net_kWh = gross_kWh \times SPF \times ISR \times RRE \times NTG$ 

• Calculation of Net Summer Electric Peak Demand Coincident kW Savings

 $net_kW_{SP} = gross_kW \times SPF \times ISR \times RR_{SP} \times CF_{SP} \times NTG$ 

Calculation of Net Winter Electric Peak Demand Coincident kW Savings

net kWwp = gross kW × SPF × ISR × RRwp × CFwp × NTG

• Calculation of Net Annual Natural Gas Energy Savings

net MMBtu = gross MMBtu  $\times$  SPF  $\times$  ISR  $\times$  RR<sub>G</sub>  $\times$  NTG

#### Where:

Gross\_kWh = Gross Annual kWh Savings

net kWh = Net Annual kWh Savings

Gross\_kWsp = Gross Connected kW Savings (summer peak)

Gross kWwp = Gross Connected kW Savings (winter peak)

net kWsp = Adjusted Gross Connected kW Savings (winter peak)

net\_kWwp = Net Coincident kW Savings (winter peak)

Gross MMBtu = Gross Annual MMBtu Savings

net MMBtu = Net Annual MMBtu Savings

SPF = Savings Persistence Factor

ISR = In-Service Rate

CF<sub>SP</sub> = Peak Coincidence Factor (summer peak)

CFwp = Peak Coincidence Factor (winter peak)

RRE = Realization Rate for electric energy (kWh)

RRG = Realization Rate for gas (MMBtu)

RRsp = Realization Rate for summer peak kW RRwp = Realization Rate for winter peak kW NTG = Net-to-Gross Ratio FR = Free-Ridership Factor SOP = Participant Spillover Factor SONP = Non-Participant Spillover Factor

Depending on the evaluation study methodology:

- NTG is equal to (1 FR + SO<sub>P</sub> + SO<sub>NP</sub>), or
- NTG is a single value with no distinction of FR, SOP, SONP, and/or other factors that cannot be reliably isolated.

# **Measure Characterizations**

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# Residential

## **Adaptive Reuse**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Adaptive Reuse

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Adaptive Reuse	Calc	Calc	0.00	0.00	0.00	Calc	Calc

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Adaptive Reuse	15	1.00	1.00		1.00	1.00	1.00	0.24	0.89

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Adaptive Reuse	0.90%	4.10%	53.80%	41.20%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Adaptive Reuse	0.00	0.00	117.00	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Adaptive Reuse	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

#### **CODES AND STANDARDS**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Codes and Standards Measure Sub Type: Codes and

Standards

Program: A02a Energy Star Homes

#### **Measure Description**

Energy efficiency code trainings and advocacy work to improve energy efficiency of buildings and equipment within Rhode Island.

#### **Baseline Description**

Un-influenced adoption curve of federal minimum codes and standards.

#### **Savings Principle**

Accelerated adoption of advancing energy codes and equipment standards.

#### **Savings Method**

Calculated based on attribution study

#### Unit

Adoption of advancing energy codes and equipment standards.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
CODES AND STANDARDS	Calc	Calc	0.00	0.00	0.00	0.00	0.00

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CODES AND STANDARDS	12	1.00	1.00		1.00	1.00	1.00	0.24	0.89

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
CODES AND STANDARDS	34.00%	51.00%	8.00%	7.00%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
CODES AND STANDARDS	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CODES AND STANDARDS	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

## Cooling\_Tier1

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Cooling

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW wp custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Cooling_Tier1	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Cooling_Tier1	25	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Cooling_Tier1	6.59%	3.85%	47.32%	42.24%	

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Cooling_Tier1	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Cooling_Tier1	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

## Cooling\_Tier2

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Cooling

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Cooling_Tier2	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Cooling_Tier2	25	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Cooling_Tier2	6.59%	3.85%	47.32%	42.24%	

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Cooling_Tier2	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Cooling_Tier2	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

## Cooling\_Tier3

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Cooling

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Cooling_Tier3	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Cooling_Tier3	25	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Cooling_Tier3	6.59%	3.85%	47.32%	42.24%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Cooling_Tier3	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Cooling_Tier3	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

### **COOLINGCP**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: COOLINGCP

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COOLINGCP	Calc	Calc	0.00	0.00	0.00	Calc	Calc

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COOLINGCP	25	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
COOLINGCP	6.59%	3.85%	47.32%	42.24%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
COOLINGCP	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COOLINGCP	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

#### **CWASHER**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Whole Home Measure Type: Clothes Washer Measure Sub Type: Clothes Washer

Program: A02a Energy Star Homes

**Measure Description** 

The installation of an Energy Star clothes washer in a Residential New Construction home.

**Baseline Description** 

A standard non-Energy Star clothes washer.

**Savings Principle** 

An Energy Star clothes washer uses less electricity and water to clean clothes.

**Savings Method** 

Deemed

Unit

Installed clothes washer.

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
CWASHER	47.5	0.0200	0.00	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CWASHER	11	1.00	1.00		1.00	1.00	1.00	0.89	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
CWASHER	26.00%	40.00%	14.00%	20.00%	

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
CWASHER	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CWASHER	0.30	0.00	0.00	0.70

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: Assumed to equal incentive amount. per housing Unit

## DHW\_Tier1

 Sector: Residential
 Fuel: Electric
 Program Type: Custom

 Measure Category: Whole Home
 Measure Type: Custom
 Measure Sub Type: DHW

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
DHW_Tier1	Calc	Calc	0.00	0.00	0.00	Calc	Calc

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
DHW_Tier1	15	1.00	1.00		1.00	1.00	1.00	0.00	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
DHW_Tier1	41.52%	31.39%	15.22%	11.88%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
DHW_Tier1	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
DHW_Tier1	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

## DHW\_Tier2

 Sector: Residential
 Fuel: Electric
 Program Type: Custom

 Measure Category: Whole Home
 Measure Type: Custom
 Measure Sub Type: DHW

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
DHW_Tier2	Calc	Calc	0.00	0.00	0.00	Calc	Calc

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
DHW_Tier2	15	1.00	1.00		1.00	1.00	1.00	0.00	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
DHW_Tier2	41.52%	31.39%	15.22%	11.88%	

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
DHW_Tier2	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
DHW_Tier2	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

## DHW\_Tier3

 Sector: Residential
 Fuel: Electric
 Program Type: Custom

 Measure Category: Whole Home
 Measure Type: Custom
 Measure Sub Type: DHW

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
DHW_Tier3	Calc	Calc	0.00	0.00	0.00	Calc	Calc

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
DHW_Tier3	15	1.00	1.00		1.00	1.00	1.00	0.00	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
DHW_Tier3	41.52%	31.39%	15.22%	11.88%	

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
DHW_Tier3	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
DHW_Tier3	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

#### **DHWCP**

Fuel: Electric Sector: Residential Program Type: Custom Measure Category: Whole Home Measure Type: Custom Measure Sub Type: DHW

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW sp custom Gross Winter kW = deltakW wp custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
DHWCP	Calc	Calc	0.00	0.00	0.00	Calc	Calc

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
DHWCP	15	1.00	1.00		1.00	1.00	1.00	0.00	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
DHWCP	41.52%	31.39%	15.22%	11.88%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
DHWCP	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
DHWCP	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

#### **DISHWASH**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Whole Home Measure Type: Dishwasher Measure Sub Type: Dishwasher

Program: A02a Energy Star Homes

**Measure Description** 

The installation of an Energy Star Dishwasher in a Residential New Construction home.

**Baseline Description** 

A standard non-Energy Star Dishwasher.

**Savings Principle** 

An Energy Star dishwasher uses less electricity and water to clean dishes.

**Savings Method** 

Deemed

Unit

Installed dish washer.

**Savings Equation** 

Gross kWh =  $Qty \times deltakWh$ 

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
DISHWASH	40.0	0.0048	0.00	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
DISHWASH	10	1.00	1.00		1.00	1.00	1.00	0.90	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
DISHWASH	26.00%	40.00%	14.00%	20.00%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
DISHWASH	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
DISHWASH	0.91	0.00	0.00	0.09

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: Assumed to equal incentive amount. per housing Unit

## Heating\_Tier1

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating_Tier1	Calc	Calc	0.00	0.00	0.00	Calc	Calc

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating_Tier1	25	1.00	1.00		1.00	1.00	1.00	0.00	0.43

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heating_Tier1	43.13%	56.87%	0.00%	0.00%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heating_Tier1	0.00	0.00	142.33	0

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating_Tier1	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$1,445.00 / home
Incentive: \$885.00 / home

## Heating\_Tier2

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating_Tier2	Calc	Calc	0.00	0.00	0.00	Calc	Calc

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating_Tier2	25	1.00	1.00		1.00	1.00	1.00	0.00	0.43

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heating_Tier2	43.13%	56.87%	0.00%	0.00%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heating_Tier2	0.00	0.00	142.33	0

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating_Tier2	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$4,860.00 / home

Incentive: \$1,525.00 / home

## Heating\_Tier3

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating_Tier3	Calc	Calc	0.00	0.00	0.00	Calc	Calc

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating_Tier3	25	1.00	1.00		1.00	1.00	1.00	0.00	0.43

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heating_Tier3	43.13%	56.87%	0.00%	0.00%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Heating_Tier3	0.00	0.00	142.33	0	

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating_Tier3	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$7,688.00 / home
Incentive: \$2,650.00 / home

#### **HEATINGCP**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: A02a Energy Star Homes

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

#### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
HEATINGCP	Calc	Calc	0.00	0.00	0.00	Calc	Calc

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
HEATINGCP	25	1.00	1.00	•	1.00	1.00	1.00	0.00	0.43

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
HEATINGCP	43.13%	56.87%	0.00%	0.00%	

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
HEATINGCP	0.00	0.00	142.33	0	

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
HEATINGCP	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$787.00 / home

Incentive: \$345.00 / home

#### **LED Fixture**

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Lighting
 Measure Type: Interior
 Measure Sub Type: LED Fixture

Program: A02a Energy Star Homes

#### **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

#### **Baseline Description**

The baseline efficiency case is blend of incandescent, CFLs and other bulbs types, as provided by market research or for a home energy audit, the base line is a 65 Watt incandescent.

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

#### **Savings Method**

Calculated using deemed inputs

#### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = Qty × deltakW × Hours

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

DeltakW = Deemed average kW reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 985.5.

Hours Source: Nexus Market Research and RLW Analytics (2004). Impact Evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs.

Hours Note: The average annual operating hours are 912.5 hours/year or calculated for home audit applications.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LED Fixture	68.9	0.0600	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model Electric kW Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

## Energy Impact Factors

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Fixture	1	0.95	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LED Fixture	26.00%	40.00%	14.00%	20.00%

Measure Life Note: Based on MA EUL assumptions

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014

CFwp Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LED Fixture	0.00	0.00	0	3.50

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LED Fixture	0.70	0.04	0.00	0.34

NTG Source: NMR Group (2012). Rhode Island 2011 Basline Study of Single-Family Residential New Construction. Prepared for national Grid.

## **LEDs**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Interior Measure Sub Type: LED Screw Base

Program: A02a Energy Star Homes

# **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

## **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

## **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

## **Savings Method**

Calculated using deemed inputs

## Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 946.4.

Hours Source: MA19R12-E - Residential Lighting Hours-of-Use Quick Hit Study

Hours Note: hrs/yr

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LEDs	36.1	0.0120	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: NMR (2020). MA19R09-E - Delta Watts Update/MA19R12-E - Residential Lighting Hours-of-Use Quick Hit Study

Electric kW Source: NMR (2020). MA19R09-E - Delta Watts Update/MA19R12-E - Residential Lighting Hours-of-Use Quick Hit Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LEDs	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LEDs	35.10%	30.80%	19.00%	15.10%

Measure Life Note: Based on MA EUL assumptions

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LEDs	0.00	0.00	0	3.00

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LEDs	0.70	0.00	0.00	0.30

NTG Source: NMR Group (2012). Rhode Island 2011 Basline Study of Single-Family Residential New Construction. Prepared for national Grid.

# Refrigerators

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: Refrigerators Measure Sub Type: Refrigerator

Program: A02a Energy Star Homes

#### **Measure Description**

This measure covers the replacement of an existing inefficient refrigerator with a new efficient refrigerator.

## **Baseline Description**

Existing refrigerator continues to operate.

## **Savings Principle**

The high efficiency case is an Energy Star® refrigerator or a model that is ENERGY STAR® rated and included in the Most Efficient® or Top Ten USA® ranking.

# Savings Method

Calculated using deemed inputs

#### Unit

Installed refrigerator

#### **Savings Equation**

Gross kWh = Qty × (kWh\_base - kWh\_ee)

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

kWh\_base = Deemed average demand per baseline unit.

kWh\_ee = Deemed average demand per high-efficiency unit.

DeltakW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Refrigerators	104.0	0.0130	0.00	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Refrigerators	12	1.00	1.00		1.00	1.00	1.00	1.00	0.92

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Refrigerators	26.00%	40.00%	14.00%	20.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Refrigerators	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Refrigerators	0.54	0.00	0.00	0.46

NTG Note: Per C-team savings from evaluation are net. Gross Savings and NTGR provided by C-team.

TRC: ESH Bundled costs

Incentive: ESH Bundled costs

# Renovation Rehab Cooling\_Tier1

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Cooling

Program: A02a Energy Star Homes

# **Measure Description**

The cooling savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

## **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Cooling_Tier1	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Cooling_Tier1	25	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Cooling_Tier1	0.90%	4.12%	53.82%	41.17%

Measure Life Note: Common measure life for insulation measures.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Cooling_Tier1	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Cooling_Tier1	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

# Renovation Rehab Cooling\_Tier2

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Cooling

Program: A02a Energy Star Homes

# **Measure Description**

The cooling savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

## **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Cooling_Tier2	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Cooling_Tier2	25	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Cooling_Tier2	0.90%	4.12%	53.82%	41.17%

Measure Life Note: Common measure life for insulation measures.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Cooling_Tier2	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Cooling_Tier2	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

# Renovation Rehab Cooling\_Tier3

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Cooling

Program: A02a Energy Star Homes

# **Measure Description**

The cooling savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

## **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

# Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Cooling_Tier3	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Cooling_Tier3	25	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Cooling_Tier3	0.90%	4.12%	53.82%	41.17%

Measure Life Note: Common measure life for insulation measures.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Cooling_Tier3	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Cooling_Tier3	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

# **Renovation Rehab CoolingCP**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Cooling

Program: A02a Energy Star Homes

## **Measure Description**

The cooling savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

## **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

# Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab CoolingCP	Calc	Calc	Calc	0.00	0.00	Calc	Calc

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab CoolingCP	25	1.00	1.00		1.00	1.00	1.00	0.24	0.89

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab CoolingCP	0.90%	4.12%	53.82%	41.17%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab CoolingCP	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab CoolingCP	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

# Renovation Rehab Domestic Hot Water\_Tier1

 Sector: Residential
 Fuel: Electric
 Program Type: Custom

 Measure Category: Whole Home
 Measure Type: Custom
 Measure Sub Type: DHW

Program: A02a Energy Star Homes

## **Measure Description**

The DHW savings resulting from Renovation Rehab projects that include more efficient water heating systems.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

#### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Domestic Hot Water_Tier1	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Domestic Hot Water_Tier1	15	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Domestic Hot Water_Tier1	35.84%	30.76%	17.26%	16.14%

Measure Life Note: Common measure life for insulation measures.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Domestic Hot Water_Tier1	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_Tier1	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

# Renovation Rehab Domestic Hot Water\_Tier2

 Sector: Residential
 Fuel: Electric
 Program Type: Custom

 Measure Category: Whole Home
 Measure Type: Custom
 Measure Sub Type: DHW

Program: A02a Energy Star Homes

## **Measure Description**

The DHW savings resulting from Renovation Rehab projects that include more efficient water heating systems.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

#### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Domestic Hot Water_Tier2	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Domestic Hot Water_Tier2	15	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Domestic Hot Water_Tier2	35.84%	30.76%	17.26%	16.14%

Measure Life Note: Common measure life for insulation measures.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Domestic Hot Water_Tier2	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_Tier2	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

# Renovation Rehab Domestic Hot Water\_Tier3

 Sector: Residential
 Fuel: Electric
 Program Type: Custom

 Measure Category: Whole Home
 Measure Type: Custom
 Measure Sub Type: DHW

Program: A02a Energy Star Homes

## **Measure Description**

The DHW savings resulting from Renovation Rehab projects that include more efficient water heating systems.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

#### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Domestic Hot Water_Tier3	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Domestic Hot Water_Tier3	15	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Domestic Hot Water_Tier3	35.84%	30.76%	17.26%	16.14%

Measure Life Note: Common measure life for insulation measures.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Domestic Hot Water_Tier3	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_Tier3	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

# Renovation Rehab Domestic Hot WaterCP

 Sector: Residential
 Fuel: Electric
 Program Type: Custom

 Measure Category: Whole Home
 Measure Type: Custom
 Measure Sub Type: DHW

Program: A02a Energy Star Homes

## **Measure Description**

The DHW savings resulting from Renovation Rehab projects that include more efficient water heating systems.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

#### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

## Unit

Complete Renovation Rehab project

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Domestic Hot WaterCP	Calc	Calc	Calc	0.00	0.00	Calc	Calc

# **Energy Impact Factors**

	Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
_	Renovation Rehab Domestic Hot WaterCP	25	1.00	1.00		1.00	1.00	1.00	0.24	0.89

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Domestic Hot WaterCP	35.84%	30.76%	17.26%	16.14%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Domestic Hot WaterCP	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot WaterCP	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

# Renovation Rehab Heating\_Tier1

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: A02a Energy Star Homes

# **Measure Description**

The heating savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

## **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

# Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Heating_Tier1	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Heating_Tier1	25	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Heating_Tier1	37.81%	61.53%	0.17%	0.49%

Measure Life Note: Common measure life for insulation measures.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Heating_Tier1	0.00	0.00	142.33	0

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_Tier1	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$1,874.00 / home
Incentive: \$900.00 / home

# Renovation Rehab Heating\_Tier2

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: A02a Energy Star Homes

## **Measure Description**

The heating savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

## **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Heating_Tier2	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Heating_Tier2	25	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Heating_Tier2	37.81%	61.53%	0.17%	0.49%

Measure Life Note: Common measure life for insulation measures.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Heating_Tier2	0.00	0.00	142.33	0

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_Tier2	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$2,767.00 / home

Incentive: \$1,520.00 / home

# Renovation Rehab Heating\_Tier3

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: A02a Energy Star Homes

# **Measure Description**

The heating savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

## **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

# Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Heating_Tier3	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor Electric kW Note: Supplied by vendor

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Heating_Tier3	25	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Renovation Rehab Heating_Tier3	37.81%	61.53%	0.17%	0.49%	

Measure Life Note: Common measure life for insulation measures.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Heating_Tier3	0.00	0.00	142.33	0

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_Tier3	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$14,107.00 / home
Incentive: \$2,643.00 / home

# **Renovation Rehab HeatingCP**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: A02a Energy Star Homes

# **Measure Description**

The heating savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

## **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab HeatingCP	Calc	Calc	Calc	0.00	0.00	Calc	Calc

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab HeatingCP	25	1.00	1.00		1.00	1.00	1.00	0.24	0.89

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab HeatingCP	37.81%	61.53%	0.17%	0.49%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab HeatingCP	0.00	0.00	142.33	0

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab HeatingCP	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$787.00 / home

Incentive: \$345.00 / home

# **Showerheads**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A02a Energy Star Homes

# **Measure Description**

Installation of a low flow showerhead with a flow rate of 1.5 GPM or less.

## **Baseline Description**

The baseline efficiency case is a showerhead with a flow of 2.5 gpm. For home audit applications, the baseline is the existing showerhead.

#### **Savings Principle**

The high efficiency is a low-flow showerhead with a flow of 1.5 gpm or less.

# **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Showerheads	247.0	0.0590	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Showerheads	15	1.00	1.00		1.00	1.00	1.00	0.58	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Showerheads	40.00%	33.00%	15.00%	13.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Measure Life Note: Massachusetts Common Assumption

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rates are 100% since savings estimates are based on evaluation results.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Showerheads	3696.00	0.00	0	0

Water/Sewer Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Showerheads	0.00	0.00	0.00	1.00

## **ACDOWNSIZE**

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Cooling
 Measure Sub Type: Central AC

Program: A02b Energy Star HVAC

# **Measure Description**

Reduction in system size consistent with manual J calculations.

## **Baseline Description**

The baseline efficiency case is a system that is not sized in accordance with a manual J calculation.

## **Savings Principle**

The high efficiency case is a system that is sized in accordance with a manual J calculation.

## **Savings Method**

Deemed

#### Unit

Completed job (assume downsize 1/2 ton).

## **Savings Equation**

Gross kWh =  $Qty \times deltakWh$ 

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ACDOWNSIZE	203.0	0.2950	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kW Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kW Note: Updated based on historic measure mix.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ACDOWNSIZE	18	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
ACDOWNSIZE	6.60%	3.80%	47.30%	42.20%

Measure Life Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
ACDOWNSIZE	0.00	0.00	0.64	0

Annual \$ Note: MA values

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ACDOWNSIZE	0.15	0.00	0.00	0.85

NTG Note: Massachusetts Common Assumption

TRC: \$250.00 / measure

Incentive: \$250.00 / measure

#### **CENTRAL AC**

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Cooling
 Measure Sub Type: Central AC

Program: A02b Energy Star HVAC

#### **Measure Description**

The purchase and installation of high efficiency central air-conditioning (CAC) unit rather than a standard CAC system, and/or to replace an existing inefficient CAC system.

## **Baseline Description**

The baseline efficiency case is a blend of code-compliant central air-conditioning system with SEER = 14 and EER = 11. For early replacement installations, the baseline is an HVAC unit with rated SEER = 13.5 and an actual SEER efficiency of 12.0.

#### **Savings Principle**

The high efficiency case is a SEER 16, EER 13 central AC unit.

## **Savings Method**

Calculated using deemed inputs

#### Unit

Installed high-efficiency central AC system for cooling.

#### **Savings Equation**

Gross kWh = Tons × (kBtu/hr per ton) × (1/SEER base - 1/SEER ee) × Hours C

Gross kW = Tons × (kBtu/hr per ton) × (1/SEER\_base - 1/SEER\_ee)

Where:

Tons = Deemed average equipment capacity: 2.7 tons for 16 SEER unit / 3.1 tons for 18 SEER unit

12 kBtu/hr per ton = Conversion factor

SEER\_base = Seasonal Energy Efficiency Ratio of baseline equipment.

SEER\_ee = Seasonal Energy Efficiency Ratio of new equipment.

Hours\_C = Deemed average equivalent full load cooling hours

Hours: 419.0.

Hours Source: Navigant (2018). Res 1 - MA Residential Electric Load Shape and Baseline Study (Cooling and Heating Season report)

Hours Note: The equivalent full load cooling hours are 360 hours/year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
CENTRAL AC	223.2	0.3500	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Guidehouse (2021). Comprehensive TRM Review/RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kWh Note: Baseline update can be found in first source and calculations for savings can be found in second source.

Electric kW Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kW Note: Updated based on historic measure mix.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CENTRAL AC	15	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
CENTRAL AC	6.60%	3.80%	47.30%	42.20%

Measure Life Source: RI\_2022 Annual Plan Electric H&C Savings Workbook\_06-14-2021

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Massachusetts Common Assumption RRsp Note: Massachusetts Common Assumption RRwp Note: Massachusetts Common Assumption

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
CENTRAL AC	0.00	0.00	8.98	0	

Annual \$ Source: RI\_PAs\_2021-2023 PLAN Electric H&C Savings Workbook 08-11-2020

Annual \$ Note: MA values

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CENTRAL AC	0.34	0.22	0.00	0.88

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$1,208.00 / measure
Incentive: \$50.00 / measure

# **Central Heat Pump**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heat Pumps Measure Sub Type: Heat Pump

Electrification

Program: A02b Energy Star HVAC

# **Measure Description**

The installation of a high efficiency rated heat pump (15 SEER 9 HSPF).

## **Baseline Description**

The baseline efficiency case is a non-energy efficiency® rated central heat pump with SEER 14, HSPF 8.7.

#### **Savings Principle**

The high efficiency case is a high-efficiency central Heat pump.

## **Savings Method**

Calculated using deemed inputs

#### Unit

Installed high-efficiency mini-split heat pump system for heating and cooling.

## **Savings Equation**

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Central Heat Pump	1,533.2	0.5800	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI 2022 Annual PLan Electric H&C Savings Workbook 06-14-2021

Electric kWh Note: Updated based on historic measure mix.

Electric kW Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Central Heat Pump	15	1.00	1.00		1.00	1.00	1.00	0.35	0.53

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Central Heat Pump	35.10%	45.80%	10.10%	9.00%	

Measure Life Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

SPF Note: Savings persistence is assumed to be 100%.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

**Non-Energy Impact Factors** 

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Central Heat Pump	0.00	0.00	8.11	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Central Heat Pump	0.34	0.22	0.00	0.88

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$689.00 / measure

Incentive: \$350.00 / measure

# **CoolSmart AC QIV ES**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Type: HVAC Measure Type: HVAC O&M Measure Sub Type: Central AC

Quality Install

Program: A02b Energy Star HVAC

# **Measure Description**

The verification of proper charge and airflow during installation of new Central AC system.

### **Baseline Description**

The baseline efficiency case is a cooling system not installed according to manufacturer specifications.

#### **Savings Principle**

The high efficiency case is the same cooling system installed according to manufacturer specifications.

### **Savings Method**

Calculated using deemed inputs

#### Unit

Completed QIV on new AC system

#### **Savings Equation**

Gross kWh = Tons × (kBtu/hr per ton) × 1/SEER × Hours\_C × %SAVE

Gross kW = Tons  $\times$  (kBtu/hr per ton)  $\times$  1/EER  $\times$  %SAVE

Where:

Tons = Deemed average equipment capacity: 2.7 tons

12 kBtu/hr per ton = Conversion factor

SEER = Seasonal Energy Efficiency Ratio of existing equipment

Hours\_C = Deemed average equivalent full load cooling hours

5%SAVE = Average percent demand reduction; National Grid assumption based on regional PA working groups.

EER = Peak efficiency of existing equipment

Hours: 419.0.

Hours Source: Navigant (2018). Res 1 - MA Residential Electric Load Shape and Baseline Study (Cooling and Heating Season

report)

Hours Note: The equivalent full load cooling hours are 360 hours/year.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
CoolSmart AC QIV ES	40.3	0.0640	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kWh Note: Updated based on historic measure mix.

Electric kW Source: RI 2022 Annual PLan Electric H&C Savings Workbook 06-14-2021

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CoolSmart AC QIV ES	18	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
CoolSmart AC QIV ES	6.60%	3.80%	47.30%	42.20%	

Measure Life Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

CFwp Source: ADM Associated, Inc. (2009). Residential Central AC Regional Evaluation. Prepared for NSTAR, National Grid,

Connecticut Light & Power and United Illuminating.

# **Non-Energy Impact Factors**

Measure	Water: Gallons		Annual \$	One-time \$
CoolSmart AC QIV ES	0.00	0.00	1.53	0

Annual \$ Note: MA values

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CoolSmart AC QIV ES	0.25	0.16	0.00	0.91

NTG Source: The Cadmus Group (2013). 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Netto-Gross, Market Effects, and Equipment Replacement Timing.

TRC: \$130.00 / measure

Incentive: \$175.00 / measure

# **CoolSmart HP Digital Check**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: HVAC O&M Measure Sub Type: Heat Pump Tune

Up

Program: A02b Energy Star HVAC

## **Measure Description**

Tune-up of an existing heat pump system.

### **Baseline Description**

The baseline efficiency case is a standard residential heat pump system that does not operating according to manufacturer specifications.

## **Savings Principle**

The high efficiency case is the same baseline system but which operates according to manufacturer specifications.

### **Savings Method**

Calculated using deemed inputs

#### Unit

Completed tune-up of existing heat pump system

#### **Savings Equation**

Gross kWh = Tons × (kBtu/hr per ton) × (1/SEER × Hours C + 1/HSPF × Hours H) × %SAVE

Gross kW = Tons  $\times$  (kBtu/hr per ton)  $\times$  max[(1/EER),(1/HSPF)]  $\times$  %SAVE

#### Where:

Tons = Deemed average equipment capacity: 2.6 tons

12 kBtu/hr per ton = Conversion factor

SEER= Seasonal Energy Efficiency Ratio of existing equipment

HSPF = Heating efficiency of existing equipment

Hours\_C = Deemed average equivalent full load cooling hours

Hours H = Deemed average equivalent full load heating hours

5%SAVE = Average percent demand reduction; National Grid assumption based on regional PA working groups.

EER = Peak efficiency of existing equipment

Hours: N/A.

Hours Source: ADM Associated, Inc. (2009). Residential Central AC Regional Evaluation. Prepared for NSTAR, National Grid, Connecticut Light & Power and United Illuminating.

Hours Note: Equivalent full load hours are 1200 hours/year for heating and 360 hours/year for cooling

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
CoolSmart HP Digital Check	341.9	0.1240	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kWh Note: Updated based on historic measure mix.

Electric kW Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kW Note: Updated based on historic measure mix.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CoolSmart HP Digital Check	5	1.00	1.00	•	1.00	1.00	1.00	0.26	0.62

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
CoolSmart HP Digital Check	35.10%	45.80%	10.10%	9.00%	

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

CFsp Note: Massachusetts Common Assumption

CFwp Source: Navigant Consulting (2018). Baseline Loadshape StudyCFwp Note: Massachusetts Common Assumption

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
CoolSmart HP Digital Check	0.00	0.00	1.53	0	

Annual \$ Note: MA values

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CoolSmart HP Digital Check	0.15	0.00	0.00	0.85

NTG Note: Massachusetts Common Assumption

TRC: \$175.00 / measure

Incentive: \$175.00 / measure

# **CoolSmart HP QIV ES**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: HVAC O&M Measure Sub Type: Heat Pump

**Quality Install** 

Program: A02b Energy Star HVAC

## **Measure Description**

The verification of proper charge and airflow during installation of new Heat Pump systems.

### **Baseline Description**

The baseline efficiency case is a heating and cooling system not installed according to manufacturer specifications.

#### **Savings Principle**

The high efficiency case is the same heating and cooling system not installed according to manufacturer specifications.

### **Savings Method**

Calculated using deemed inputs

#### Unit

Completed QIV on new heat pump system

#### **Savings Equation**

Gross kWh = Tons × (kBtu/hr per ton) × (1/SEER × Hours\_C + 1/HSPF × Hours\_H) × %SAVE

Gross kW = Tons  $\times$  (kBtu/hr per ton)  $\times$  max[(1/EER),(1/HSPF)]  $\times$  %SAVE

Where:

Tons = Deemed average equipment capacity: 2.6 tons

12 kBtu/hr per ton = Conversion factor

SEER= Seasonal Energy Efficiency Ratio of existing equipment

HSPF = Heating efficiency of existing equipment

Hours\_C = Deemed average equivalent full load cooling hours

Hours\_H = Deemed average equivalent full load heating hours

5%SAVE = Average percent demand reduction; National Grid assumption based on regional PA working groups.

EER = Peak efficiency of existing equipment

Hours: N/A.

Hours Note: Equivalent full load hours are 1200 hours/year for heating and 360 hours/year for cooling

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
CoolSmart HP QIV ES	265.6	0.0970	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kWh Note: Updated based on historic measure mix.

Electric kW Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kW Note: Updated based on historic measure mix.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CoolSmart HP QIV ES	18	1.00	1.00		1.00	1.00	1.00	0.25	0.62

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
CoolSmart HP QIV ES	35.10%	45.80%	10.10%	9.00%

Measure Life Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
CoolSmart HP QIV ES	0.00	0.00	1.53	0

Annual \$ Note: MA values

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CoolSmart HP QIV ES	0.25	0.16	0.00	0.91

NTG Source: The Cadmus Group (2013). 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Netto-Gross, Market Effects, and Equipment Replacement Timing.

TRC: \$200.00 / measure
Incentive: \$175.00 / measure

# Duct Sealing - 100 CFM Reduction in Leaks 15% of Flow to 5%

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Ducting Measure Sub Type: Duct Insulation

Program: A02b Energy Star HVAC

### **Measure Description**

A 66% reduction in duct leakage from 15% to 5% of supplied CFM.

### **Baseline Description**

The baseline efficiency case is assumes a 15% leakage.

### **Savings Principle**

The high efficiency case is a system with duct leakage reduced by 66% to 5% leakage.

### **Savings Method**

Deemed

### Unit

Complete duct sealing job for existing HVAC system

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Duct Sealing - 100 CFM Reduction in Leaks 15% of Flow to 5%	442.0	0.3100	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Navigant (2018) Res 34 Home Energy Services Impact Evaluation Electric kW Source: Navigant (2018) Res 34 Home Energy Services Impact Evaluation

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Duct Sealing - 100 CFM Reduction in Leaks 15% of Flow to 5%	20	1.00	1.00		1.00	1.00	1.00	0.35	

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Duct Sealing - 100 CFM Reduction in Leaks 15% of Flow to 5%	6.60%	3.80%	47.30%	42.20%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Duct Sealing - 100 CFM Reduction in Leaks 15% of Flow to 5%	0.00	0.00	0.23	0.00

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Duct Sealing - 100 CFM Reduction in Leaks 15% of Flow to 5%	0.25	0.12	0.00	0.87

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

NTG Note: Massachusetts Common Assumption

TRC: \$1.00 / linear foot
Incentive: \$2.00 / linear foot

# **ECM Pumps**

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Motors
 Measure Sub Type: ECM Motor

Program: A02b Energy Star HVAC

### **Measure Description**

Heating hot water circulation retrofit projects replacing the existing hot water circulation systems with ECM pumps and zone valves.

### **Baseline Description**

The baseline case is standard efficiency steady-state motor without variable speed capabilities.

### **Savings Principle**

The efficient case is the installation of a pump with an electronically commutated motor (ECM) with variable speed capabilities on a boiler.

## **Savings Method**

Deemed

#### Unit

Installed ECM circulator pump retrofit project.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ECM Pumps	75.2	0.0410	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Residential Baseline Study - ECM Pumps (Report has not been finalized)

Electric kW Source: RI\_PAs\_2021-2023 PLAN Electric H&C Savings Workbook 08-11-2020

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ECM Pumps	15	1.00	1.00		1.00	1.00	1.00	0.00	0.53

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
ECM Pumps	45.00%	55.00%	0.00%	0.00%

Measure Life Source: The Cadmus Group (2012). Impact Evaluation of the 2011-2012 ECM Circulation Pump Pilot Program.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFwp Source: RI\_PAs\_2020PLAN Electric H&C Savings Workbook 08-20-2019

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
ECM Pumps	0.00	0.00	0.00	0.00

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ECM Pumps	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$120.00 / measure

Incentive: \$100.00 / measure

# **Electric Resistance to MSHP**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heating Measure Sub Type: Heat Pump

Electrification

Program: A02b Energy Star HVAC

## **Measure Description**

The purchase and installation of high efficiency mini-split heat pump system to replace an electric resistance heating system.

### **Baseline Description**

The baseline efficiency case for heating is a residential electric resistance heating system.

The baseline efficiency case for cooling is a residential window AC unit with EER 9.8.

# **Savings Principle**

The high efficiency case is an ENERGY STAR® qualified air-source heat pump.

#### Savings Method

Deemed

### Unit

Installed high-efficiency mini-split heat pump system for heating and cooling.

### **Savings Equation**

Heating Gross kWh = Qty\*deltakWh\_heating

Cooling Gross kWh = Qty\*deltakWh cooling

Cooling Gross kW = Qty\*deltakW

Where:

Qty = Total number of units.

deltakWh\_heating = Average annual heating kWh reduction per unit.

deltakWh cooling = Average annual cooling kWh reduction per unit.

deltakW = Average annual kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Electric Resistance to MSHP	6,549.0	2.8300	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kWh Note: Updated based on historic measure mix.

Electric kW Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Electric Resistance to MSHP	18	1.00	1.00		1.00	1.00	1.00	0.02	0.62

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Electric Resistance to MSHP	42.90%	57.10%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Electric Resistance to MSHP	0.00	0.00	4.21	0.00

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Electric Resistance to MSHP	0.31	0.22	0.00	0.91

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$6,650.00 / measure
Incentive: \$4,000.00 / measure

# **HPWH <55 Gallon (Electric)**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Heat Pump Water

Heater

Program: A02b Energy Star HVAC

## **Measure Description**

Installation of a heat pump water heater (HPWH) instead of an electric resistance water heater.

### **Baseline Description**

The baseline efficiency case is a new, standard efficiency electric resistance hot water heater.

#### **Savings Principle**

The high efficiency case is a high efficiency heat pump water heater.

### **Savings Method**

Deemed

### Unit

Installed heat pump water heater.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
HPWH <55 Gallon (Electric)	1,712.0	0.3400	-0.10	0.00	0.00	-0.50	-0.07

Electric kWh Source: Heat Pump Water Heaters - 2021 Quick Hit Study

Electric kW Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

Gas Heat MMBtu Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

Oil MMBtu Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

Propane MMBtu Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
HPWH <55 Gallon (Electric)	13	1.00	1.00		1.00	1.00	1.00	0.41	0.75

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
HPWH <55 Gallon (Electric)	39.10%	33.00%	14.90%	13.00%

Measure Life Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
HPWH <55 Gallon (Electric)	0.00	0.00	0.00	0.00

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
HPWH <55 Gallon (Electric)	0.19	0.12	0.00	0.93

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$1,090.00 / measure
Incentive: \$600.00 / measure

# HPWH >55 Gallon, UEF 2.70 (Electric)

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Heat Pump Water

Heater

Program: A02b Energy Star HVAC

## **Measure Description**

Installation of a heat pump water heater (HPWH) instead of an electric resistance water heater.

### **Baseline Description**

The baseline efficiency case is a new, standard efficiency electric resistance hot water heater.

### **Savings Principle**

The high efficiency case is a high efficiency heat pump water heater.

### **Savings Method**

Deemed

### Unit

Installed heat pump water heater.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
HPWH >55 Gallon, UEF 2.70 (Electric)	197.0	0.0400	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Heat Pump Water Heaters - 2021 Quick Hit Study

Electric kW Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
HPWH >55 Gallon, UEF 2.70 (Electric)	13	1.00	1.00		1.00	1.00	1.00	0.41	0.75

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
HPWH >55 Gallon, UEF 2.70 (Electric)	39.10%	33.00%	14.90%	13.00%

Measure Life Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
HPWH >55 Gallon, UEF 2.70 (Electric)	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
HPWH >55 Gallon, UEF 2.70 (Electric)	0.19	0.12	0.00	0.93

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$660.00 / measure
Incentive: \$150.00 / measure

# Mini Split Heat Pump QIV

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Type: HVAC Measure Type: HVAC O&M Measure Sub Type: Central AC

**Quality Install** 

Program: A02b Energy Star HVAC

## **Measure Description**

The verification of proper charge and airflow during installation of new Central AC system.

### **Baseline Description**

The baseline efficiency case is a cooling system and heating system not installed according to manufacturer specifications.

#### **Savings Principle**

The high efficiency case is the same cooling and heating system installed according to manufacturer specifications.

### **Savings Method**

Calculated using deemed inputs

#### Unit

Completed QIV on new AC system

#### **Savings Equation**

Gross kWh = Tons × (kBtu/hr per ton) × 1/SEER × Hours\_C × %SAVE

Gross kW = Tons  $\times$  (kBtu/hr per ton)  $\times$  1/EER  $\times$  %SAVE

Where:

Tons = Deemed average equipment capacity: 2.7 tons

12 kBtu/hr per ton = Conversion factor

SEER = Seasonal Energy Efficiency Ratio of existing equipment

Hours\_C = Deemed average equivalent full load cooling hours

5%SAVE = Average percent demand reduction; National Grid assumption based on regional PA working groups.

EER = Peak efficiency of existing equipment

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Mini Split Heat Pump QIV	82.3	0.0290	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kWh Note: Updated based on historic measure mix.

Electric kW Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kW Note: Updated based on historic measure mix.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Mini Split Heat Pump QIV	18	1.00	1.00		1.00	1.00	1.00	0.23	0.62

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Mini Split Heat Pump QIV	36.40%	48.20%	8.00%	7.40%

Measure Life Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Mini Split Heat Pump QIV	0.00	0.00	1.53	0

Annual \$ Note: MA values

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Mini Split Heat Pump QIV	0.00	0.00	0.00	1.00

TRC: \$200.00 / measure

Incentive: \$175.00 / measure

# MiniSplit HP

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heat Pumps
 Measure Sub Type: Ductless

Program: A02b Energy Star HVAC

# **Measure Description**

The installation of a more efficient rated Ductless MiniSplit system (15 SEER, 10 HSPF).

### **Baseline Description**

The baseline efficiency case is a non- energy efficiency® rated ductless mini split heat pump with SEER 15, HSPF 8.2.

#### **Savings Principle**

The high efficiency case is a high-efficiency mini-split Heat pump.

### **Savings Method**

Calculated using deemed inputs

#### Unit

Installed MiniSplit HP

### **Savings Equation**

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
MiniSplit HP	584.2	0.1700	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kWh Note: Updated based on historic measure mix.

Electric kW Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
MiniSplit HP	18	1.00	1.00		1.00	1.00	1.00	0.27	0.62

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
MiniSplit HP	36.40%	48.20%	8.00%	7.40%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
MiniSplit HP	0.00	0.00	4.21	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
MiniSplit HP	0.34	0.22	0.00	0.88

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$689.00 / measure
Incentive: \$350.00 / measure

# WiFi Programmable Thermostat with Cooling (Gas)

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A02b Energy Star HVAC

#### **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

### **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

### **Savings Method**

Deemed

#### Unit

Installed programmable thermostat.

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Programmable Thermostat with Cooling (Gas)	18.0	0.0300	2.79	0.00	0.00	0.00	0.00

 ${\tt Electric~kWh~Source:~Wi-Fi-Thermostat-Impact-Evaluation-Secondary-Literature-Study\_FINAL}$ 

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Gas Heat MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Programmable Thermostat with Cooling (Gas)	15	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WiFi Programmable Thermostat with Cooling (Gas)	6.60%	3.80%	47.30%	42.20%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WiFi Programmable Thermostat with Cooling (Gas)	0.00	0.00	3.63	0.00

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Programmable Thermostat with Cooling (Gas)	0.13	0.12	0.00	0.99

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$265.00 / measure
Incentive: \$75.00 / measure

# WiFi Programmable Thermostat with Cooling (Oil)

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A02b Energy Star HVAC

#### **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

### **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

### **Savings Method**

Deemed

#### Unit

Installed programmable thermostat.

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Programmable Thermostat with Cooling (Oil)	64.4	0.0500	0.00	0.00	0.00	2.79	0.00

 ${\tt Electric~kWh~Source:~Wi-Fi-Thermostat-Impact-Evaluation-Secondary-Literature-Study\_FINAL}$ 

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Programmable Thermostat with Cooling (Oil)	15	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WiFi Programmable Thermostat with Cooling (Oil)	6.60%	3.80%	47.30%	42.20%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WiFi Programmable Thermostat with Cooling (Oil)	0.00	0.00	3.63	0.00

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Programmable Thermostat with Cooling (Oil)	0.13	0.12	0.00	0.99

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$265.00 / measure
Incentive: \$75.00 / measure

# Window - Electric Resistance

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, electric

resistance

Program: A02b Energy Star HVAC

### **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Electric Resistance	131.0	0.1300	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM Electric kW Source: MA 2022 TRM

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Electric Resistance	14	1.00	1.00		1.00	1.00	1.00	0.33	0.43

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Window - Electric Resistance	45.00%	44.00%	6.00%	5.00%	

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption

RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Window - Electric Resistance	0.00	0.00	6.72	0

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Electric Resistance	0.04	0.00	0.00	0.96

NTG Source: MA 2022 TRM
TRC: \$251.00 / measure
Incentive: \$75.00 / measure

# Window - Heat Pump

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, heat

pump

Program: A02b Energy Star HVAC

# **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Heat Pump	69.0	0.0500	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM Electric kW Source: MA 2022 TRM

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Heat Pump	13	1.00	1.00		1.00	1.00	1.00	0.37	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Heat Pump	25.00%	29.00%	24.00%	21.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption

RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Window - Heat Pump	0.00	0.00	6.72	0	

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Heat Pump	0.04	0.00	0.00	0.96

NTG Source: MA 2022 TRM
TRC: \$251.00 / measure
Incentive: \$75.00 / measure

# Window - Oil

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, oil

Program: A02b Energy Star HVAC

# **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

# **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross kWh =  $Qty \times deltakWh$ 

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Oil	7.0	0.0100	0.60	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM
Electric kW Source: MA 2022 TRM
Gas Heat MMBtu Source: MA 2022 TRM

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Oil	14	1.00	1.00		1.00	1.00	1.00	0.37	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Oil	4.00%	4.00%	50.00%	43.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption
RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Window - Oil	0.00	0.00	6.72	0

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Oil	0.04	0.00	0.00	0.96

NTG Source: MA 2022 TRM
TRC: \$251.00 / measure
Incentive: \$75.00 / measure

# Window - Propane

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows,

propane

Program: A02b Energy Star HVAC

## **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Propane	7.0	0.0100	0.60	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM
Electric kW Source: MA 2022 TRM
Gas Heat MMBtu Source: MA 2022 TRM

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Propane	14	1.00	1.00		1.00	1.00	1.00	0.37	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Propane	4.00%	4.00%	50.00%	43.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption
RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study CFwp Source: Guidehouse, MA Residential Baseline Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Window - Propane	0.00	0.00	6.72	0

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Propane	0.04	0.00	0.00	0.96

NTG Source: MA 2022 TRM TRC: \$251.00 / measure Incentive: \$75.00 / measure

# Aerator, Electric

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: A03b Energywise

### **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a residential setting with service water heated by electricity.

# **Baseline Description**

The baseline efficiency case is the existing faucet aerator with 2.2 GPM or greater flow rate.

#### **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less installed.

### **Savings Method**

Deemed

### Unit

Installed faucet aerator.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Aerator, Electric	28.0	0.0100	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Aerator, Electric	7	0.86	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Aerator, Electric	41.50%	31.40%	15.20%	11.90%

Measure Life Note: Massachusetts Common Assumption

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in faucet aerators, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Aerator, Electric	269.00	0.00	0	0	

Water/Sewer Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Aerator, Electric	0.27	0.01	0.04	0.78

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$7.00 / unit

Incentive: \$7.00 / unit

# Aerator, Oil

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: A03b Energywise

### **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a residential setting with service water heated by oil.

### **Baseline Description**

The baseline efficiency case is the existing faucet aerator with 2.2 GPM or greater flow rate.

### **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less installed.

### **Savings Method**

Deemed

### Unit

Installed faucet aerator.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Aerator, Oil	0.0	0.0000	0.00	0.00	0.00	0.15	0.00

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Aerator, Oil	7	0.86	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Aerator, Oil	0.00%	0.00%	0.00%	0.00%

Measure Life Note: Massachusetts Common Assumption

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in faucet aerators, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Aerator, Oil	269.00	0.00	0	0

Water/Sewer Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Aerator, Oil	0.27	0.01	0.04	0.78

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$7.00 / unit

Incentive: \$7.00 / unit

# Aerator, Others

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: A03b Energywise

# **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a residential setting with service water heated by propane.

# **Baseline Description**

The baseline efficiency case is the existing faucet aerator with 2.2 GPM or greater flow rate.

#### **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less installed.

### **Savings Method**

Deemed

### Unit

Installed faucet aerator.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Aerator, Others	0.0	0.0000	0.00	0.00	0.00	0.00	0.14

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Propane MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Aerator, Others	7	0.86	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Aerator, Others	0.00%	0.00%	0.00%	0.00%	

Measure Life Note: Massachusetts Common Assumption

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in faucet aerators, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Aerator, Others	269.00	0.00	0	0

Water/Sewer Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Aerator, Others	0.27	0.01	0.04	0.78

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$7.00 / unit

Incentive: \$7.00 / unit

# Air Sealing Kit, Electric

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building ShellMeasure Type: Air SealingMeasure Sub Type: AirSealing/Infiltration

Program: A03b Energywise

## **Measure Description**

The installation of recessed lighting cans that provide air sealing benefits.

### **Baseline Description**

The baseline is leaky recessed lighting cans.

### **Savings Principle**

The high efficiency case is the existing building after the air sealing measure is implemented.

### **Savings Method**

Deemed

### Unit

Installed kit

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Air Sealing Kit, Electric	94.0	0.0710	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Sealing Kit, Electric	12	1.00	1.00		1.00	1.00	1.00	0.34	0.21

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Air Sealing Kit, Electric	26.10%	30.50%	22.50%	20.80%	

Measure Life Source: Rise Engineering (2015). Memo on Pilot Findings for LED inserts for Recessed Light Cans.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Air Sealing Kit, Electric	0.00	0.00	0	0	

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Air Sealing Kit, Electric	0.00	0.00	0.04	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

# Air Sealing Kit, Oil

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building ShellMeasure Type: Air SealingMeasure Sub Type: Air Sealing/Infiltration

Program: A03b Energywise

# **Measure Description**

The installation of recessed lighting cans that provide air sealing benefits.

### **Baseline Description**

The baseline is leaky recessed lighting cans.

### **Savings Principle**

The high efficiency case is the existing building after the air sealing measure is implemented.

### **Savings Method**

Deemed

### Unit

Installed kit

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Air Sealing Kit, Oil	0.0	0.0000	0.00	0.00	0.00	0.38	0.00

Oil MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Oil MMBtu Note: Calculated: (cfm50 pre in - cfm50 new in)/(18.5\* height factor in) \* 0.018 \* 24 \* 60\* heating degree day in / seasonal efficiency in \* correction factor in

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Sealing Kit, Oil	12	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Air Sealing Kit, Oil	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Rise Engineering (2015). Memo on Pilot Findings for LED inserts for Recessed Light Cans.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Air Sealing Kit, Oil	0.00	0.00	0	0	

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Air Sealing Kit, Oil	0.00	0.00	0.04	1.04

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

# Air Sealing Kit, Others

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building ShellMeasure Type: Air SealingMeasure Sub Type: AirSealing/Infiltration

Program: A03b Energywise

# **Measure Description**

The installation of recessed lighting cans that provide air sealing benefits.

### **Baseline Description**

The baseline is leaky recessed lighting cans.

### **Savings Principle**

The high efficiency case is the existing building after the air sealing measure is implemented.

### **Savings Method**

Deemed

### Unit

Installed kit

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Air Sealing Kit, Others	0.0	0.0000	0.00	0.00	0.00	0.00	0.37

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Propane MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Sealing Kit, Others	12	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Air Sealing Kit, Others	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Rise Engineering (2015). Memo on Pilot Findings for LED inserts for Recessed Light Cans.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Air Sealing Kit, Others	0.00	0.00	0	0	

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Air Sealing Kit, Others	0.00	0.00	0.04	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

## **Electric Resistance to MSHP**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heating Measure Sub Type: Heat Pump

Electrification

Program: A03b Energywise

## **Measure Description**

The purchase and installation of high efficiency mini-split heat pump system to replace an electric resistance heating system.

### **Baseline Description**

The baseline efficiency case for heating is a residential electric resistance heating system.

The baseline efficiency case for cooling is a residential window AC unit with EER 9.8.

#### **Savings Principle**

The high efficiency case is an ENERGY STAR® qualified air-source heat pump.

#### Savings Method

Deemed

### Unit

Installed high-efficiency mini-split heat pump system for heating and cooling.

## **Savings Equation**

Heating Gross kWh = Qty\*deltakWh\_heating

Cooling Gross kWh = Qty\*deltakWh cooling

Cooling Gross kW = Qty\*deltakW

Where:

Qty = Total number of units.

deltakWh heating = Average annual heating kWh reduction per unit.

deltakWh\_cooling = Average annual cooling kWh reduction per unit.

deltakW = Average annual kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Electric Resistance to MSHP	6,549.0	2.8300	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kWh Note: Updated based on historic measure mix.

Electric kW Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Electric Resistance to MSHP	18	1.00	1.00		1.00	1.00	1.00	0.02	0.62

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Electric Resistance to MSHP	42.90%	57.10%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Electric Resistance to MSHP	0.00	0.00	4.21	0.00

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Electric Resistance to MSHP	0.31	0.22	0.04	0.91

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$7,000.00 / measure
Incentive: \$4,200.00 / measure

## **LED Bulbs**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Interior Measure Sub Type: LED Screw Base

Program: A03b Energywise

## **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LED offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly

longer lamp lifetimes.

# **Baseline Description**

The baseline efficiency case is a combination of an incandescent bulb and halogen bulb

### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED bulb.

#### **Savings Method**

Deemed

### Unit

Rebated lamp or fixture.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LED Bulbs	18.0	0.0050	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Bulbs	1	0.95	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LED Bulbs	35.10%	30.70%	19.00%	15.10%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in LEDs, ISR is assumed at 83% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LED Bulbs	0.00	0.00	0	3.00

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LED Bulbs	0.00	0.00	0.04	1.04

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$3.00 / unit

Incentive: \$3.00 / unit

# **LED Bulbs (EISA Exempt)**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Interior Measure Sub Type: LED Screw Base

Program: A03b Energywise

## **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is a combination of an incandescent bulb and halogen bulb

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED bulb.

### **Savings Method**

Deemed

### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LED Bulbs (EISA Exempt)	15.0	0.0040	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Bulbs (EISA Exempt)	1	0.95	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LED Bulbs (EISA Exempt)	35.10%	30.70%	19.00%	15.10%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in LEDs, ISR is assumed at 83% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LED Bulbs (EISA Exempt)	0.00	0.00	0	3.00

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LED Bulbs (EISA Exempt)	0.00	0.00	0.04	1.04

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

# **LED Bulbs Reflectors**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Interior Measure Sub Type: LED Screw Base

Program: A03b Energywise

## **Measure Description**

The installation of Light-Emitting Diode (LED) reflectors. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly

longer lamp lifetimes.

# **Baseline Description**

The baseline efficiency case is a combination of an incandescent bulb and halogen bulb

# **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED bulb.

#### **Savings Method**

Deemed

# Unit

Rebated lamp or fixture.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LED Bulbs Reflectors	19.0	0.0050	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Bulbs Reflectors	1	0.95	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LED Bulbs Reflectors	35.10%	30.70%	19.00%	15.10%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in LEDs, ISR is assumed at 83% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LED Bulbs Reflectors	0.00	0.00	0	3.00

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LED Bulbs Reflectors	0.00	0.00	0.04	1.04

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

## **LED Fixture**

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Lighting
 Measure Type: Interior
 Measure Sub Type: LED Fixture

Program: A03b Energywise

# **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is a combination of an incandescent bulb and halogen bulb

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

### **Savings Method**

Deemed

### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LED Fixture	34.0	0.0090	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Fixture	1	0.95	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LED Fixture	35.10%	30.70%	19.00%	15.10%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in LEDs, ISR is assumed at 83% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LED Fixture	0.00	0.00	0	3.50

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LED Fixture	0.00	0.00	0.04	1.04

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

## **LED Outdoor Fixture**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Exterior Measure Sub Type: LED Screw Base

Program: A03b Energywise

## **Measure Description**

The installation of Light-Emitting Diode (LED) outdoor fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly

longer lamp lifetimes.

# **Baseline Description**

The baseline efficiency case is a combination of an incandescent bulb and halogen bulb

### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

#### **Savings Method**

Deemed

### Unit

Rebated lamp or fixture.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LED Outdoor Fixture	34.0	0.0090	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Outdoor Fixture	1	0.95	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LED Outdoor Fixture	35.10%	30.70%	19.00%	15.10%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in LEDs, ISR is assumed at 83% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LED Outdoor Fixture	0.00	0.00	0	3.50

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LED Outdoor Fixture	0.00	0.00	0.04	1.04

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

# **Participant**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Participant Measure Type: Participant Measure Sub Type: Participant

Program: A03b Energywise

**Measure Description** 

This row identifies a participant for tracking and cost purposes.

**Baseline Description** 

**Savings Principle** 

**Savings Method** 

Deemed

Unit

Per participant

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Participant	0.0	0.0000	0.00	0.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Participant	11	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Participant	0.00%	0.00%	0.00%	0.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

Non-Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Participant	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Participant	0.00	0.00	0.04	1.04

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

TRC: \$375.00 / participant

Incentive: \$375.00 / participant

# Pipe Insulation, Electric

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Insulation Measure Sub Type: Pipe Insulation

Program: A03b Energywise

**Measure Description** 

Insulation upgrades to existing water heating system pipes.

**Baseline Description** 

The baseline case is uninsulated heated water pipes.

**Savings Principle** 

The high efficiency case includes pipe wrap.

**Savings Method** 

Deemed

Unit

Insulated equipment

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Insulation, Electric	46.0	0.0100	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pipe Insulation, Electric	7	0.98	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pipe Insulation, Electric	41.50%	31.40%	15.20%	11.90%

Measure Life Note: Massachusetts Common Assumption

ISR Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pipe Insulation, Electric	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pipe Insulation, Electric	0.27	0.01	0.04	0.78

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$7.00 / unit

Incentive: \$7.00 / unit

# Pipe Insulation, Oil

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Insulation Measure Sub Type: Pipe Insulation

Program: A03b Energywise

**Measure Description** 

Insulation upgrades to existing water heating system pipes.

**Baseline Description** 

The baseline case is uninsulated heated water pipes.

**Savings Principle** 

The high efficiency case includes pipe wrap.

**Savings Method** 

Deemed

Unit

Insulated equipment

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Insulation, Oil	0	0.0000	0.00	0.00	0.00	0.30	0.00

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pipe Insulation, Oil	7	0.98	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Pipe Insulation, Oil	0.00%	0.00%	0.00%	0.00%	

Measure Life Note: Massachusetts Common Assumption

ISR Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pipe Insulation, Oil	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pipe Insulation, Oil	0.27	0.01	0.04	0.78

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$7.00 / unit

Incentive: \$7.00 / unit

# Pipe Insulation, Others

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Insulation Measure Sub Type: Pipe Insulation

Program: A03b Energywise

**Measure Description** 

Insulation upgrades to existing water heating system pipes.

**Baseline Description** 

The baseline case is uninsulated heated water pipes.

**Savings Principle** 

The high efficiency case includes pipe wrap.

**Savings Method** 

Deemed

Unit

Insulated equipment

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Insulation, Others	0	0.0000	0.00	0.00	0.00	0.00	0.30

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Propane MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pipe Insulation, Others	7	0.98	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pipe Insulation, Others	0.00%	0.00%	0.00%	0.00%

Measure Life Note: Massachusetts Common Assumption

ISR Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pipe Insulation, Others	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pipe Insulation, Others	0.27	0.01	0.04	0.78

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$7.00 / unit

Incentive: \$7.00 / unit

# **Pre-Weatherization**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Whole Home Measure Type: Weatherization Measure Sub Type: Pre-

Weatherization

Program: A03b Energywise

## **Measure Description**

Rebate for customers to improve home to make it ready for Wx install; non-energy related measures such as asbestos removal or remove knob and tube wiring.

# **Baseline Description**

N/A

## **Savings Principle**

# **Savings Method**

N/A

### Unit

Rebated Pre-Wx

# **Savings Equation**

Gross kWh =  $Qty \times deltakWh$ 

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pre-Weatherization	0.0	0.0000	0.00	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pre-Weatherization	1	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pre-Weatherization	0.00%	0.00%	0.00%	0.00%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pre-Weatherization	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pre-Weatherization	0.00	0.00	0.04	1.04

NTG Source: Guidehouse Inc., Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado

TRC: \$250.00 / job

Incentive: \$250.00 / job

# **Programmable Thermostat, Electric**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A03b Energywise

## **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

### **Baseline Description**

The baseline efficiency case is an HVAC system without a programmable thermostat.

### **Savings Principle**

The high efficiency case is an HVAC system with a programmable thermostat installed.

### **Savings Method**

Deemed

### Unit

Installed programmable thermostat.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat, Electric	222.6	0.1700	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat, Electric	19	0.88	1.00		1.00	1.00	1.00	0.34	0.21

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat, Electric	26.00%	31.00%	23.00%	21.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in thermostats, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat, Electric	0.00	0.00	3.63	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

#### Annual \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat, Electric	0.47	0.01	0.04	0.58

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$100.00 / unit

Incentive: \$100.00 / unit

# **Programmable Thermostat, Oil**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A03b Energywise

## **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

### **Baseline Description**

The baseline efficiency case is an HVAC system without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system with a programmable thermostat installed.

# **Savings Method**

Deemed

### Unit

Installed programmable thermostat.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat, Oil	27.0	0.0400	0.00	0.00	0.00	2.07	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat, Oil	19	0.88	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat, Oil	7.00%	4.00%	47.00%	42.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in thermostats, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat, Oil	0.00	0.00	3.63	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# Annual \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat, Oil	0.47	0.01	0.04	0.58

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$100.00 / unit

Incentive: \$100.00 / unit

# **Programmable Thermostat, Others**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A03b Energywise

## **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

### **Baseline Description**

The baseline efficiency case is an HVAC system without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system with a programmable thermostat installed.

### **Savings Method**

Deemed

### Unit

Installed programmable thermostat.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat, Others	27.0	0.0400	0.00	0.00	0.00	0.00	2.07

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Propane MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat, Others	19	0.88	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Programmable Thermostat, Others	7.00%	4.00%	47.00%	42.00%	

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in thermostats, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat, Others	0.00	0.00	3.63	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# Annual \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat, Others	0.47	0.01	0.04	0.58

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$100.00 / unit

Incentive: \$100.00 / unit

# **Refrigerator Brush**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Refrigeration Measure Type: Refrigeration O&M Measure Sub Type: Refrigerator

Brush

Program: A03b Energywise

**Measure Description** 

The cleaning of refrigerator coils.

**Baseline Description** 

A refrigerator with uncleaned coils.

**Savings Principle** 

A refrigerator with coils cleaned by an auditor.

**Savings Method** 

Deemed

Unit

Per brushed refrigerator coil

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Refrigerator Brush	10.9	0.0020	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Refrigerator Brush	5	1.00	1.00		1.00	1.00	1.00	0.79	0.65

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Refrigerator Brush	29.00%	32.00%	18.00%	21.00%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Refrigerator Brush	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Refrigerator Brush	0.00	0.00	0.04	1.04

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

TRC: \$5.00 / unit
Incentive: \$5.00 / unit

# Showerhead, Electric

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A03b Energywise

## **Measure Description**

A showerhead with a control that limits flow once water is heated.

### **Baseline Description**

The baseline case is a showerhead with a flow of 2.5 gallons per minute, or for the case of the adapter, a low flow showerhead with flow of 1.5 gpm or less.

#### **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

### **Savings Method**

Deemed

#### Unit

Installed showerhead

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Showerhead, Electric	213.0	0.0500	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Showerhead, Electric	15	0.85	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Showerhead, Electric	41.50%	31.40%	15.20%	11.90%	

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in showerheads, ISR is assumed at 53% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Showerhead, Electric	1565.00	0.00	0	0.03

Water/Sewer Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential

and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Showerhead, Electric	0.27	0.01	0.04	0.78

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$30.00 / unit

Incentive: \$30.00 / unit

# Showerhead, Oil

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A03b Energywise

## **Measure Description**

A showerhead with a control that limits flow once water is heated.

### **Baseline Description**

The baseline case is a showerhead with a flow of 2.5 gallons per minute, or for the case of the adapter, a low flow showerhead with flow of 1.5 gpm or less.

## **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

### **Savings Method**

Deemed

#### Unit

Installed showerhead

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu			Propane MMBtu
Showerhead, Oil	0	0	0.00	0.00	0.00	1.20	0.00

Oil MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Showerhead, Oil	15	0.85	1.00	•	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Showerhead, Oil	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in showerheads, ISR is assumed at 53% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Showerhead, Oil	1565.00	0.00	0	0.03

Water/Sewer Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Showerhead, Oil	0.27	0.01	0.04	0.78

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$30.00 / unit

Incentive: \$30.00 / unit

# Showerhead, Others

Fuel: Electric Sector: Residential Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A03b Energywise

## **Measure Description**

A showerhead with a control that limits flow once water is heated.

### **Baseline Description**

The baseline case is a showerhead with a flow of 2.5 gallons per minute, or for the case of the adapter, a low flow showerhead with flow of 1.5 gpm or less.

## **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

### **Savings Method**

Deemed

#### Unit

Installed showerhead

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Showerhead, Others	0	0	0.00	0.00	0.00	0.00	1.10

Propane MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Showerhead, Others	15	0.85	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Showerhead, Others	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in showerheads, ISR is assumed at 53% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Showerhead, Others	1565.00	0.00	0	0.03

Water/Sewer Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Showerhead, Others	0.27	0.01	0.04	0.78

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$30.00 / unit

Incentive: \$30.00 / unit

# **Smart Strip**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Plug Load Measure Type: Smart Strips Measure Sub Type: Smart Strip

Program: A03b Energywise

## **Measure Description**

The basic measures switches off plug load using current sensors and switching devices which turn off plug load when electrical current drops below threshold low levels. The advanced measure shuts devices off after it no longer senses activity from their infrared controls.

### **Baseline Description**

The baseline efficiency case is the absence power strip and leaving peripheral devices plugged in or using a power surge protector and leaving peripheral devices on

## **Savings Principle**

The high efficiency case is the use of a smart strip or advanced smart strip.

#### Savings Method

Deemed

#### Unit

Rebated smart strip.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Smart Strip	105.0	0.0200	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Smart Strip	5	0.84	1.00		0.92	0.92	0.92	0.58	0.86

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Smart Strip	32.00%	34.80%	15.00%	18.00%

Measure Life Note: Massachusetts Common Assumption

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study RRsp Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study RRwp Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Smart Strip	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Smart Strip	0.31	0.01	0.04	0.74

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$22.00 / unit

Incentive: \$22.00 / unit

## Weatherization, Electric

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Building Shell
 Measure Type: Insulation
 Measure Sub Type: Shell

Program: A03b Energywise

## **Measure Description**

Installation of weatherization measures such as air sealing and insulation upgrades in existing facilities.

### **Baseline Description**

The baseline efficiency case is any existing home shell measures.

### **Savings Principle**

The high efficiency case includes increased weatherization insulation levels.

### **Savings Method**

Deemed

#### Unit

Completed insulation project.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Weatherization, Electric	840.0	0.6400	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Weatherization, Electric	20	1.00	1.00		1.00	1.00	1.00	0.34	0.21

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Weatherization, Electric	26.00%	31.00%	23.00%	21.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Weatherization, Electric	0.00	0.00	66.59	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Weatherization, Electric	0.14	0.01	0.04	0.91

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$3,700.00 / participant

Incentive: \$3,080.00 / participant

## Weatherization, Oil

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Building Shell
 Measure Type: Insulation
 Measure Sub Type: Shell

Program: A03b Energywise

## **Measure Description**

Installation of weatherization measures such as air sealing and insulation upgrades in existing facilities.

### **Baseline Description**

The baseline efficiency case is any existing home shell measures.

#### **Savings Principle**

The high efficiency case includes increased weatherization insulation levels.

### **Savings Method**

Deemed

#### Unit

Completed insulation project.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Weatherization, Oil	48.0	0.0800	0.00	0.00	0.00	9.80	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Weatherization, Oil	20	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Weatherization, Oil	7.00%	4.00%	47.00%	42.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Weatherization, Oil	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Weatherization, Oil	0.14	0.01	0.04	0.91

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$4,700.00 / participant

Incentive: \$2,945.00 / participant

## Weatherization, Others

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Building Shell
 Measure Type: Insulation
 Measure Sub Type: Shell

Program: A03b Energywise

## **Measure Description**

Installation of weatherization measures such as air sealing and insulation upgrades in existing facilities.

### **Baseline Description**

The baseline efficiency case is any existing home shell measures.

#### **Savings Principle**

The high efficiency case includes increased weatherization insulation levels.

### **Savings Method**

Deemed

#### Unit

Completed insulation project.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Weatherization, Others	48.0	0.0800	0.00	0.00	0.00	0.00	9.60

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Propane MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Weatherization, Others	20	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Weatherization, Others	7.00%	4.00%	47.00%	42.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Weatherization, Others	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Weatherization, Others	0.14	0.01	0.04	0.91

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$4,700.00 / participant

Incentive: \$2,945.00 / participant

# WiFi Thermostat, AC Only

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A03b Energywise

#### **Measure Description**

Installation of wifi thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

### **Baseline Description**

The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a wifi thermostat installed.

### **Savings Method**

Deemed

#### Unit

Installed programmable thermostat.

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Thermostat, AC Only	51.0	0.0800	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Thermostat, AC Only	15	0.88	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WiFi Thermostat, AC Only	7.00%	4.00%	47.00%	42.00%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in thermostats, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results. RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WiFi Thermostat, AC Only	0.00	0.00	3.63	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Thermostat, AC Only	0.47	0.01	0.04	0.58

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$300.00 / unit
Incentive: \$200.00 / unit

## WiFi Thermostat, Electric

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A03b Energywise

#### **Measure Description**

Installation of wifi thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

### **Baseline Description**

The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a wifi thermostat installed.

### **Savings Method**

Deemed

#### Unit

Installed programmable thermostat.

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Thermostat, Electric	222.6	0.1700	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Thermostat, Electric	15	0.88	1.00		1.00	1.00	1.00	0.34	0.21

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WiFi Thermostat, Electric	26.00%	31.00%	23.00%	21.00%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in thermostats, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

 $RRwp\ Note: Realization\ rate\ is\ 100\%\ since\ gross\ savings\ values\ are\ based\ on\ evaluation\ results.$ 

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WiFi Thermostat, Electric	0.00	0.00	3.63	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Thermostat, Electric	0.47	0.01	0.04	0.58

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$300.00 / unit
Incentive: \$200.00 / unit

## WiFi Thermostat, Oil

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A03b Energywise

#### **Measure Description**

Installation of wifi thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

### **Baseline Description**

The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a wifi thermostat installed.

### **Savings Method**

Deemed

#### Unit

Installed programmable thermostat.

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Thermostat, Oil	27.0	0.0400	0.00	0.00	0.00	2.79	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

**Energy Impact Factors** 

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Thermostat, Oil	15	0.88	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WiFi Thermostat, Oil	7.00%	4.00%	47.00%	42.00%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in thermostats, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WiFi Thermostat, Oil	0.00	0.00	3.63	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Thermostat, Oil	0.47	0.01	0.04	0.58

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$300.00 / unit
Incentive: \$200.00 / unit

## WiFi Thermostat, Others

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A03b Energywise

#### **Measure Description**

Installation of wifi thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

### **Baseline Description**

The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a wifi thermostat installed.

## Savings Method

Deemed

#### Unit

Installed programmable thermostat.

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Thermostat, Others	27.0	0.0400	0.00	0.00	0.00	0.00	2.79

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Propane MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

**Energy Impact Factors** 

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Thermostat, Others	15	0.88	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WiFi Thermostat, Others	7.00%	4.00%	47.00%	42.00%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

ISR Note: For mailed-in thermostats, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WiFi Thermostat, Others	0.00	0.00	3.63	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Thermostat, Others	0.47	0.01	0.04	0.58

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$300.00 / unit
Incentive: \$200.00 / unit

## Window - Electric Resistance

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, electric

resistance

Program: A03b EnergyWise

## **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Electric Resistance	131.0	0.1300	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM Electric kW Source: MA 2022 TRM

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Electric Resistance	14	1.00	1.00		1.00	1.00	1.00	0.33	0.43

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Window - Electric Resistance	45.00%	44.00%	6.00%	5.00%	

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption

RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Window - Electric Resistance	0.00	0.00	6.72	0

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Electric Resistance	0.04	0.00	0.04	0.96

NTG Source: MA 2022 TRM

## Window - Heat Pump

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, heat

pump

Program: A03b EnergyWise

## **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Heat Pump	69.0	0.0500	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM Electric kW Source: MA 2022 TRM

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Heat Pump	13	1.00	1.00		1.00	1.00	1.00	0.37	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Window - Heat Pump	25.00%	29.00%	24.00%	21.00%	

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption

RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Window - Heat Pump	0.00	0.00	6.72	0

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Heat Pump	0.04	0.00	0.04	0.96

NTG Source: MA 2022 TRM

## Window - Oil

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, oil

Program: A03b EnergyWise

## **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

### **Savings Equation**

Gross kWh =  $Qty \times deltakWh$ 

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Oil	7.0	0.0100	0.60	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM
Electric kW Source: MA 2022 TRM
Gas Heat MMBtu Source: MA 2022 TRM

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Oil	14	1.00	1.00		1.00	1.00	1.00	0.37	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Oil	4.00%	4.00%	50.00%	43.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Window - Oil	0.00	0.00	6.72	0

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Oil	0.04	0.00	0.04	0.96

NTG Source: MA 2022 TRM

## Window - Propane

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows,

propane

Program: A03b EnergyWise

## **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Propane	7.0	0.0100	0.60	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM
Electric kW Source: MA 2022 TRM
Gas Heat MMBtu Source: MA 2022 TRM

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Propane	14	1.00	1.00		1.00	1.00	1.00	0.37	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Propane	4.00%	4.00%	50.00%	43.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study CFwp Source: Guidehouse, MA Residential Baseline Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Window - Propane	0.00	0.00	6.72	0

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Propane	0.04	0.00	0.04	0.96

NTG Source: MA 2022 TRM

## **AERATOR Elec**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: A03b EnergywiseMF

### **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a commercial setting with service water heated by electricity.

## **Baseline Description**

The baseline efficiency case is 2.2 GPM or greater faucet.

### **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less aerator installed.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed faucet aerator.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
AERATOR Elec	38.0	0.0091	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
AERATOR Elec	7	0.90	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
AERATOR Elec	41.50%	31.40%	15.20%	11.90%

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
AERATOR Elec	359.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
AERATOR Elec	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: LI MF Bundled costs (see Participant listing)

Incentive: LI MF Bundled costs (see Participant listing)

## **AERATOR OIL**

Fuel: Electric Sector: Residential Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: A03b EnergywiseMF

## **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a commercial setting with service water heated by electricity.

## **Baseline Description**

The baseline efficiency case is 2.2 GPM or greater faucet.

### **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less aerator installed.

### **Savings Method**

Deemed

### Unit

Installed faucet aerator.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
AERATOR Oil	0	0	0.00	0.00	0.00	0.20	0.00

Oil MMBtu Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
AERATOR OII	7	0.90	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
AERATOR Oil	0.00%	0.00%	0.00%	0.00%

Measure Life Note: National Grid assumption based on regional PA working groups.

ISR Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
AERATOR Oil	359.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
AERATOR Oil	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

Incentive: EW MF Bundled costs (see Participant listing)

### AIR SEALING ELEC WITH AC

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Building Shell Measure Type: Air Sealing Measure Sub Type: Electric with AC

Program: A03b EnergywiseMF

#### **Measure Description**

Thermal shell air leaks are sealed through strategic use and location of air-tight materials.

### **Baseline Description**

The baseline efficiency case is the existing building before the air sealing measure is implemented. The baseline building is characterized by the existing CFM50 measurement (CFM50PRE) for single family homes, or the existing air changes per hour (ACHPRE)

#### **Savings Principle**

The high efficiency case is the existing building after the air sealing measure is implemented. The high efficiency building is characterized by the new CFM50 measurement for single family homes (CFM50POST), or the new air changes per hour (ACHPOST) for multi-family facilities, which is measured after the air sealing measure is implemented.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed air sealing project.

#### **Savings Equation**

Gross kWh = Stories × SQFT × (CFM/SQFT\_pre - CFM/SQFT\_post) × deltakWh/CFM

Gross kW = Gross kWh × kW/kWh

Where:

Stories = Total stories in the multi-family building

SQFT = Area of building in square feet

CFM/SQFT\_pre = Estimate of pre-retrofit air leakagein CFM/SQFT based on number of stories in the building and air-tightness ratings of the existing roof and floor

CFM/SQFT\_post = Estimate of post-retrofit air leakage in CFM/SQFT based on number of stories in the building and airtightness ratings of theimproved roof and floor

deltakWh/CFM = Average annual kWh reduction per CFM

Gross kWh = Stories × SQFT × (CFM/SQFT\_pre - CFM/SQFT\_post) × deltakWh/CFM

kW/kWh = Average kW reduction per kWh reduction

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
AIR SEALING ELEC WITH AC	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
AIR SEALING ELEC WITH AC	20	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
AIR SEALING ELEC WITH AC	6.59%	3.85%	47.32%	42.24%

Measure Life Source: 'ComEd Effective Useful Life Research Report', May 2018

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
AIR SEALING ELEC WITH AC	0.00	0.00	19.35	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
AIR SEALING ELEC WITH AC	0.33	0.01	0.00	0.68

NTG Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

#### AIR SEALING OIL

 Sector: Residential
 Fuel: Electric
 Program Type: Custom

 Measure Category: Building Shell
 Measure Type: Air Sealing
 Measure Sub Type: Oil

Program: A03b EnergywiseMF

### **Measure Description**

Thermal shell air leaks are sealed through strategic use and location of air-tight materials.

### **Baseline Description**

The baseline efficiency case is the existing building before the air sealing measure is implemented. The baseline building is characterized by the existing CFM50 measurement (CFM50PRE) for single family homes, or the existing air changes per hour (ACHPRE)

### **Savings Principle**

The high efficiency case is the existing building after the air sealing measure is implemented. The high efficiency building is characterized by the new CFM50 measurement for single family homes (CFM50POST), or the new air changes per hour (ACHPOST) for multi-family facilities, which is measured after the air sealing measure is implemented.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed air sealing project.

#### **Savings Equation**

Gross kWh = Stories × SQFT × (CFM/SQFT\_pre - CFM/SQFT\_post) × deltakWh/CFM

Gross  $kW = Gross kWh \times kW/kWh$ 

Where:

Stories = Total stories in the multi-family building

SQFT = Area of building in square feet

CFM/SQFT\_pre = Estimate of pre-retrofit air leakagein CFM/SQFT based on number of stories in the building and air-tightness ratings of the existing roof and floor

CFM/SQFT\_post = Estimate of post-retrofit air leakage in CFM/SQFT based on number of stories in the building and airtightness ratings of theimproved roof and floor

deltakWh/CFM = Average annual kWh reduction per CFM

Gross kWh = Stories × SQFT × (CFM/SQFT\_pre - CFM/SQFT\_post) × deltakWh/CFM

kW/kWh = Average kW reduction per kWh reduction

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
AIR SEALING OIL	Calc	Calc	0.00	0.00	0.00	Calc	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Oil MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
AIR SEALING OIL	20	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
AIR SEALING OIL	0.00%	0.00%	0.00%	0.00%

Measure Life Source: 'ComEd Effective Useful Life Research Report', May 2018

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
AIR SEALING OIL	0.00	0.00	19.35	0	

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# Net-to-Gross Factors

Measure	FR	Sop	Sonp	NTG
AIR SEALING OIL	0.33	0.01	0.00	0.68

NTG Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

# **Common Ext LED Bulb**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Exterior Measure Sub Type: Common LED

Program: A03b EnergywiseMF

**Measure Description** 

The installation of ENERGY STAR® LED outdoor bulbs.

**Baseline Description** 

The baseline efficiency case is the existing installed bulb.

**Savings Principle** 

The high efficiency case is bulbs that use fewer watts.

**Savings Method** 

Deemed

Unit

Installed bulb

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Ext LED Bulb	162.0	0.0405	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Ext LED Bulb	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Ext LED Bulb	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

SPF Note: Savings persistence is assumed to be 100%.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Common Ext LED Bulb	0.00	0.00	14.12	0	

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Ext LED Bulb	0.23	0.01	0.00	0.78

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

### **Common Ext LED Fixture**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Exterior Measure Sub Type: Common LED

Program: A03b EnergywiseMF

### **Measure Description**

The installation of ENERGY STAR® compact fluorescent (CFL) indoor fixtures. Compact fluorescent fixtures offer comparable luminosity to incandescent fixtures at significantly

less wattage and significantly longer lifetimes. Hardwired fluorescent fixturesoffer comparable luminosity to incandescent fixtures at significantly lower wattage and offer significantly longer lifespan.

# **Baseline Description**

The baseline efficiency case is the existing lighting hours of use.

# **Savings Principle**

The high efficiency case is lights that are using fewer hours, reducing energy.

#### **Savings Method**

Calculated using site-specific inputs

# Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh =  $[(QTY_pre \times Watts_pre \times Hours_base) - (QTY_ee \times Watts_ee \times Hours_ee)]/1000 \times 52$ 

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY ee = Quantity of efficient fixtures/bulbs installed

Watts pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Note: Multifamily common area hours are site specific

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Ext LED Fixture	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Ext LED Fixture	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Ext LED Fixture	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Ext LED Fixture	0.00	0.00	14.12	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Ext LED Fixture	0.23	0.01	0.00	0.78

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

# **Common Ext Reflector**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Exterior Measure Sub Type: Common

Reflector

Program: A03b EnergywiseMF

## **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

#### **Savings Method**

Deemed

#### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts\_pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Note: Multifamily common area hours are site specific

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Ext Reflector	210.0	0.0525	0.00	0.00	0.00	0.00	0.00

 ${\bf Electric\ kWh\ Source:\ RI-20-RX-EWMFImpact-Impact\ Evaluation\ of\ EnergyWise\ Multifamily\ Program}$ 

Electric kW Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Ext Reflector	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Ext Reflector	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Ext Reflector	0.00	0.00	14.12	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Ext Reflector	0.23	0.01	0.00	0.78

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

# **Common Int EISA Exempt**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Common EISA

Program: A03b EnergywiseMF

### **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

### **Savings Method**

Deemed

#### Unit

Rebated lamp or fixture.

### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts pre = Rated watts of pre-retrofit fixtures/bulbs

Watts ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Note: Multifamily common area hours are site specific

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Int EISA Exempt	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Int EISA Exempt	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Int EISA Exempt	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Int EISA Exempt	0.00	0.00	14.12	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Int EISA Exempt	0.23	0.01	0.00	0.78

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

# **Common Int LED Bulbs**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Common LED

Program: A03b EnergywiseMF

**Measure Description** 

The installation of ENERGY STAR® LED indoor bulbs.

**Baseline Description** 

The baseline efficiency case is the existing installed bulb.

**Savings Principle** 

The high efficiency case is bulbs that use fewer watts.

**Savings Method** 

Deemed

Unit

Installed bulb

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Int LED Bulbs	179.0	0.0448	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Int LED Bulbs	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Int LED Bulbs	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

SPF Note: Savings persistence is assumed to be 100%.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Int LED Bulbs	0.00	0.00	14.12	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Int LED Bulbs	0.23	0.01	0.00	0.78

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

### **Common Int LED Fixture**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Common LED

Program: A03b EnergywiseMF

#### **Measure Description**

The installation of ENERGY STAR® compact fluorescent (CFL) indoor fixtures. Compact fluorescent fixtures offer comparable luminosity to incandescent fixtures at significantly

less wattage and significantly longer lifetimes. Hardwired fluorescent fixturesoffer comparable luminosity to incandescent fixtures at significantly lower wattage and offer significantly longer lifespan.

### **Baseline Description**

The baseline efficiency case is a blend of incandescent, compact fluorescent, and halogen lamps. For home audit applications, the baseline is the existing fixture.

#### **Savings Principle**

The high efficiency case is an ENERGY STAR® qualified compact fluorescent light fixture wired for exclusive use with pin-based CFLs.

# **Savings Method**

Deemed

### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts\_pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Note: Multifamily common area hours are site specific

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Int LED Fixture	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Int LED Fixture	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Int LED Fixture	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Int LED Fixture	0.00	0.00	14.12	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Int LED Fixture	0.23	0.01	0.00	0.78

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

# **Common Int Reflector**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Common

Reflector

Program: A03b EnergywiseMF

# **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

#### **Savings Method**

Deemed

#### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts\_pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014

Hours Note: Multifamily common area hours are site specific

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Int Reflector	140.0	0.0350	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Int Reflector	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Int Reflector	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Int Reflector	0.00	0.00	14.12	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Int Reflector	0.23	0.01	0.00	0.78

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

### Custom

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Custom Measure Sub Type: Custom

Program: A03b EnergywiseMF

# **Measure Description**

Vendors install a variety of measures at multifamily facilities; includes all custom multifamily measures.

### **Baseline Description**

For retrofit projects, the baseline efficiency case is the same as the existing, or pre-retrofit, case for the custom multifamily measures.

### **Savings Principle**

The high efficiency scenario is specific to the facility and may include one or more energy efficiency custom non-lighting multifamily measures.

## **Savings Method**

Calculated using site-specific inputs

# Unit

Completed custom project

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom	Calc	Calc	0.00	0.00	0.00	Calc	Calc

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom	multi	1.00	1.00		0.86	0.86	0.86	0.58	0.43

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Custom	43.13%	56.87%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%.

CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Custom	0.00	0.00	0	0	

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom	0.00	0.00	0.00	1.00

TRC: EW MF Bundled costs (see Participant listing)

# **Dwelling Ext LED Fixture**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Exterior Measure Sub Type: Dwelling LED

Program: A03b EnergywiseMF

#### **Measure Description**

The installation of ENERGY STAR® compact fluorescent (CFL) indoor fixtures. Compact fluorescent fixtures offer comparable luminosity to incandescent fixtures at significantly

less wattage and significantly longer lifetimes. Hardwired fluorescent fixturesoffer comparable luminosity to incandescent fixtures at significantly lower wattage and offer significantly longer lifespan.

### **Baseline Description**

The baseline efficiency case is a blend of incandescent, compact fluorescent, and halogen lamps. For home audit applications, the baseline is the existing fixture.

## **Savings Principle**

The high efficiency case is an ENERGY STAR® qualified compact fluorescent light fixture wired for exclusive use with pin-based CFLs.

# **Savings Method**

Calculated using site-specific inputs

#### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts\_pre = Rated watts of pre-retrofit fixtures/bulbs

Watts ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014

Hours Note: Multifamily dwelling unit hours defined by room type from NMR HOU study.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dwelling Ext LED Fixture	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Ext LED Fixture	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dwelling Ext LED Fixture	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dwelling Ext LED Fixture	0.00	0.00	0	3.50

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dwelling Ext LED Fixture	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

TRC: EW MF Bundled costs (see Participant listing)

# **Dwelling Ext Reflector**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Exterior Measure Sub Type: Dwelling

Reflector

Program: A03b EnergywiseMF

## **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

#### **Savings Method**

Deemed

#### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts\_pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Note: Multifamily dwelling unit hours defined by room type from NMR HOU study.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dwelling Ext Reflector	19.0	0.0048	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Ext Reflector	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dwelling Ext Reflector	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$ One-time \$		
Dwelling Ext Reflector	0.00	0.00	0	3.00	

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dwelling Ext Reflector	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

TRC: EW MF Bundled costs (see Participant listing)

# **Dwelling Int EISA Exempt**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Dwelling EISA

Program: A03b EnergywiseMF

#### **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

### **Savings Method**

Deemed

#### Unit

Rebated lamp or fixture.

### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts pre = Rated watts of pre-retrofit fixtures/bulbs

Watts ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014

Hours Note: Multifamily dwelling unit hours defined by room type from NMR HOU study.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dwelling Int EISA Exempt	15.0	0.0038	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int EISA Exempt	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Dwelling Int EISA Exempt	35.11%	30.72%	19.04%	15.12%	

Measure Life Note: Based on MA EUL assumptions

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dwelling Int EISA Exempt	0.00	0.00	0	3.00

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dwelling Int EISA Exempt	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

TRC: EW MF Bundled costs (see Participant listing)

# **Dwelling Int LED Bulbs**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Dwelling LED

Program: A03b EnergywiseMF

**Measure Description** 

The installation of ENERGY STAR® LED indoor bulbs.

**Baseline Description** 

The baseline efficiency case is the existing installed bulb.

**Savings Principle** 

The high efficiency case is bulbs that use fewer watts.

**Savings Method** 

Deemed

Unit

Installed bulb

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dwelling Int LED Bulbs	18.0	0.0045	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int LED Bulbs	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dwelling Int LED Bulbs	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions SPF Note: Savings persistence is assumed to be 100%.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dwelling Int LED Bulbs	0.00	0.00	0	3.50

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dwelling Int LED Bulbs	0.00	0.00	0.00	1.00

TRC: EW MF Bundled costs (see Participant listing)

# **Dwelling Int LED Fixture**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Dwelling LED

Program: A03b EnergywiseMF

### **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, CFLs and other bulbs types, as provided by market research or for a home energy audit, the base line is a 65 Watt incandescent.

### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts pre = Rated watts of pre-retrofit fixtures/bulbs

Watts ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014

Hours Note: Multifamily dwelling unit hours defined by room type from NMR HOU study.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dwelling Int LED Fixture	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int LED Fixture	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dwelling Int LED Fixture	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated. RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Dwelling Int LED Fixture	0.00	0.00	0	3.50	

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dwelling Int LED Fixture	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

TRC: EW MF Bundled costs (see Participant listing)

# **Dwelling Int Reflector**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Dwelling

Reflector

Program: A03b EnergywiseMF

## **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

#### **Savings Method**

Deemed

#### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts\_pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014

Hours Note: Multifamily dwelling unit hours defined by room type from NMR HOU study.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dwelling Int Reflector	19.0	0.0048	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int Reflector	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dwelling Int Reflector	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dwelling Int Reflector	0.00	0.00	0	3.00

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dwelling Int Reflector	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

TRC: EW MF Bundled costs (see Participant listing)

# **Heating System Retrofit-Boiler**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heating Measure Sub Type: Retrofit Boiler

Program: A03b EnergywiseMF

**Measure Description** 

The installation of high efficiency heating systems.

**Baseline Description** 

The baseline is the existing heating system.

**Savings Principle** 

The high efficiency case includes replacing heating systems with higher efficiency systems.

**Savings Method** 

Calculated using site-specific inputs

Unit

Installed high-efficiency heating system.

**Savings Equation** 

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

 $Gross\ MMBtu\_Oil = Qty \times deltaMMBtu\_Oil$ 

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

deltaMMBtu Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating System Retrofit-Boiler	0	0	0.00	0.00	0.00	20.40	0.00

Oil MMBtu Source: The Cadmus Group, Inc. (2012). Low Income Single Family Impact Evaluation. Prepared for the Electric and Gas Program Administrators of Massachusetts.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating System Retrofit-Boiler	23	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Heating System Retrofit-Boiler	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heating System Retrofit-Boiler	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating System Retrofit-Boiler	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

TRC: EW MF Bundled costs (see Participant listing)

# **Heating System Retrofit-Furnace**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heating Measure Sub Type: Retrofit Furnace

Program: A03b EnergywiseMF

**Measure Description** 

The installation of high efficiency heating systems.

**Baseline Description** 

The baseline is the existing heating system.

**Savings Principle** 

The high efficiency case includes replacing heating systems with higher efficiency systems.

**Savings Method** 

Calculated using site-specific inputs

Unit

Installed high-efficiency heating system.

**Savings Equation** 

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Gross MMBtu\_Oil = Qty  $\times$  deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating System Retrofit-Furnace	132.0	0.0700	0.00	0.00	0.00	14.30	0.00

Electric kWh Source: The Cadmus Group, Inc. (2012). Low Income Single Family Impact Evaluation. Prepared for the Electric and Gas Program Administrators of Massachusetts.

Electric kW Source: The Cadmus Group, Inc. (2012). Low Income Single Family Impact Evaluation. Prepared for the Electric and Gas Program Administrators of Massachusetts.

Oil MMBtu Source: The Cadmus Group, Inc. (2012). Low Income Single Family Impact Evaluation. Prepared for the Electric and Gas Program Administrators of Massachusetts.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating System Retrofit-Furnace	17	1.00	1.00		1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heating System Retrofit-Furnace	38.00%	62.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Heating System Retrofit-Furnace	0.00	0.00	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating System Retrofit-Furnace	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

TRC: EW MF Bundled costs (see Participant listing)

### INSULATION ELEC WITH AC

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Building Shell Measure Type: Insulation Measure Sub Type: Electric with AC

Program: A03b EnergywiseMF

### **Measure Description**

Shell insulation upgrades applied in existing facilities including improved insulation in attics, basements and sidewalls.

## **Baseline Description**

The baseline efficiency case is any existing home shell measures.

#### **Savings Principle**

The high efficiency case includes increased weatherization insulation levels.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed insulation project.

#### **Savings Equation**

Gross kWh =  $SQFT \times deltakWh/SQFT \times (1/R_pre - 1/R_post)$ 

Gross kW = Gross kWh × kW/kWh

Where:

SQFT = Square feet of insulation installed

deltakWh/SQFT = Average annual kWh reduction per SQFT of insulation

R\_pre = R-Value of the existing insulation

R post =R-Value of the new installed insulation

Gross kWh = Stories × SQFT × (CFM/SQFT\_pre - CFM/SQFT\_post) × deltakWh/CFM

kW/kWh = Average annual kW reduction per kWh reduction

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
INSULATION ELEC WITH AC	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
INSULATION ELEC WITH AC	25	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
INSULATION ELEC WITH AC	6.59%	3.85%	47.32%	42.24%	

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
INSULATION ELEC WITH AC	0.00	0.00	47.31	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
INSULATION ELEC WITH AC	0.33	0.01	0.00	0.68

 $NTG\ Source:\ RI-20-RX-EWMFImpact-Impact\ Evaluation\ of\ EnergyWise\ Multifamily\ Program$ 

TRC: EW MF Bundled costs (see Participant listing)

## **INSULATION OIL**

Sector: ResidentialFuel: ElectricProgram Type: CustomMeasure Category: Building ShellMeasure Type: InsulationMeasure Sub Type: Oil

Program: A03b EnergywiseMF

### **Measure Description**

Shell insulation upgrades applied in existing facilities including improved insulation in attics, basements and sidewalls.

## **Baseline Description**

The baseline efficiency case is any existing home shell measures.

#### **Savings Principle**

The high efficiency case includes increased weatherization insulation levels.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed insulation project.

#### **Savings Equation**

Gross kWh =  $SQFT \times deltakWh/SQFT \times (1/R_pre - 1/R_post)$ 

Gross kW = Gross kWh × kW/kWh

Where:

SQFT = Square feet of insulation installed

deltakWh/SQFT = Average annual kWh reduction per SQFT of insulation

R\_pre = R-Value of the existing insulation

 $R_post = R-Value of the new installed insulation$ 

Gross kWh = Stories × SQFT × (CFM/SQFT\_pre - CFM/SQFT\_post) × deltakWh/CFM

kW/kWh = Average annual kW reduction per kWh reduction

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
INSULATION OIL	Calc	Calc	0.00	0.00	0.00	7.17	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
INSULATION OIL	25	1.00	1.00		1.00	1.00	1.00	1.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
INSULATION OIL	1.00%	4.00%	53.00%	42.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
INSULATION OIL	0.00	0.00	47.31	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
INSULATION OIL	0.33	0.01	0.00	0.68

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

# **Participant**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Participant Measure Type: Participant Measure Sub Type: Participant

Program: A03b EnergywiseMF

**Measure Description** 

This row identifies a participant for tracking and cost purposes.

**Baseline Description** 

**Savings Principle** 

**Savings Method** 

Unit

Per participant

**Savings Equation** 

N/A

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Participant	0	0	0.00	0.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Participant	11	1.00	1.00		0.86	0.86	0.86	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Participant	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Participant	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Participant	0.00	0.00	0.00	1.00

TRC: \$454.00 / participant

Incentive: \$363.00 / participant

# Pipe Wrap DHW Elec

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Insulation Measure Sub Type: Pipe Insulation

Program: A03b EnergywiseMF

## **Measure Description**

Installation of insulation to reduce water heating energy.

## **Baseline Description**

The baseline case is uninsulated heated water pipes.

#### **Savings Principle**

The high efficiency case is the installation of high-efficiency domestic hot water equipment such as low-flow showerheads and faucet aerators.

## **Savings Method**

Deemed

## Unit

Linear Foot

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Wrap DHW Elec	38.0	0.0060	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pipe Wrap DHW Elec	15	0.90	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pipe Wrap DHW Elec	41.52%	31.39%	15.22%	11.88%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

Measure Life Note: Massachusetts Common Assumption

ISR Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pipe Wrap DHW Elec	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pipe Wrap DHW Elec	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

# Pipe Wrap DHW Oil

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Insulation Measure Sub Type: Pipe Insulation

Program: A03b EnergywiseMF

### **Measure Description**

Installation of insulation to reduce water heating energy.

## **Baseline Description**

The baseline case is uninsulated heated water pipes.

#### **Savings Principle**

The high efficiency case is the installation of high-efficiency domestic hot water equipment such as low-flow showerheads and faucet aerators.

## **Savings Method**

Deemed

## Unit

Linear Foot

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Wrap DHW Oil	0	0	0.00	0.00	0.00	0.15	0.00

Oil MMBtu Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pipe Wrap DHW Oil	15	0.90	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pipe Wrap DHW Oil	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

Measure Life Note: Massachusetts Common Assumption

ISR Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pipe Wrap DHW Oil	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pipe Wrap DHW Oil	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

## **Refrig Rebate**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Appliances Measure Type: Refrigerators Measure Sub Type: Refrigerator

Program: A03b EnergywiseMF

### **Measure Description**

This measure covers the replacement of an existing inefficient refrigerator with a new ENERGY STAR® rated refrigerator. ENERGY STAR® qualified refrigerators use at least 20% less energy than non-qualified models.

#### **Baseline Description**

The baseline efficiency case is the existing refrigerator. It is assumed that low-income customers would otherwise replace their refrigerators with a used inefficient unit.

## **Savings Principle**

The high efficiency case is an ENERGY STAR® rated refrigerator that meets the ENERGY STAR® criteria for full-sized refrigerators (7.75 cubic feet), using at least 20% less energy than models meeting the minimum Federal government standard.

## **Savings Method**

Deemed

#### Unit

Installed high-efficiency refrigerator.

### **Savings Equation**

delta kWh = ((kWhpre-kWhes) x (RUL/EUL)) + (((kWhstd+kWhused)/2 - kWhes) x ((EUL-RUL)/EUL)) x Focc

Where:

kWhpre = Annual kWh consumption of existing equipment. Value is based on metering or AHAM database. The default value is 874 kWh

kWhES = Annual kWhconsumption of new ENERGY STAR qualified refrigerator or freezer. This is from the nameplate on the new unit. The default value is 358 kWh.

STD Average annual consumption of equipment meeting federal standard: Calculated by dividing the kWhES by 0.9 (i.e., the Energy Star units are assumed to be 10% more efficient than the kWhstd units). The default value is

398 kWh.

kWhused Average annual consumption of used equipment. Default value is 475 kWh.34

RUL = Remaining Useful life assumed to be 6 years

EUL = Estimated useful life for a new refrigerator is 12 years35

Focc = Occupant adjustment factor used to adjust the energy savings according to the number of occupants in the dwelling unit. See table below. Default is 2.3 occupants per tenant unit

 $\Delta kWh = 330$ , using the default assumptions

Hours: 8,760.0.

Hours Note: The average annual operating hours are 8760 hours/year.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Refrig Rebate	914.0	0.1645	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Refrig Rebate	12	1.00	1.00		1.00	1.00	1.00	0.79	0.65

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Refrig Rebate	29.00%	31.95%	18.18%	20.87%

Measure Life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR Qualified Residential Refrigerator.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rates are 100% since savings estimates are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Refrig Rebate	0.00	0.00	20.10	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Refrig Rebate	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

TRC: EW MF Bundled costs (see Participant listing)

## **SHOWERHEAD Elec**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: A03b EnergywiseMF

## **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a commercial setting with service water heated by electricity.

## **Baseline Description**

The baseline efficiency case is 2.2 GPM or greater faucet.

## **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less aerator installed.

## **Savings Method**

Deemed

## Unit

Installed faucet aerator.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
SHOWERHEAD Elec	246.0	0.0590	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
SHOWERHEAD Elec	15	0.90	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
SHOWERHEAD Elec	41.52%	31.39%	15.22%	11.88%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Measure Life Note: National Grid assumption based on regional PA working groups.

ISR Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

RRsp Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

RRwp Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
SHOWERHEAD Elec	1786.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
SHOWERHEAD Elec	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

## **SHOWERHEAD OIL**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A03b EnergywiseMF

## **Measure Description**

Installation of a low flow showerhead with a flow rate of 1.5 GPM or less.

## **Baseline Description**

The baseline efficiency case is a showerhead with a flow of 2.5 gpm. For home audit applications, the baseline is the existing showerhead.

## **Savings Principle**

The high efficiency is a low-flow showerhead with a flow of 1.5 gpm or less.

## **Savings Method**

Deemed

#### Unit

Installed showerhead.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
SHOWERHEAD OIL	0	0	0.00	0.00	0.00	1.40	0.00

Oil MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
SHOWERHEAD OIL	15	0.90	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
SHOWERHEAD Oil	0.00%	0.00%	0.00%	0.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Measure Life Note: National Grid assumption based on regional PA working groups.

ISR Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
SHOWERHEAD Oil	1786.00	0.00	0.58	0	

Water/Sewer Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
SHOWERHEAD OIL	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

# **Smart Strips**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Plug Load Measure Type: Smart Strips Measure Sub Type: Smart Strip

Program: A03b EnergywiseMF

#### **Measure Description**

The basic measures switches off plug load using current sensors and switching devices which turn off plug load when electrical current drops below threshold low levels. The advanced measure shuts devices off after it no longer senses activity from their infrared controls.

## **Baseline Description**

The baseline efficiency case is the absence power strip and leaving peripheral devices plugged in or using a power surge protector and leaving peripheral devices on

## **Savings Principle**

The high efficiency case is the use of a smart strip or advanced smart strip.

#### Savings Method

Deemed

#### Unit

Rebated smart strip.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: Since the power strip is assumed to be plugged in all year, the savings are based on 8,760 operational hours per

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Smart Strips	105.0	0.0189	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Smart Strips	5	0.84	1.00		0.92	0.92	0.92	0.73	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Smart Strips	34.00%	33.00%	16.00%	17.00%	

Measure Life Note: Massachusetts Common Assumption

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised RRsp Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised RRwp Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Smart Strips	0.00	0.00	0	0	

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Smart Strips	0.31	0.01	0.00	0.70

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

## THERMOSTAT Elec with AC

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A03b EnergywiseMF

## **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

## **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

# **Savings Method**

Deemed

## Unit

Installed thermostat

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
THERMOSTAT Elec with AC	278.0	0.2363	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
THERMOSTAT Elec with AC	13	0.95	1.00		1.00	1.00	1.00	0.34	0.17

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
THERMOSTAT Elec with AC	23.21%	27.86%	25.20%	23.73%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
THERMOSTAT Elec with AC	0.00	0.00	14.35	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
THERMOSTAT Elec with AC	0.48	0.01	0.00	0.53

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

# **THERMOSTAT Heat Pump**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A03b EnergywiseMF

## **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

## **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

# **Savings Method**

Deemed

## Unit

Installed thermostat

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
THERMOSTAT Heat Pump	278.0	0.2363	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
THERMOSTAT Heat Pump	13	0.95	1.00		1.00	1.00	1.00	0.34	0.17

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
THERMOSTAT Heat Pump	23.21%	27.86%	25.20%	23.73%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
THERMOSTAT Heat Pump	0.00	0.00	14.35	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
THERMOSTAT Heat Pump	0.48	0.01	0.00	0.53

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

## THERMOSTAT OIL

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A03b EnergywiseMF

## **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

## **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

# **Savings Method**

Deemed

## Unit

Installed thermostat

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
THERMOSTAT OIL	29.0	0.0247	0.00	0.00	0.00	1.60	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Oil MMBtu Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
THERMOSTAT OIL	13	0.95	1.00		1.00	1.00	1.00	0.34	0.17

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
THERMOSTAT OIL	23.21%	27.86%	25.20%	23.73%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
THERMOSTAT OIL	0.00	0.00	14.35	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
THERMOSTAT OIL	0.48	0.01	0.00	0.53

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

## **TSV Showerhead Elec**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A03b EnergywiseMF

## **Measure Description**

A showerhead with a control that limits flow once water is heated.

## **Baseline Description**

The baseline efficiency case is a showerhead with a flow of 2.5 gpm. For home audit applications, the baseline is the existing showerhead.

## **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

## **Savings Method**

Deemed

#### Unit

Installed showerhead.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
TSV Showerhead Elec	315.0	0.0756	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
TSV Showerhead Elec	15	0.90	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
TSV Showerhead Elec	41.52%	31.39%	15.22%	11.88%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
TSV Showerhead Elec	2254.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
TSV Showerhead Elec	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

## **TSV Showerhead Oil**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A03b EnergywiseMF

## **Measure Description**

A showerhead with a control that limits flow once water is heated.

## **Baseline Description**

The baseline efficiency case is a showerhead with a flow of 2.5 gpm. For home audit applications, the baseline is the existing showerhead.

## **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

## **Savings Method**

Deemed

#### Unit

Installed showerhead.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
TSV Showerhead Oil	0	Calc	0.00	0.00	0.00	1.70	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Oil MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
TSV Showerhead Oil	15	0.90	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
TSV Showerhead Oil	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
TSV Showerhead Oil	2254.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
TSV Showerhead Oil	0.08	0.01	0.00	0.93

 $NTG\ Source:\ RI-20-RX-EWMFImpact-Impact\ Evaluation\ of\ EnergyWise\ Multifamily\ Program$ 

TRC: EW MF Bundled costs (see Participant listing)

## **TSV Showerhead Other**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A03b EnergywiseMF

## **Measure Description**

A showerhead with a control that limits flow once water is heated.

## **Baseline Description**

The baseline efficiency case is a showerhead with a flow of 2.5 gpm. For home audit applications, the baseline is the existing showerhead.

## **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

## **Savings Method**

Deemed

#### Unit

Installed showerhead.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
TSV Showerhead Other	0	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
TSV Showerhead Other	15	0.90	1.00	•	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
TSV Showerhead Other	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
TSV Showerhead Other	2254.00	0.00	0.58	0	

Water/Sewer Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
TSV Showerhead Other	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

# **Vending Miser**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Vending Miser Measure Type: Vending Miser Measure Sub Type: Vending Miser

Program: A03b EnergywiseMF

#### **Measure Description**

Controls significantly reduce the energy consumption of refrigerated beverage vending machine lighting and refrigeration systems by powering down these systems during periods of inactivity while maintaining a refrigerated product. This measure applies torefrigerated beverage vending machines and glass front refrigerated coolers. This measure does not apply to ENERGY STAR® qualified vending machines, as they already have built-in controls.

## **Baseline Description**

The baseline efficiency case is a standard efficiency refrigerated beverage vending machine, or glass front refrigerated cooler without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

#### **Savings Principle**

The high efficiency case is a standard efficiency refrigerated beverage vending machine, or glass front refrigerated cooler with a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

### **Savings Method**

Deemed

#### Unit

Installed vending miser.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: It is assumed that the connected equipment operates 24 hours per day, 7 days per week for a total annual operating hours of 8,760.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Vending Miser	1,612.0	0.0000	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Vending Miser	5	1.00	1.00		0.86	0.86	0.86	0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Vending Miser	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

CFsp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

CFwp Source: Navigant Consulting (2018). Baseline Loadshape StudyCFwp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Vending Miser	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Vending Miser	0.00	0.00	0.00	1.00

TRC: EW MF Bundled costs (see Participant listing)

# **Home Energy Report, Existing Dual Fuel**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Behavior Measure Sub Type: Home Energy

Reports

Program: A03c Behavior/Feedback Program

## **Measure Description**

A Home Energy report sent to electric and gas customers that displays home energy consumption in comparison with peers and prompts energy conserving behavior.

## **Baseline Description**

No Home Energy Report.

## **Savings Principle**

A home that receives Home Energy Reports.

## **Savings Method**

Calculated by comparing consumption of treatment (with reports) and control groups (no reports)

#### Unit

Per participant

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Home Energy Report, Existing Dual Fuel	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor

Electric kW Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Home Energy Report, Existing Dual Fuel	1	1.00	1.00		1.08	1.08	1.08	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Home Energy Report, Existing Dual Fuel	35.00%	31.00%	19.00%	15.00%

Measure Life Source: Opinion Dynamics with Navigant Consulting (2012). Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report July 2012. Prepared for Massachusetts EEAC & Behavioral Research Team

ISR Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

ISR Note: In-service rates are set to 100% because savings represent average for all treatment household (including opt outs).

SPF Note: Savings persistence is 100% since measure life is 1 year.

RRe Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

RRsp Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

RRwp Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Home Energy Report, Existing Dual Fuel	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Home Energy Report, Existing Dual Fuel	0.00	0.00	0.00	1.00

NTG Note: Net-t-gross is set to 100% since the HER program is implemented as a randomized control trial (RCT). RCT produces net savings accounting for free-ridership.

TRC: \$8.00 / participant

Incentive: \$8.00 / participant

# **Home Energy Report, Existing Electric**

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Behavior Measure Sub Type: Home Energy

Reports

Program: A03c Behavior/Feedback Program

## **Measure Description**

A Home Energy report sent to electric customers that displays home energy consumption in comparison with peers and prompts energy conserving behavior.

## **Baseline Description**

No Home Energy Report.

## **Savings Principle**

A home that receives Home Energy Reports.

## **Savings Method**

Calculated by comparing consumption of treatment (with reports) and control groups (no reports)

#### Unit

Per participant

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Home Energy Report, Existing Electric	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor

Electric kW Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Home Energy Report, Existing Electric	1	1.00	1.00		1.08	1.08	1.08	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Home Energy Report, Existing Electric	35.00%	31.00%	19.00%	15.00%

Measure Life Source: Opinion Dynamics with Navigant Consulting (2012). Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report July 2012. Prepared for Massachusetts EEAC & Behavioral Research Team

ISR Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

ISR Note: In-service rates are set to 100% because savings represent average for all treatment household (including opt outs).

SPF Note: Savings persistence is 100% since measure life is 1 year.

RRe Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

RRsp Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

RRwp Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Home Energy Report, Existing Electric	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Home Energy Report, Existing Electric	0.00	0.00	0.00	1.00

NTG Note: Net-t-gross is set to 100% since the HER program is implemented as a randomized control trial (RCT). RCT produces net savings accounting for free-ridership.

TRC: \$8.00 / participant

Incentive: \$8.00 / participant

# Home Energy Report, New Movers Dual Fuel

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Behavior Measure Sub Type: Home Energy

Reports

Program: A03c Behavior/Feedback Program

## **Measure Description**

A Home Energy report sent to electric and gas customers that displays home energy consumption in comparison with peers and prompts energy conserving behavior.

## **Baseline Description**

No Home Energy Report.

## **Savings Principle**

A home that receives Home Energy Reports.

## **Savings Method**

Calculated by comparing consumption of treatment (with reports) and control groups (no reports)

#### Unit

Per participant

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Home Energy Report, New Movers Dual Fuel	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor

Electric kW Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Home Energy Report, New Movers Dual Fuel	1	1.00	1.00		0.67	0.67	0.67	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Home Energy Report, New Movers Dual Fuel	35.00%	31.00%	19.00%	15.00%

Measure Life Source: Opinion Dynamics with Navigant Consulting (2012). Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report July 2012. Prepared for Massachusetts EEAC & Behavioral Research Team

ISR Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

ISR Note: In-service rates are set to 100% because savings represent average for all treatment household (including opt outs).

SPF Note: Savings persistence is 100% since measure life is 1 year.

RRe Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

RRsp Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

RRwp Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Home Energy Report, New Movers Dual Fuel	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Home Energy Report, New Movers Dual Fuel	0.00	0.00	0.00	1.00

NTG Note: Net-t-gross is set to 100% since the HER program is implemented as a randomized control trial (RCT). RCT produces net savings accounting for free-ridership.

TRC: \$8.00 / participant

Incentive: \$8.00 / participant

# Home Energy Report, New Movers Electric

Sector: Residential Fuel: Electric Program Type: Custom

Measure Category: Whole Home Measure Type: Behavior Measure Sub Type: Home Energy

Reports

Program: A03c Behavior/Feedback Program

### **Measure Description**

A Home Energy report sent to electric customers that displays home energy consumption in comparison with peers and prompts energy conserving behavior.

### **Baseline Description**

No Home Energy Report.

#### **Savings Principle**

A home that receives Home Energy Reports.

### **Savings Method**

Calculated by comparing consumption of treatment (with reports) and control groups (no reports)

#### Unit

Per participant

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Home Energy Report, New Movers Electric	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Supplied by vendor

Electric kW Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Home Energy Report, New Movers Electric	1	1.00	1.00		0.67	0.67	0.67	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Home Energy Report, New Movers Electric	35.00%	31.00%	19.00%	15.00%

Measure Life Source: Opinion Dynamics with Navigant Consulting (2012). Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report July 2012. Prepared for Massachusetts EEAC & Behavioral Research Team

ISR Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

ISR Note: In-service rates are set to 100% because savings represent average for all treatment household (including opt outs).

SPF Note: Savings persistence is 100% since measure life is 1 year.

RRe Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

RRsp Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

RRwp Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Home Energy Report, New Movers Electric	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Home Energy Report, New Movers Electric	0.00	0.00	0.00	1.00

NTG Note: Net-t-gross is set to 100% since the HER program is implemented as a randomized control trial (RCT). RCT produces net savings accounting for free-ridership.

TRC: \$8.00 / participant

Incentive: \$8.00 / participant

# **Advanced Power Strips IR**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Plug Load Measure Type: Smart Strips Measure Sub Type: Smart Strip

Program: A04b Energy Star Products

#### **Measure Description**

The basic measures switches off plug load using current sensors and switching devices which turn off plug load when electrical current drops below threshold low levels. The advanced measure shuts devices off after it no longer senses activity from their infrared controls.

### **Baseline Description**

The baseline efficiency case is the absence power strip and leaving peripheral devices plugged in or using a power surge protector and leaving peripheral devices on

## **Savings Principle**

The high efficiency case is the use of a smart strip or advanced smart strip.

#### Savings Method

Deemed

#### Unit

Rebated smart strip.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: Since the power strip is assumed to be plugged in all year, the savings are based on 8,760 operational hours per

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Advanced Power Strips IR	207.0	0.0400	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study-Revised

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Advanced Power Strips IR	5	0.74	1.00		0.92	0.92	0.92	0.58	0.86

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Advanced Power Strips IR	32.00%	35.00%	15.00%	18.00%

Measure Life Note: Massachusetts Common Assumption

ISR Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study
RRsp Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study
RRsp Note: National Grid assumption based on regional PA working groups.
RRwp Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study
RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Advanced Power Strips IR	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Advanced Power Strips IR	0.00	0.00	0.00	1.00

NTG Note: Realization rate is assumed 100% because energy savings are custom calculated.

TRC: \$100.00 / measure
Incentive: \$35.00 / measure

## **Advanced Power Strips IR - OS**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Plug Load Measure Type: Smart Strips Measure Sub Type: Smart Strip

Program: A04b Energy Star Products

#### **Measure Description**

The basic measures switches off plug load using current sensors and switching devices which turn off plug load when electrical current drops below threshold low levels. The advanced measure shuts devices off after it no longer senses activity from their infrared controls and occupancy sensors.

### **Baseline Description**

The baseline efficiency case is the absence power strip and leaving peripheral devices plugged in or using a power surge protector and leaving peripheral devices on

### **Savings Principle**

The high efficiency case is the use of a smart strip or advanced smart strip.

#### Savings Method

Deemed

#### Unit

Rebated smart strip.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: Since the power strip is assumed to be plugged in all year, the savings are based on 8,760 operational hours per

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Advanced Power Strips IR - OS	207.0	0.0400	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study-Revised

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Advanced Power Strips IR - OS	5	0.74	1.00		0.92	0.92	0.92	0.58	0.86

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Advanced Power Strips IR - OS	32.00%	35.00%	15.00%	18.00%	

Measure Life Note: Massachusetts Common Assumption

ISR Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study
RRsp Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study
RRsp Note: National Grid assumption based on regional PA working groups.
RRwp Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study
RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Advanced Power Strips IR - OS	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Advanced Power Strips IR - OS	0.00	0.00	0.00	1.00

NTG Note: Realization rate is assumed 100% because energy savings are custom calculated.

TRC: \$200.00 / measure
Incentive: \$35.00 / measure

## **Dehumidifier**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: Dehumidifiers Measure Sub Type: Dehumidifier

Program: A04b Energy Star Products

#### **Measure Description**

The Installation of high efficiency dehumidifiers and the turn-in of existing inefficient dehumidifiers.

### **Baseline Description**

Standard efficiency.

#### **Savings Principle**

The high efficiency case is an ENERGY STAR® replacement unit with an efficiency of 1.47 L/kWh. The high efficiency case is an ENERGY STAR® replacement unit with an efficiency of 1.47 L/kWh.

### **Savings Method**

Calculated using deemed inputs

#### Unit

Per dehumidifier

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	•	
Dehumidifier	82.3	0.0189	0.00	0.00	0.00	0.00	0.00	

Electric kWh Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dehumidifier	17	0.99	1.00		1.00	1.00	1.00	0.82	0.17

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Dehumidifier	22.00%	23.00%	25.00%	30.00%	

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dehumidifier	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dehumidifier	0.51	0.00	0.00	0.49

NTG Source: NMR Group, Inc. (2021). Residential Products NTG Report.

TRC: \$34.00 / measure

Incentive: \$30.00 / measure

# **Dehumidifier Recycling**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: Dehumidifiers Measure Sub Type: Dehumidifier

Program: A04b Energy Star Products

**Measure Description** 

Recycling of old dehumidifiers.

**Baseline Description** 

Operating inefficient unit.

**Savings Principle** 

Recycling of inefficient unit.

**Savings Method** 

Deemed

Unit

Per dehumidifier

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dehumidifier Recycling	407.1	0.0350	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dehumidifier Recycling	4	1.00	1.00		1.00	1.00	1.00	0.82	0.17

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dehumidifier Recycling	22.00%	23.00%	25.00%	30.00%

Measure Life Note: Massachusetts Common Assumption

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dehumidifier Recycling	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dehumidifier Recycling	0.59	0.00	0.00	0.41

NTG Source: NMR Group, Inc. (2021). MA Appliance Recycling NTG Report

TRC: \$65.00 / measure
Incentive: \$30.00 / measure

# **EnergyStar Dryer**

Sector: ResidentialFuel: ElectricProgram Type: PrescriptiveMeasure Category: AppliancesMeasure Type: Clothes DryersMeasure Sub Type: Dryer

Program: A04b Energy Star Products

**Measure Description** 

The installation of an EnergyStar clothes dryer .

**Baseline Description** 

A new electric dryer.

**Savings Principle** 

An EnergyStar electric dryer.

**Savings Method** 

Deemed

Unit

Installed EnergyStar dryer.

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
EnergyStar Dryer	160.0	0.0460	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA TRM, 2016-2018: Energy Star Clothes Dryer

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
EnergyStar Dryer	16	0.99	1.00		1.00	1.00	1.00	0.45	0.58

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
EnergyStar Dryer	38.90%	30.00%	16.90%	14.20%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
EnergyStar Dryer	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
EnergyStar Dryer	0.47	0.00	0.00	0.53

NTG Source: NMR Group, Inc. (2021). Residential Products NTG Report.

TRC: \$70.00 / measure

Incentive: \$50.00 / measure

# **Freezer Recycling**

Fuel: Electric Sector: Residential Program Type: Prescriptive

Measure Category: Appliances Measure Type: Recycling Measure Sub Type: Freezer Recycling

**Program:** A04b Energy Star Products

### **Measure Description**

The retirement of old, inefficient secondary refrigerators and freezers.

### **Baseline Description**

The baseline efficiency case is an old, inefficient secondary working refrigerator or freezer. Estimated average usage is based on combined weight of freezer energy use and refrigerator energy use.

### **Savings Principle**

The high efficiency case assumes no replacement of secondary unit.

### **Savings Method**

Deemed

### Unit

Removal of existing refrigerator or freezer.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: The average annual operating hours are 8760 hours/year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Freezer Recycling	754.0	0.1100	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Freezer Recycling	8	1.00	1.00		0.83	0.83	0.83	0.91	0.68

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Freezer Recycling	29.00%	33.00%	17.00%	21.00%

Measure Life Source: NMR Group, Inc. (2011). Massachusetts Appliance Turn-In Program Evaluation Integrated Report Findings – FINAL. Prepared for National Grid, NSTAR Electric, Cape Light Compact, and Western Massachusetts Electric Company.

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo RRsp Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo RRwp Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Freezer Recycling	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Freezer Recycling	0.50	0.00	0.00	0.50

NTG Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo

TRC: \$200.00 / measure
Incentive: \$95.00 / measure

# Low E Storm Windows, Electric Heat

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Storm Windows,

electric heat

Program: A04b Energy Star Products

**Measure Description** 

The installation of Low E storm windows over existing windows.

**Baseline Description** 

The base case is existing windows.

**Savings Principle** 

The high efficiency case is Low E storm windows installed over existing windows.

**Savings Method** 

Deemed

Unit

Installed Low E storm windows.

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low E Storm Windows, Electric Heat	229.0	0.1800	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Culp, Thomas D., & Cort, Katherine A. Energy Savings of Low-E Storm Windows and Panels across US Climate Zones. United States.

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low E Storm Windows, Electric Heat	20	1.00	1.00		1.00	1.00	1.00	0.34	0.20

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low E Storm Windows, Electric Heat	25.00%	30.00%	22.00%	23.00%

Measure Life Source: Culp, Thomas D., & Cort, Katherine A. Energy Savings of Low-E Storm Windows and Panels across US Climate Zones. United States.

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low E Storm Windows, Electric Heat	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low E Storm Windows, Electric Heat	0.00	0.00	0.00	1.00

TRC: \$55.00 / measure

Incentive: \$25.00 / measure

# Low E Storm Windows, Gas Heat

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Storm Windows,

gas heat

Program: A04b Energy Star Products

**Measure Description** 

The installation of Low E storm windows over existing windows.

**Baseline Description** 

The base case is existing windows.

**Savings Principle** 

The high efficiency case is Low E storm windows installed over existing windows.

**Savings Method** 

Deemed

Unit

Installed Low E storm windows.

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low E Storm Windows, Gas Heat	5.0	0.0000	0.76	0.00	0.00	0.00	0.00

Electric kWh Source: Culp, Thomas D., & Cort, Katherine A. Energy Savings of Low-E Storm Windows and Panels across US Climate Zones. United States.

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Gas Heat MMBtu Source: Culp, Thomas D., & Cort, Katherine A. Energy Savings of Low-E Storm Windows and Panels across US Climate Zones. United States.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low E Storm Windows, Gas Heat	20	1.00	1.00		1.00	1.00	1.00	0.34	0.20

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low E Storm Windows, Gas Heat	25.00%	30.00%	22.00%	23.00%

Measure Life Source: Culp, Thomas D., & Cort, Katherine A. Energy Savings of Low-E Storm Windows and Panels across US Climate Zones. United States.

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low E Storm Windows, Gas Heat	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low E Storm Windows, Gas Heat	0.00	0.00	0.00	1.00

TRC: \$55.00 / measure

Incentive: \$35.00 / measure

# Low E Storm Windows, Other Heat

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Storm Windows,

other heat

**Program:** A04b Energy Star Products

**Measure Description** 

The installation of Low E storm windows over existing windows.

**Baseline Description** 

The base case is existing windows.

**Savings Principle** 

The high efficiency case is Low E storm windows installed over existing windows.

**Savings Method** 

Deemed

Unit

Installed Low E storm windows.

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low E Storm Windows, Other Heat	5.0	0.0000	0.00	0.00	0.00	0.76	0.00

Electric kWh Source: Culp, Thomas D., & Cort, Katherine A. Energy Savings of Low-E Storm Windows and Panels across US Climate Zones. United States.

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: Culp, Thomas D., & Cort, Katherine A. Energy Savings of Low-E Storm Windows and Panels across US Climate Zones. United States.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low E Storm Windows, Other Heat	20	1.00	1.00		1.00	1.00	1.00	0.34	0.20

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low E Storm Windows, Other Heat	25.00%	30.00%	22.00%	23.00%

Measure Life Source: Culp, Thomas D., & Cort, Katherine A. Energy Savings of Low-E Storm Windows and Panels across US Climate Zones. United States.

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Water: Gallons Sewer: Gallons		One-time \$
Low E Storm Windows, Other Heat	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low E Storm Windows, Other Heat	0.00	0.00	0.00	1.00

TRC: \$55.00 / measure

Incentive: \$25.00 / measure

# Low-Flow Showerhead with Thermo Control (Roadrunner, Electric DHW)

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A04b Energy Star Products

## **Measure Description**

A showerhead with a control that limits flow once water is heated.

### **Baseline Description**

The baseline case is a showerhead with a flow of 2.5 gallons per minute, or for the case of the adapter, a low flow showerhead with flow of 1.5 gpm or less.

### **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

### **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow Showerhead with Thermo Control (Roadrunner, Electric DHW)	247.0	0.0600	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow Showerhead with Thermo Control (Roadrunner, Electric DHW)	7	0.78	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Flow Showerhead with Thermo Control (Roadrunner, Electric DHW)	42.00%	31.00%	15.00%	12.00%

Measure Life Note: Massachusetts Common Assumption

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low-Flow Showerhead with Thermo Control (Roadrunner, Electric DHW)	3022.00	0.00	0	0

Water/Sewer Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead with Thermo Control (Roadrunner, Electric DHW)	0.03	0.00	0.00	0.97

NTG Source: NMR Group, Inc. (2021). Residential Products NTG Report.

TRC: \$40.00 / measure

Incentive: \$15.00 / measure

# Low-Flow Showerhead with Thermo Control (Roadrunner, Gas DHW)

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

**Program:** A04b Energy Star Products

### **Measure Description**

A showerhead with a control that limits flow once water is heated.

### **Baseline Description**

The baseline case is a showerhead with a flow of 2.5 gallons per minute, or for the case of the adapter, a low flow showerhead with flow of 1.5 gpm or less.

#### **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

### **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

## **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow Showerhead with Thermo Control (Roadrunner, Gas DHW)	0	0.0000	0.00	1.22	0.00	0.00	0.00

Gas DHW MMBtu Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow Showerhead with Thermo Control (Roadrunner, Gas DHW)	7	0.78	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Flow Showerhead with Thermo Control (Roadrunner, Gas DHW)	0.00%	0.00%	0.00%	0.00%

Measure Life Note: Massachusetts Common Assumption

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low-Flow Showerhead with Thermo Control (Roadrunner, Gas DHW)	3022.00	0.00	0	0

Water/Sewer Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead with Thermo Control (Roadrunner, Gas DHW)	0.03	0.00	0.00	0.97

NTG Source: NMR Group, Inc. (2021). Residential Products NTG Report.

TRC: \$40.00 / measure

Incentive: \$15.00 / measure

# Low-Flow Showerhead with Thermo Control (Roadrunner, Oil/Propane DHW)

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A04b Energy Star Products

## **Measure Description**

A showerhead with a control that limits flow once water is heated.

### **Baseline Description**

The baseline case is a showerhead with a flow of 2.5 gallons per minute, or for the case of the adapter, a low flow showerhead with flow of 1.5 gpm or less.

### **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

### **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow Showerhead with Thermo Control (Roadrunner, Oil/Propane DHW)	0	0.0000	0.00	0.00	0.00	1.32	1.22

Oil MMBtu Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Propane MMBtu Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow Showerhead with Thermo Control (Roadrunner, Oil/Propane DHW)	7	0.78	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Flow Showerhead with Thermo Control (Roadrunner, Oil/Propane DHW)	0.00%	0.00%	0.00%	0.00%

Measure Life Note: Massachusetts Common Assumption

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low-Flow Showerhead with Thermo Control (Roadrunner, Oil/Propane DHW)	3022.00	0.00	0	0

Water/Sewer Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead with Thermo Control (Roadrunner, Oil/Propane DHW)	0.03	0.00	0.00	0.97

NTG Source: NMR Group, Inc. (2021). Residential Products NTG Report.

TRC: \$40.00 / measure

Incentive: \$15.00 / measure

# Pool Pump (2-Speed)

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Motors/Drives
 Measure Type: Variable Speed Drive
 Measure Sub Type: Pump

Program: A04b Energy Star Products

### **Measure Description**

The installation of a 2-speed or variable speed drive pool pump. Operating a pool pump for a longer period of time at a lower wattage can move the same amount of water using significantly less energy.

### **Baseline Description**

The baseline efficiency case is a single speed pump.

### **Savings Principle**

The high efficiency case is a 2-speed or variable speed pump.

### **Savings Method**

Calculated using deemed inputs

#### Unit

Installed efficient pool pump.

#### **Savings Equation**

Gross kWh = Qty × kWh\_base × %SAVE

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

kWh\_base = Deemed average annual kWh consumption per baseline unit.

%SAVE = Deemed average savings factor.

DeltakW = Deemed average kW reduction per unit.

Hours: N/A.

Hours Note: Hours are considered on a case-by-case basis since they are dependent on seasonal factors, pool size, and treatment conditions.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pool Pump (2-Speed)	639.0	0.6700	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Guidehouse (2021). Comprehensive TRM Review. Electric kW Source: Guidehouse (2021). Comprehensive TRM Review.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pool Pump (2-Speed)	6	1.00	1.00		1.00	1.00	1.00	0.55	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pool Pump (2-Speed)	5.00%	2.00%	55.00%	38.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pool Pump (2-Speed)	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pool Pump (2-Speed)	0.11	0.00	0.00	0.89

NTG Source: NMR Group, Inc. (2021). Residential Products NTG Report.

TRC: \$300.00 / measure
Incentive: \$200.00 / measure

# **Pool Pump (Variable)**

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Motors/Drives
 Measure Type: Variable Speed Drive
 Measure Sub Type: Pump

Program: A04b Energy Star Products

### **Measure Description**

The installation of a 2-speed or variable speed drive pool pump. Operating a pool pump for a longer period of time at a lower wattage can move the same amount of water using significantly less energy.

### **Baseline Description**

The baseline efficiency case is a single speed pump.

### **Savings Principle**

The high efficiency case is a 2-speed or variable speed pump.

### **Savings Method**

Calculated using deemed inputs

#### Unit

Installed efficient pool pump.

#### **Savings Equation**

Gross kWh = Qty × kWh\_base × %SAVE

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

kWh\_base = Deemed average annual kWh consumption per baseline unit.

%SAVE = Deemed average savings factor.

DeltakW = Deemed average kW reduction per unit.

Hours: N/A.

Hours Note: Hours are considered on a case-by-case basis since they are dependent on seasonal factors, pool size, and treatment conditions.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pool Pump (Variable)	1,284.0	1.3500	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Guidehouse (2021). Comprehensive TRM Review. Electric kW Source: Guidehouse (2021). Comprehensive TRM Review.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pool Pump (Variable)	6	1.00	1.00		1.00	1.00	1.00	0.55	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pool Pump (Variable)	5.00%	2.00%	55.00%	38.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pool Pump (Variable)	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pool Pump (Variable)	0.11	0.00	0.00	0.89

NTG Source: NMR Group, Inc. (2021). Residential Products NTG Report.

TRC: \$650.00 / measure
Incentive: \$500.00 / measure

# **Refrigerator Recycle**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: Recycling Measure Sub Type: Refrigerator

Recycling

Program: A04b Energy Star Products

## **Measure Description**

The retirement of old, inefficient secondary refrigerators and freezers.

### **Baseline Description**

The baseline efficiency case is an old, inefficient secondary working refrigerator or freezer. Estimated average usage is based on combined weight of freezer energy use and refrigerator energy use.

### **Savings Principle**

The high efficiency case assumes no replacement of secondary unit.

## **Savings Method**

Deemed

#### Unit

Removal of existing refrigerator or freezer.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: The average annual operating hours are 8760 hours/year.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Refrigerator Recycle	983.0	0.1800	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Refrigerator Recycle	8	1.00	1.00		0.90	0.90	0.90	0.79	0.65

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Refrigerator Recycle	29.00%	32.00%	18.00%	21.00%	

Measure Life Source: NMR Group, Inc. (2011). Massachusetts Appliance Turn-In Program Evaluation Integrated Report Findings – FINAL. Prepared for National Grid, NSTAR Electric, Cape Light Compact, and Western Massachusetts Electric Company.

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo RRsp Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo RRwp Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Refrigerator Recycle	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Refrigerator Recycle	0.54	0.00	0.00	0.46

NTG Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo

TRC: \$200.00 / measure
Incentive: \$95.00 / measure

# **Refrigerator Recycling (Primary)**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: Refrigerator Recycling Measure Sub Type: Refrigerator

Recycling

Program: A04b Energy Star Products

## **Measure Description**

The retirement of old, inefficient primary refrigerators and freezers.

### **Baseline Description**

The baseline efficiency case is an old, inefficient primary working refrigerator or freezer. Estimated average usage is based on combined weight of freezer energy use and refrigerator energy use.

#### Savings Principle

The high efficiency case is the replacement of the refrigerator with an Energy Star® refrigerator or a model that is ENERGY STAR® rated and included in the Most Efficient® or Top Ten USA® ranking.

#### **Savings Method**

Deemed

#### Unit

Removal of existing refrigerator or freezer.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Refrigerator Recycling (Primary)	983.0	0.1800	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Refrigerator Recycling (Primary)	8	1.00	1.00		0.90	0.90	0.90	0.79	0.65

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Refrigerator Recycling (Primary)	29.00%	32.00%	18.00%	21.00%

Measure Life Source: NMR Group, Inc. (2011). Massachusetts Appliance Turn-In Program Evaluation Integrated Report Findings – FINAL. Prepared for National Grid, NSTAR Electric, Cape Light Compact, and Western Massachusetts Electric Company.

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo RRsp Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo RRwp Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Refrigerator Recycling (Primary)	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Refrigerator Recycling (Primary)	0.54	0.00	0.00	0.46

NTG Source: NMR Group, Inc. (2021). RI CT Appliance Recycling Impact Memo

TRC: \$200.00 / measure
Incentive: \$95.00 / measure

# Room AC (10.8)

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Cooling
 Measure Sub Type: Room AC

Program: A04b Energy Star Products

#### **Measure Description**

The installation of ENERGY STAR® qualified room air conditioners. ENERGY STAR® qualified air conditioners are typically 10% more efficient than models meeting federal standards.

### **Baseline Description**

The baseline efficiency case is a window AC unit that meets the minimum federal efficiency standard for efficiency which currently is EER 9.8.

### **Savings Principle**

The high efficiency level is a room AC unit meeting or exceeding the federal efficiency standard by 10% or more. Average size is 10,000 Btu and average EERs is 10.8.

#### **Savings Method**

Deemed

#### Unit

Installed high-efficiency room air-conditioner.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Room AC (10.8)	36.0	0.0600	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Environmental Protection Agency (2018). Savings Calculator for Energy Star Qualified Appliances. http://www.energystar.gov/sites/default/files/asset/document/appliance\_calculator.xlsx

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Room AC (10.8)	12	1.00	1.00		1.00	1.00	1.00	0.33	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Room AC (10.8)	3.00%	2.00%	48.00%	47.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Room AC (10.8)	0.00	0.00	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Room AC (10.8)	0.44	0.00	0.00	0.56

NTG Source: NMR Group, Inc. (2021). Residential Products NTG Report.

TRC: \$40.00 / measure

Incentive: \$40.00 / measure

## **Room Air Cleaners**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Plug Load Measure Type: Room Air Cleaners Measure Sub Type: Room Air Cleaner

Program: A04b Energy Star Products

### **Measure Description**

Rebates provided for the purchase of an ENERGY STAR® qualified room air cleaner. ENERGY STAR® air cleaners are 40% more energy-efficient than standard models.

### **Baseline Description**

The baseline efficiency case is a conventional unit with clean air delivery rate (CADR) of 51-100.

#### **Savings Principle**

The high efficiency case is an ENERGY STAR® qualified air cleaner with a CADR of 51-100.

# **Savings Method**

Deemed

### Unit

Rebated ENERGY STAR® room air cleaner

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,840.0.

Hours Source: Environmental Protection Agency (2012), Savings Calculator for Energy Star Qualified Appliances

Hours Note: The Savings are based on 16 operating hours per day, 365 days per year

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Room Air Cleaners	391.0	0.0900	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Environmental Protection Agency (2018). Savings Calculator for Energy Star Qualified Appliances. http://www.energystar.gov/sites/default/files/asset/document/appliance calculator.xlsx

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Room Air Cleaners	9	0.97	1.00		1.00	1.00	1.00	0.82	0.17

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Room Air Cleaners	22.00%	23.00%	25.00%	30.00%

Measure Life Source: Environmental Protection Agency (2018). Savings Calculator for Energy Star Qualified Appliances. http://www.energystar.gov/sites/default/files/asset/document/appliance\_calculator.xlsx

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Room Air Cleaners	0.00	0.00	0	0	

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Room Air Cleaners	0.37	0.00	0.00	0.63

NTG Source: NMR Group, Inc. (2021). Residential Products NTG Report.

TRC: \$78.00 / measure
Incentive: \$40.00 / measure

# **Smart Strips**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Plug Load Measure Type: Smart Strips Measure Sub Type: Smart Strip

Program: A04b Energy Star Products

#### **Measure Description**

The basic measures switches off plug load using current sensors and switching devices which turn off plug load when electrical current drops below threshold low levels. The advanced measure shuts devices off after it no longer senses activity from their infrared controls.

## **Baseline Description**

The baseline efficiency case is the absence power strip and leaving peripheral devices plugged in or using a power surge protector and leaving peripheral devices on

## **Savings Principle**

The high efficiency case is the use of a smart strip or advanced smart strip.

#### **Savings Method**

Deemed

### Unit

Per smart strip

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: Since the power strip is assumed to be plugged in all year, the savings are based on 8,760 operational hours per

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Smart Strips	105.0	0.0200	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Smart Strips	5	0.81	1.00		0.92	0.92	0.92	0.58	0.86

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Smart Strips	32.00%	35.00%	15.00%	18.00%

Measure Life Note: Massachusetts Common Assumption

ISR Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study
RRsp Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study
RRsp Note: National Grid assumption based on regional PA working groups.
RRwp Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study
RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Smart Strips	0.00	0.00	0	0	

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Smart Strips	0.00	0.00	0.00	1.00

NTG Note: Realization rate is assumed 100% because energy savings are custom calculated.

TRC: \$30.00 / measure
Incentive: \$10.00 / measure

# **Tricklestar Keyboard**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Other Measure Type: Tricklestar Keyboards Measure Sub Type: Tricklestar

Keyboard

Program: A04b Energy Star Products

**Measure Description** 

The basic measures puts the PC/laptop to sleep when the user is absent from the PC.

**Baseline Description** 

The baseline efficiency is using a normal keyboard.

**Savings Principle** 

The high efficiency case is using a tricklestar keyboard.

**Savings Method** 

Deemed

Unit

Per tricklestar keyboard

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Tricklestar Keyboard	105.0	0.0670	0.00	0.00	0.00	0.00	0.00

Electric kW Source: https://www.energuide.be/en/questions-answers/how-much-power-does-a-computer-use-and-how-much-co2-does-that-represent/54/

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Tricklestar Keyboard	5	0.81	1.00		0.92	0.92	0.92	0.58	0.86

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Tricklestar Keyboard	32.00%	35.00%	15.00%	18.00%

SPF Note: Savings persistence is assumed to be 100%.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Tricklestar Keyboard	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Tricklestar Keyboard	0.31	0.01	0.00	0.70

NTG Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

TRC: \$99.90 / measure

# **Battery Storage**

Sector: Residential Fuel: Electric Program Type: Prescriptive

Measure Category: Whole Home Measure Type: Demand Response Measure Sub Type: Whole Home

Program: Residential ConnectedSolutions

### **Measure Description**

This is a Battery Storage program offering where during called events National Grid will discharge the customers battery during peak load times in order to reduce the system peak.

### **Baseline Description**

No action taken for these customers

### **Savings Principle**

Peak Demand savings are achieved by discharging the battery.

### **Savings Method**

Deemed

### Unit

Per demand response event

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Battery Storage	0	5.5000	0.00	0.00	0.00	0.00	0.00

Electric kW Source: 2019 Residential Energy Storage Demand Response Demonstration Evaluation (Summer Season)

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Battery Storage	1	1.00	1.00					1.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Battery Storage	0.00%	0.00%	0.00%	0.00%

Measure Life Source: 2019 Residential Energy Storage Demand Response Demonstration Evaluation (Summer Season) SPF Note: Savings persistence is assumed to be 100%.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Battery Storage	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Battery Storage	0.00	0.00	0.00	1.00

TRC: \$2,640.00 / Summer Net kW Savings

Incentive: \$2,640.00 / Summer Net kW savings

# **Direct Load Control Thermostats Existing**

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Demand Response
 Measure Sub Type: Cooling

Program: Residential ConnectedSolutions

### **Measure Description**

This is a Wi-Fi Direct load control program where during called events National Grid will adjust the thermostat down for a precooling set period and then back up above it's original setpoint during the event reducing the demand load during an event.

## **Baseline Description**

No action taken for these customers

### **Savings Principle**

Peak Demand savings are achieved by reducing these customers set points during peak times.

### **Savings Method**

Deemed

#### Unit

Per demand response event

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Direct Load Control Thermostats Existing	8.5	0.5900	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: 2019 Residential Wi-Fi Thermostat Direct Load Control Offering Evaluation

Electric kWh Note: MA study avg kWh savings = 6,330 kWh/event; 0.85/thermostat/event. Here assume 10 events; annual savings = 8.48 kWh/thermostat.

Electric kW Source: 2019 Residential Wi-Fi Thermostat Direct Load Control Offering Evaluation

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Direct Load Control Thermostats Existing	1	1.00	1.00					1.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Direct Load Control Thermostats Existing	47.30%	42.20%	6.60%	3.80%

Measure Life Source: 2019 Residential Wi-Fi Thermostat Direct Load Control Offering Evaluation

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Direct Load Control Thermostats Existing	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Direct Load Control Thermostats Existing	0.00	0.00	0.00	1.00

TRC: \$25.00 / thermostat

Incentive: \$25.00 / thermostat

## **Direct Load Control Thermostats New**

 Sector: Residential
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Demand Response
 Measure Sub Type: Cooling

**Program:** Residential ConnectedSolutions

### **Measure Description**

This is a Wi-Fi Direct load control program where during called events National Grid will adjust the thermostat down for a precooling set period and then back up above it's original setpoint during the event reducing the demand load during an event.

## **Baseline Description**

No action taken for these customers

### **Savings Principle**

Peak Demand savings are achieved by reducing these customers set points during peak times.

### **Savings Method**

Deemed

#### Unit

Per demand response event

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Direct Load Control Thermostats New	8.5	0.5900	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: 2019 Residential Wi-Fi Thermostat Direct Load Control Offering Evaluation

Electric kWh Note: MA study avg kWh savings = 6,330 kWh/event; 0.85/thermostat/event. Here assume 10 events; annual savings = 8.48 kWh/thermostat.

Electric kW Source: 2019 Residential Wi-Fi Thermostat Direct Load Control Offering Evaluation

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Direct Load Control Thermostats New	1	1.00	1.00					1.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Direct Load Control Thermostats New	47.30%	42.20%	6.60%	3.80%

Measure Life Source: 2019 Residential Wi-Fi Thermostat Direct Load Control Offering Evaluation

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Direct Load Control Thermostats New	0.00	0.00	0	0	

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Direct Load Control Thermostats New	0.00	0.00	0.00	1.00

TRC: \$45.00 / thermostat

Incentive: \$45.00 / thermostat

# Solar Inverters, Existing

Sector: ResidentialFuel: ElectricProgram Type: PrescriptiveMeasure Category: ControlsMeasure Type: Demand ResponseMeasure Sub Type: Controls

**Program:** Residential ConnectedSolutions

### **Measure Description**

This is a solar inverter program where during called events the solar inverter is to inject or absorb reactive power depending on local voltage and generation conditions.

### **Baseline Description**

No action taken for these customers.

### **Savings Principle**

Peak Demand savings are achieved by customers shifting load from peak times to off peak times.

### **Savings Method**

Deemed

### Unit

Installed existing solar inverter

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Solar Inverters, Existing	0.0	0.2750	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Solar Inverter Power Factor Correction Demonstration (MA21DR03) Evaluation Memorandum

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Solar Inverters, Existing	1	1.00	1.00					1.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Solar Inverters, Existing	30.50%	36.10%	15.20%	18.30%

SPF Note: Savings persistence is assumed to be 100%.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Solar Inverters, Existing	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Solar Inverters, Existing	0.00	0.00	0.00	1.00

TRC: \$20.00 / solar inverter

Incentive: \$20.00 / solar inverter

# Solar Inverters, New

Sector: ResidentialFuel: ElectricProgram Type: PrescriptiveMeasure Category: ControlsMeasure Type: Demand ResponseMeasure Sub Type: Controls

**Program:** Residential ConnectedSolutions

### **Measure Description**

This is a solar inverter program where during called events the solar inverter is to inject or absorb reactive power depending on local voltage and generation conditions.

### **Baseline Description**

No action taken for these customers

### **Savings Principle**

Peak Demand savings are achieved by customers shifting load from peak times to off peak times.

### **Savings Method**

Deemed

### Unit

Installation of new solar inverter

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Solar Inverters, New	0.0	0.2750	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Solar Inverter Power Factor Correction Demonstration (MA21DR03) Evaluation Memorandum

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Solar Inverters, New	1	1.00	1.00					1.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Solar Inverters, New	30.50%	36.10%	15.20%	18.30%

SPF Note: Savings persistence is assumed to be 100%.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Solar Inverters, New	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Solar Inverters, New	0.00	0.00	0.00	1.00

TRC: \$45.00 / solar inverter

Incentive: \$45.00 / solar inverter

# Boiler (Forced Hot Water) >= 95% AFUE

 Sector: Residential
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Boiler

Program: A02b Energy Star Heating System

#### **Measure Description**

Installation of a new space heating gas-fired condensing boiler.

### **Baseline Description**

The end of life baseline efficiency case is a boiler with a rated AFUE equal to 86.5% and an actual efficiency of 83.7%. For the early retirement portion of the savings, the baseline efficiency is a rated 85.5% AFUE and an actual efficiency of 77.4%.

#### **Savings Principle**

The high efficiency case is a boiler with an AFUE greater than or equal to 90% or 95%.

# **Savings Method**

Deemed

#### Unit

Installation of new high-efficiency boiler

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler (Forced Hot Water) >= 95% AFUE	0	0.0000	10.70	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Guidehouse (2021). Comprehensive TRM Review/RI\_2022 Annual Plan Gas HVAC WH Calculations 2021-06-10

Gas Heat MMBtu Note: Baseline update can be found in first source and calculations for savings can be found in second source.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler (Forced Hot Water) >= 95% AFUE	18	1.00	1.00	1.00	1.00	1.00	1.00		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Boiler (Forced Hot Water) >= 95% AFUE	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review/RI\_2022 Annual

Plan\_Gas\_HVAC\_WH\_Calculations\_2021-06-10

Measure Life Note: Baseline update can be found in first source and calculations for savings can be found in second source.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Boiler (Forced Hot Water) >= 95% AFUE	0.00	0.00	49.11	0

Annual \$ Note: NEI per participant / treated unit

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler (Forced Hot Water) >= 95% AFUE	0.36	0.13	0.00	0.76

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$3,711.00 / measure

Incentive: \$1,000.00 / measure

## **Boiler Reset Controls**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Boiler Control

**Program:** A02b Energy Star Heating System

#### **Measure Description**

Boiler reset controls are devices that improve the efficiency of an existing boiler system by modulating the hot water temperature set point. Reset controls automatically control boiler water temperature based on outdoor temperature using a software program; load controls sense the thermal demand of the heating system and resets the water temperature based on the demand.

### **Baseline Description**

The baseline efficiency case is a boiler without reset or load controls.

### **Savings Principle**

The efficient case is a boiler with reset or load controls, which reset the supply water temperature based on outdoor temperatures and/or building load.

## **Savings Method**

Deemed

### Unit

Installation of boiler reset control on existing boiler

## **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler Reset Controls	0	0.0000	5.10	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Navigant (2018) Res 34 Home Energy Services Impact Evaluation

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler Reset Controls	15	1.00	1.00	1.00	1.00	1.00	1.00		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Boiler Reset Controls	0.00%	0.00%	0.00%	0.00%

Measure Life Source: ACEEE (2006). Emerging Technologies Report: Advanced Boiler Controls. Prepared for ACEEE.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Boiler Reset Controls	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler Reset Controls	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$300.00 / measure
Incentive: \$225.00 / measure

## Combo Furnace

 Sector: Residential
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Furnace

Program: A02b Energy Star Heating System

#### **Measure Description**

This measure promotes the installation of a combined condensing high-efficiency furnace and water heating unit. Combined furnace and water heating systems are more efficient than separate systems because they eliminate the standby heat losses of an additional tank.

### **Baseline Description**

The baseline efficiency case is an 80% AFUE boiler with a 0.594 EF water heater.

### **Savings Principle**

The high efficiency case is an integrated water heater/condensing furnace with a 95% AFUE boiler and a 0.95 EF water heater.

#### **Savings Method**

Deemed

#### Unit

Installation of new high-efficiency integrated furnace/water heater

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Combo Furnace	0	0.0000	15.10	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Combo Furnace	17	1.00	1.00	1.00	1.00	1.00	1.00		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Combo Furnace	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Combo Furnace	0.00	0.00	2.74	0	

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Combo Furnace	0.36	0.13	0.00	0.76

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$995.00 / measure
Incentive: \$700.00 / measure

### **ENERGY STAR COND WATER HEATER 0.80 UEF**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Condensing

Water Heater

Program: A02b Energy Star Heating System

## **Measure Description**

Condensing water heaters recover energy by using either a larger heat exchanger or a second heat exchanger to reduce the flue-gas temperature to the point that water vapor condenses, thus releasing even more energy.

### **Baseline Description**

The baseline efficiency case is a standalone tank water heater with an UEF of 0.58 for medium draw and 0.63 for high draw of 0.61. For

## **Savings Principle**

The high efficiency case is a stand-alone storage water heater with a medium draw and UEF >= 0.64 or high draw and UEF >= 0.68, a condensing water heater with an UEF >= 0.80, a tankless water heater with an UEF >= 0.87, or an indirect water heater attached to an ENERGY STAR® rated forced hot water gas boiler.

### **Savings Method**

Deemed

#### Unit

Installation of new high-efficiency water heater

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ENERGY STAR COND WATER HEATER 0.80 UEF	-43.0	-0.0200	0.00	7.00	0.00	0.00	0.00

Electric kWh Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

Electric kW Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

Gas DHW MMBtu Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ENERGY STAR COND WATER HEATER 0.80 UEF	15	1.00	1.00	1.00	1.00	1.00	1.00	0.21	0.40

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
ENERGY STAR COND WATER HEATER 0.80 UEF	41.00%	34.00%	13.00%	12.00%

Measure Life Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
ENERGY STAR COND WATER HEATER 0.80 UEF	0.00	0.00	0.70	0

Annual \$ Note: NEI per participant / treated unit

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ENERGY STAR COND WATER HEATER 0.80 UEF	0.34	0.12	0.00	0.77

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$1,285.00 / measure
Incentive: \$250.00 / measure

### **ENERGY STAR ON DEMAND WATER HEATER 0.87 UEF**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Tankless Water

Heater

Program: A02b Energy Star Heating System

## **Measure Description**

Condensing water tankless water heaters recover energy by using either a larger heat exchanger or a second heat exchanger to reduce the flue-gas temperature to the point that water vapor condenses, thus releasing even more energy and circulating water through a heat exchanger to be heated for immediate use, eliminating the standby heat loss associated with a storage tank

### **Baseline Description**

The baseline efficiency case is a high draw standalone tank water heater with an UEF of 0.63. For the early retirement portion, the UEF is equal to 0.60.

### **Savings Principle**

The high efficiency case is a stand-alone storage water heater with a medium draw and UEF >= 0.64 or high draw and UEF >= 0.68, a condensing water heater with an UEF >= 0.80, a tankless water heater with an UEF >= 0.87, or an indirect water heater attached to an ENERGY STAR® rated forced hot water gas boiler.

#### Savings Method

Deemed

#### Unit

Installed condensing tankless water heater

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ENERGY STAR ON DEMAND WATER HEATER 0.87 UEF	-43.0	-0.0200	0.00	7.00	0.00	0.00	0.00

Electric kWh Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

Electric kW Source: Water Heater UEF screening 2019-21 revised 2018.09.06

Gas DHW MMBtu Source: Guidehouse (2021). Comprehensive TRM Review/RI\_2022 Annual

Plan\_Gas\_HVAC\_WH\_Calculations\_2021-06-10

Gas DHW MMBtu Note: Baseline update can be found in first source and calculations for savings can be found in second source.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ENERGY STAR ON DEMAND WATER HEATER 0.87 UEF	19	1.00	1.00	1.00	1.00	1.00	1.00	0.21	0.40

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
ENERGY STAR ON DEMAND WATER HEATER 0.87 UEF	41.00%	34.00%	13.00%	12.00%

Measure Life Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
ENERGY STAR ON DEMAND WATER HEATER 0.87 UEF	0.00	0.00	1.23	0

Annual \$ Note: NEI per participant / treated unit

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ENERGY STAR ON DEMAND WATER HEATER 0.87 UEF	0.34	0.12	0.00	0.77

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$718.00 / measure
Incentive: \$600.00 / measure

# **ENERGY STAR STORAGE WATER HEATER .64 UEF (Med Draw)**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Efficient Standard

Tank Water Heater

Program: A02b Energy Star Heating System

## **Measure Description**

Stand-alone storage water heaters are high efficiency water heaters that are not combined with space heating devices.

#### **Baseline Description**

The baseline efficiency case is a standalone tank water heater with a medium draw of a UEF of 0.58 and high draw of 0.63. For the early retirement portion, the medium draw UEF is equal to 0.56 and high draw is equal to 0.60.

#### Savings Principle

The high efficiency case is a stand-alone storage water heater with a medium draw and UEF >= 0.64 or high draw and UEF >= 0.68, a condensing water heater with an UEF >= 0.80, a tankless water heater with an UEF >= 0.87, or an indirect water heater attached to an ENERGY STAR® rated forced hot water gas boiler.

### **Savings Method**

Deemed

### Unit

Installation of new high-efficiency water heater

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ENERGY STAR STORAGE WATER HEATER .64 UEF (Med Draw)	-43.0	-0.0200	0.00	2.50	0.00	0.00	0.00

Electric kWh Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

Electric kW Source: Water Heater UEF screening 2019-21 revised 2018.09.06

Gas DHW MMBtu Source: Guidehouse (2021). Comprehensive TRM Review/RI\_2022 Annual

 $Plan\_Gas\_HVAC\_WH\_Calculations\_2021\text{-}06\text{-}10$ 

Gas DHW MMBtu Note: Baseline update can be found in first source and calculations for savings can be found in second source.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ENERGY STAR STORAGE WATER HEATER .64 UEF (Med Draw)	9	1.00	1.00	1.00	1.00	1.00	1.00	0.21	0.40

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
ENERGY STAR STORAGE WATER HEATER .64 UEF (Med Draw)	41.00%	34.00%	13.00%	12.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review/RI\_2022 Annual Plan\_Gas\_HVAC\_WH\_Calculations\_2021-06-10

Measure Life Note: Baseline update can be found in first source and calculations for savings can be found in second source.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
ENERGY STAR STORAGE WATER HEATER .64 UEF (Med Draw)	0.00	0.00	1.30	0

Annual \$ Note: NEI per participant / treated unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ENERGY STAR STORAGE WATER HEATER .64 UEF (Med Draw)	0.34	0.12	0.00	0.77

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$165.00 / measure
Incentive: \$125.00 / measure

# **ENERGY STAR STORAGE WATER HEATER .68 UEF (High Draw)**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Efficient Standard

Tank Water Heater

Program: A02b Energy Star Heating System

## **Measure Description**

Stand-alone storage water heaters are high efficiency water heaters that are not combined with space heating devices.

#### **Baseline Description**

The baseline efficiency case is a standalone tank water heater with a medium draw of a UEF of 0.58 and high draw of 0.63. For the early retirement portion, the medium draw UEF is equal to 0.56 and high draw is equal to 0.60.

### **Savings Principle**

The high efficiency case is a stand-alone storage water heater with a medium draw and UEF >= 0.64 or high draw and UEF >= 0.68, a condensing water heater with an UEF >= 0.80, a tankless water heater with an UEF >= 0.87, or an indirect water heater attached to an ENERGY STAR® rated forced hot water gas boiler.

### **Savings Method**

Deemed

### Unit

Installation of new high-efficiency water heater

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ENERGY STAR STORAGE WATER HEATER .68 UEF (High Draw)	-43.0	-0.0200	0.00	2.50	0.00	0.00	0.00

Electric kWh Source: Water Heater UEF screening\_2019-21\_revised 2018.09.06

Electric kW Source: Water Heater UEF screening 2019-21 revised 2018.09.06

Gas DHW MMBtu Source: Guidehouse (2021). Comprehensive TRM Review/RI\_2022 Annual

 $Plan\_Gas\_HVAC\_WH\_Calculations\_2021\text{-}06\text{-}10$ 

Gas DHW MMBtu Note: Baseline update can be found in first source and calculations for savings can be found in second source.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ENERGY STAR STORAGE WATER HEATER .68 UEF (High Draw)	9	1.00	1.00	1.00	1.00	1.00	1.00	0.21	0.40

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
ENERGY STAR STORAGE WATER HEATER .68 UEF (High Draw)	41.00%	34.00%	13.00%	12.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review/RI\_2022 Annual Plan\_Gas\_HVAC\_WH\_Calculations\_2021-06-10

Measure Life Note: Baseline update can be found in first source and calculations for savings can be found in second source.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
ENERGY STAR STORAGE WATER HEATER .68 UEF (High Draw)	0.00	0.00	1.30	0

Annual \$ Note: NEI per participant / treated unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ENERGY STAR STORAGE WATER HEATER .68 UEF (High Draw)	0.34	0.12	0.00	0.77

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$165.00 / measure
Incentive: \$125.00 / measure

# Furnace (Forced Hot Air) >= 97% AFUE

 Sector: Residential
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Furnace

**Program:** A02b Energy Star Heating System

#### **Measure Description**

Installation of a new high efficiency space heating gas-fired furnace with an electronically commutated motor (ECM) for the

### **Baseline Description**

The end of life baseline efficiency case is a boiler with a rated AFUE equal to 89.0% and an actual efficiency of 90.1%. For the early retirement portion of the savings, the baseline efficiency is a rated 85.0% AFUE and an actual efficiency of 81.0%.

### **Savings Principle**

The high efficiency case is a new furnace with AFUE >= 95% and an electronically commutated motor or a new furnace with AFUE >= 97% and an electronically commutated motor.

#### **Savings Method**

Deemed

#### Unit

Installation of new high-efficiency furnace with ECM

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Furnace (Forced Hot Air) >= 97% AFUE	0	0.0000	7.60	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Guidehouse (2021). Comprehensive TRM Review/RI\_2022 Annual Plan Gas HVAC WH Calculations 2021-06-10

Gas Heat MMBtu Note: Baseline update can be found in first source and calculations for savings can be found in second source.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Furnace (Forced Hot Air) >= 97% AFUE	17	1.00	1.00	1.00	1.00	1.00	1.00		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Furnace (Forced Hot Air) >= 97% AFUE	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

Measure Life Note: Baseline update can be found in first source and calculations for savings can be found in second source.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	I\$ One-time \$		
Furnace (Forced Hot Air) >= 97% AFUE	0.00	0.00	47.16	0		

Annual \$ Note: NEI per participant / treated unit

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Furnace (Forced Hot Air) >= 97% AFUE	0.36	0.13	0.00	0.76

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$1,851.00 / measure
Incentive: \$600.00 / measure

# Furnace (Forced Hot Air) 95% AFUE w/ECM

 Sector: Residential
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Furnace

**Program:** A02b Energy Star Heating System

#### **Measure Description**

Installation of a new high efficiency space heating gas-fired furnace with an electronically commutated motor (ECM) for the

### **Baseline Description**

The end of life baseline efficiency case is a boiler with a rated AFUE equal to 89.0% and an actual efficiency of 90.1%. For the early retirement portion of the savings, the baseline efficiency is a rated 85.0% AFUE and an actual efficiency of 81.0%.

#### **Savings Principle**

The high efficiency case is a new furnace with AFUE >= 95% and an electronically commutated motor or a new furnace with AFUE >= 97% and an electronically commutated motor.

#### **Savings Method**

Deemed

#### Unit

Installation of new high-efficiency furnace with ECM

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Furnace (Forced Hot Air) 95% AFUE w/ECM	0	0.0000	6.80	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Guidehouse (2021). Comprehensive TRM Review/RI\_2022 Annual Plan Gas HVAC WH Calculations 2021-06-10

Gas Heat MMBtu Note: Baseline update can be found in first source and calculations for savings can be found in second source.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Furnace (Forced Hot Air) 95% AFUE w/ECM	17	1.00	1.00	1.00	1.00	1.00	1.00		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Furnace (Forced Hot Air) 95% AFUE w/ECM	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

Measure Life Note: Baseline update can be found in first source and calculations for savings can be found in second source.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Furnace (Forced Hot Air) 95% AFUE w/ECM	0.00	0.00	47.16	0	

Annual \$ Note: NEI per participant / treated unit

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Furnace (Forced Hot Air) 95% AFUE w/ECM	0.36	0.13	0.00	0.76

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$1,536.00 / measure
Incentive: \$350.00 / measure

# **Heat Recovery Ventilator**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Ventilation Measure Sub Type: Heat Recovery

Ventilator

Program: A02b Energy Star Heating System

## **Measure Description**

Heat Recovery Ventilators (HRV) can help make mechanical ventilation more cost effective by reclaiming energy from exhaust airflows. An electric penalty results due to the increased electricity consumed by the system fans.

### **Baseline Description**

The baseline efficiency case is an ASHRAE 62.2-compliant exhaust fan system with no heat recovery.

### **Savings Principle**

The high efficiency case is an exhaust fan system with heat recovery.

### **Savings Method**

Deemed

#### Unit

Installation of heat recovery ventilation system

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heat Recovery Ventilator	-171.0	-0.0200	8.60	0.00	0.00	0.00	0.00

Electric kWh Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Electric kW Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Gas Heat MMBtu Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heat Recovery Ventilator	20	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.45

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heat Recovery Ventilator	45.00%	55.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heat Recovery Ventilator	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heat Recovery Ventilator	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$960.00 / measure
Incentive: \$500.00 / measure

### Indirect Water Heater

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Indirect Water

Heater

Program: A02b Energy Star Heating System

#### **Measure Description**

Installation of high efficiency gas water heaters: Indirect water heaters use storage tank that is heated by the main boiler. The energy stored by the water tank allows the boiler to turn off and on less often, saving considerable energy. Condensing waterheaters recover energy by using either a larger heat exchanger or a second heat exchanger to reduce the flue-gas temperature to the point that water vapor condenses, thus releasing even more energy. Stand-alone storage water heaters are high efficiency water heaters that are not combined with space heating devices. Tankless water heaters circulate water through a heat exchanger to be heated for immediate use, eliminating the standby heat loss associated with a storage tank.

## **Baseline Description**

The baseline efficiency case is a standalone tank water heater with an energy factor of 0.61.

#### **Savings Principle**

The high efficiency case is a stand-alone storage water heater with a medium draw and UEF >= 0.64 or high draw and UEF >= 0.68, a condensing water heater with an UEF >= 0.80, a tankless water heater with an UEF >= 0.87, or an indirect water heater attached to an ENERGY STAR® rated forced hot water gas boiler.

### **Savings Method**

Deemed

#### Unit

Installation of new high-efficiency water heater

## **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Indirect Water Heater	0	0.0000	4.00	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Navigant (2018) Res 34 Home Energy Services Impact Evaluation

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Indirect Water Heater	20	1.00	1.00	1.00	1.00	1.00	1.00		_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Indirect Water Heater	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Indirect Water Heater	0.00	0.00	0.70	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Indirect Water Heater	0.34	0.12	0.00	0.77

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$1,749.00 / measure
Incentive: \$425.00 / measure

# **Integrated Water Heater/Condensing Boiler 95**

 Sector: Residential
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Boiler

**Program:** A02b Energy Star Heating System

#### **Measure Description**

This measure promotes the installation of a combined condensing high-efficiency boiler and water heating unit. Combined boiler and water heating systems are more efficient than separate systems because they eliminate the standby heat losses of an additional tank.

### **Baseline Description**

For heating, the end of life baseline efficiency case is a 86.5% rated with an actual efficiency of 83.7%. For the early retirement portion, the baseline efficiency has a rated AFUE of 85.5 with a 77.4% actual AFUE Efficiency. For water heating, there is a blend of 24% indirect water heater and 76% storage water heater.

### **Savings Principle**

The high efficiency case is an integrated water heater/condensing boiler with a 95% AFUE boiler and a 0.95 EF water heater.

### **Savings Method**

Deemed

### Unit

Installation of new high-efficiency integrated boiler/water heater

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Integrated Water Heater/Condensing Boiler 95	0	0.0000	11.70	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Guidehouse (2021). Comprehensive TRM Review/RI\_2022 Annual Plan\_Gas\_HVAC\_WH\_Calculations\_2021-06-10

Gas Heat MMBtu Note: Baseline update can be found in first source and calculations for savings can be found in second source.

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Integrated Water Heater/Condensing Boiler 95	23	1.00	1.00	1.00	1.00	1.00	1.00		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Integrated Water Heater/Condensing Boiler 95	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Integrated Water Heater/Condensing Boiler 95	0.00	0.00	2.74	0

Annual \$ Note: NEI per participant / treated unit

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Integrated Water Heater/Condensing Boiler 95	0.36	0.13	0.00	0.76

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$3,751.00 / measure

Incentive: \$1,400.00 / measure

# LOW\_FLOW\_SHOWERHEAD

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Low Flow

Showerhead

Program: A02b Energy Star Heating System

Measure Description 1.75 GPD or less

**Baseline Description**Standard Showerhead

**Savings Principle** 

**Savings Method** 

Deemed

Unit

Per Showerhead

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LOW_FLOW_SHOWERHEAD	0	0	0.00	1.20	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LOW_FLOW_SHOWERHEAD	15	0.78	1.00	1.00	1.00	1.00	1.00		_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LOW_FLOW_SHOWERHEAD	0.00%	0.00%	0.00%	0.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

**Non-Energy Impact Factors** 

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LOW_FLOW_SHOWERHEAD	2401.00	2401.00	0	0.03

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LOW_FLOW_SHOWERHEAD	0.03	0.12	0.00	1.09

NTG Source: Guidehouse Inc., Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado

TRC: \$20.00 / measure
Incentive: \$7.00 / measure

# **Programmable Thermostat**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A02b Energy Star Heating System

### **Measure Description**

Installation of a programmable thermostat which gives the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

## **Baseline Description**

The baseline efficiency case for cooling is a manual thermostat.

### **Savings Principle**

## **Savings Method**

Deemed

### Unit

Per Thermostat

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat	0	0.0000	2.07	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat	19	1.00	1.00	1.00	1.00	1.00	1.00		_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat	0.00%	0.00%	0.00%	0.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat	0.00	0.00	4.19	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat	0.25	0.12	0.00	0.87

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

TRC: \$92.00 / measure

Incentive: \$25.00 / measure

# Thermostatic Shut-Off Valve

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Low Flow

Showerhead

Program: A02b Energy Star Heating System

**Measure Description** 

TSV

**Baseline Description**Standard Showerhead

**Savings Principle** 

**Savings Method** 

Deemed

Unit

Per Showerhead

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Thermostatic Shut-Off Valve	0	0	0.00	0.38	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Thermostatic Shut-Off Valve	15	0.78	1.00	1.00	1.00	1.00	1.00		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Thermostatic Shut-Off Valve	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Thermostatic Shut-Off Valve	621.00	621.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Thermostatic Shut-Off Valve	0.03	0.12	0.00	1.09

NTG Source: Guidehouse Inc., Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado

TRC: \$21.00 / measure

Incentive: \$11.50 / measure

# **Triple Pane Windows**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, triple

pane

Program: A02b Energy Star Heating System

### **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

#### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Triple Pane Windows	7.0	0.0100	0.60	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM
Electric kW Source: MA 2022 TRM
Gas Heat MMBtu Source: MA 2022 TRM

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Triple Pane Windows	14	1.00	1.00		1.00	1.00	1.00	0.37	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Triple Pane Windows	4.00%	4.00%	50.00%	43.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption

RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study CFwp Source: Guidehouse, MA Residential Baseline Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Triple Pane Windows	0.00	0.00	6.72	0	

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Triple Pane Windows	0.04	0.00	0.00	0.96

NTG Source: MA 2022 TRM TRC: \$251.00 / measure Incentive: \$75.00 / measure

# TSV\_SHOWERHEAD

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Low Flow

Showerhead

Program: A02b Energy Star Heating System

Measure Description
TSV + 1.75 GPD or less
Baseline Description

Standard Showerhead

Savings Principle

Savings Method

Deemed

Unit

Per Showerhead

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
TSV_SHOWERHEAD	0	0	0.00	1.22	0.00	0.00	0.00

Gas DHW MMBtu Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
TSV_SHOWERHEAD	15	0.78	1.00	1.00	1.00	1.00	1.00		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
TSV_SHOWERHEAD	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
TSV_SHOWERHEAD	3022.00	3022.00	0	0.03	

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
TSV_SHOWERHEAD	0.03	0.12	0.00	1.09

NTG Source: Guidehouse Inc., Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado

TRC: \$32.00 / measure

Incentive: \$15.00 / measure

## WiFi Enabled Thermostat

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

**Program:** A02b Energy Star Heating System

#### **Measure Description**

Installation of a programmable thermostat which gives the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

### **Baseline Description**

For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating without a programmable thermostat. For the installation of a wi-fi programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating with a programmable thermostat.

### **Savings Principle**

The high efficiency case is an HVAC system that has a programmable thermostat or wi-fi programmable thermostat installed.

#### **Savings Method**

Deemed

#### Unit

Installation of programmable thermostat

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Enabled Thermostat	0	0.0000	2.79	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Enabled Thermostat	15	1.00	1.00	1.00	1.00	1.00	1.00	•	_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WiFi Enabled Thermostat	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WiFi Enabled Thermostat	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Enabled Thermostat	0.25	0.12	0.00	0.87

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

# WiFi Enabled Thermostat with Cooling

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

**Program:** A02b Energy Star Heating System

#### **Measure Description**

Installation of a programmable thermostat which gives the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

### **Baseline Description**

For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating without a programmable thermostat. For the installation of a wi-fi programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating with a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system that has a programmable thermostat or wi-fi programmable thermostat installed.

#### **Savings Method**

Deemed

#### Unit

Installation of programmable thermostat

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Enabled Thermostat with Cooling	18.0	0.0300	2.79	0.00	0.00	0.00	0.00

Electric kWh Source: Wi-Fi-Thermostat-Impact-Evaluation-Secondary-Literature-Study\_FINAL

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Gas Heat MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

### **Energy Impact Factors**

October 2022

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Enabled Thermostat with Cooling	15	1.00	1.00	1.00	1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WiFi Enabled Thermostat with Cooling	47.00%	42.00%	7.00%	4.00%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WiFi Enabled Thermostat with Cooling	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Enabled Thermostat with Cooling	0.25	0.12	0.00	0.87

NTG Source: NMR Group, Inc (2021). MA20R28-B-RCD and Selected Products NTG

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$268.00 / measure
Incentive: \$75.00 / measure

# Air Sealing

 Sector: Residential
 Fuel: Gas
 Program Type: Custom

 Measure Category: Building Shell
 Measure Type: Air Sealing
 Measure Sub Type: Air Sealing/Infiltration

Program: A03b EnergyWise Multifamily

### **Measure Description**

Thermal shell air leaks are sealed through strategic use and location of air-tight materials.

#### **Baseline Description**

The baseline efficiency case is the existing building before the air sealing measure is implemented. The baseline building is characterized by the existing CFM50 measurement (CFM50PRE) for single family homes, or the existing air changes per hour (ACHPRE)

### **Savings Principle**

The high efficiency case is the existing building after the air sealing measure is implemented. The high efficiency building is characterized by the new CFM50 measurement for single family homes (CFM50POST), or the new air changes per hour (ACHPOST) for multi-family facilities, which is measured after the air sealing measure is implemented.

#### Savings Method

Calculated using site-specific inputs

#### Unit

Completed air sealing project.

#### **Savings Equation**

Gross MMBtu Gas = (CFM50\_pre - CFM50\_post) / LBL  $\times$  HDD  $\times$  (Hours per Day)  $\times$  (Minutes per Hour)  $\times$  (Btu/ft3-°F)  $\times$  CorrectionFactor / SeasonalEff / (Btu per MMBtu)

## Where:

CFM50\_pre = CFM50 measurement before air sealing

CFM50\_post = CFM50 measurement after air sealing (cu.ft./min)

LBL = LBL factor - This factor is determined as the product of the N-factor and a Height Correction Factor according to BPI Protocol

4644 HDD = Heating degree days (deg. F-day); This value is an average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data. http://www.ncdc.noaa.gov

24 Hours per Day = Conversion factor

60 Minutes per Hour = Conversion factor

0.018 Btu/ft3-°F = Heat capacity of 1 cubic foot of air at 70 °F

1 CorrectionFactor = Correction factor determined by auditor (e.g. for seasonal homes): Default

0.7 SeasonalEff = Heating system seasonal efficiency factor determined by auditor for homes heated with natural gas: Default

1,000,000 Btuper MMBtu = Conversion factor

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

Hours Note: Heating hours are characterized by the heating degree days for the facility, 4644.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Air Sealing	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Sealing	20	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Air Sealing	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: 'ComEd Effective Useful Life Research Report', May 2018

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Air Sealing	0.00	0.00	19.35	135.83	

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Air Sealing	0.33	0.01	0.00	0.68

 $NTG\ Source:\ RI-20-RX-EWMFImpact-Impact\ Evaluation\ of\ EnergyWise\ Multifamily\ Program$ 

TRC: EW MF Bundled costs (see Participant listing)

### Custom

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Custom Measure Sub Type: Custom

Program: A03b EnergyWise Multifamily

#### **Measure Description**

Vendors install a variety of measures at multifamily facilities. Includes non-lighting multifamily measures.

### **Baseline Description**

For retrofit projects, the baseline efficiency case is the same as the existing, or pre-retrofit, case for the non-lighting multifamily measures.

### **Savings Principle**

The high efficiency scenario is specific to the facility and may include one or more energy efficiency.

# **Savings Method**

Calc

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom	Calc	Calc	Calc	Calc	Calc	0.00	0.00

Gas Heat MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom	multi	1.00	1.00	0.99	0.99			Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Custom	0.00%	0.00%	0.00%	0.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Custom	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom	0.00	0.00	0.00	1.00

TRC: EW MF Bundled costs (see Participant listing)

## **Demand Circulator**

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Demand

Circulator

Program: A03b EnergyWise Multifamily

### **Measure Description**

Installation of a demand controller on a re-circulation loop.

### **Baseline Description**

Full time operation of re-circ pump.

### **Savings Principle**

The re-circulation pump is controlled by a demand signal or timer to reduce operating hours when no hot water usage occurs.

### **Savings Method**

Calc

#### Unit

Installed recirculation controller

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Demand Circulator	0	0	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Demand Circulator	15	1.00	1.00	1.00	1.00				_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Demand Circulator	0.00%	0.00%	0.00%	0.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Demand Circulator	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Demand Circulator	0.00	0.00	0.00	1.00

TRC: EW MF Bundled costs (see Participant listing)

# **Duct Sealing**

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Ducting Measure Sub Type: Duct Sealing

Program: A03b EnergyWise Multifamily

### **Measure Description**

Ducts are sealed by reconnecting disconnected duct joints and sealing gaps or seams with mastic and fiber-mesh tape as appropriate.

### **Baseline Description**

The baseline efficiency case is the existing facility or equipment prior to the implementation of duct sealing.

#### **Savings Principle**

The baseline efficiency case is the existing facility or equipment after the implementation of duct sealing.

### **Savings Method**

Calc

#### Unit

Installation of duct sealing

#### **Savings Equation**

MMBtu = Annualheatingconsumption x %SAVE x (1/1000000)

Where

Annual Heating Consumption = The total annual heating consumption for the facility (Btu)

%SAVE = Average reduction in energy consumption.

1/1,000,000 = Conversion from Btu to MMBtu

Savings Factors for Multifamily Duct Sealing

Measure Type %SAVE158

Savings Factors for Multifamily Duct Sealing

Surface Area < 50 SQFT 7%

Surface Area > 50 SQFT and < 200 SQFT 3%

Surface Area > 200 SQFT 1%

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Duct Sealing	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Duct Sealing	20	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Duct Sealing	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Duct Sealing	0.00	0.00	0.23	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Duct Sealing	0.33	0.01	0.00	0.68

NTG Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

### **Faucet Aerator**

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: A03b EnergyWise Multifamily

### **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a commercial setting with service water heated by natural gas.

## **Baseline Description**

The baseline efficiency case is 2.2 GPM or greater faucet.

#### **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less aerator installed.

# **Savings Method**

Deemed

### Unit

Installed faucet aerator.

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Faucet Aerator	0	0	0.00	0.20	0.00	0.00	0.00

Gas DHW MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Faucet Aerator	7	0.90	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Faucet Aerator	0.00%	0.00%	0.00%	0.00%

Measure Life Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

ISR Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Faucet Aerator	359.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Faucet Aerator	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

## Low-Flow showerhead

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A03b EnergyWise Multifamily

### **Measure Description**

Installation of a low flow showerhead with a flow rate of 1.5 GPM or less.

### **Baseline Description**

The baseline efficiency case is a showerhead with a flow of 2.5 gpm. For home audit applications, the baseline is the existing showerhead.

#### **Savings Principle**

The high efficiency is a low-flow showerhead with a flow of 1.5 gpm or less.

### **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

#### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow showerhead	0	0	0.00	1.30	0.00	0.00	0.00

Gas DHW MMBtu Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow showerhead	15	0.90	1.00	1.00	1.00				_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Flow showerhead	0.00%	0.00%	0.00%	0.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low-Flow showerhead	1786.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow showerhead	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

# Low-Flow Showerhead Thermo Control (Ladybug Gas DHW)

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A03b EnergyWise Multifamily

### **Measure Description**

A showerhead with a control that limits flow once water is heated.

### **Baseline Description**

The baseline case is a showerhead with a flow of 2.5 gallons per minute, or for the case of the adapter, a low flow showerhead with flow of 1.5 gpm or less.

### **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

### **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

## **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow Showerhead Thermo Control (Ladybug Gas DHW)	0	0	0.00	0.34	0.00	0.00	0.00

Gas DHW MMBtu Source: National Grid (2014). Review of ShowerStart evolve.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow Showerhead Thermo Control (Ladybug Gas DHW)	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Flow Showerhead Thermo Control (Ladybug Gas DHW)	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low-Flow Showerhead Thermo Control (Ladybug Gas DHW)	558.00	0.00	0	0

Water/Sewer Source: National Grid (2014). Review of ShowerStart evolve.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead Thermo Control (Ladybug Gas DHW)	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

# Low-Flow Showerhead with Thermo Control (Roadrunner Gas DHW)

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: A03b EnergyWise Multifamily

### **Measure Description**

A showerhead with a control that limits flow once water is heated.

### **Baseline Description**

The baseline case is a showerhead with a flow of 2.5 gallons per minute, or for the case of the adapter, a low flow showerhead with flow of 1.5 gpm or less.

### **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

### **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

## **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	0	0	0.00	1.60	0.00	0.00	0.00

Gas DHW MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	15	0.90	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Low-Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	2254.00	0.00	0.58	0	

Water/Sewer Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

### MF Shell Insulation

 Sector: Residential
 Fuel: Gas
 Program Type: Custom

 Measure Category: Building Shell
 Measure Type: Insulation
 Measure Sub Type: Shell

Program: A03b EnergyWise Multifamily

#### Measure Description

Insulation upgrades are applied in existing multifamily facilities.

### **Baseline Description**

The baseline efficiency case is characterized by the total R-value of the existing attic, basement or sidewall (Rexisit). This is calculated as the R-value of the existing insulation, estimated by the program contractor, plus the R-value of the ceiling, floor, or wall (for all projects: RCEILING = 3.36; RFLOOR = 6.16; RWALL = 6.65)

### **Savings Principle**

The high efficiency case is characterized by the total R-value of the attic after the installation of additional attic, basement or sidewall insulation. This is calculated as the sum of the existing R-value (RBASE) plus the R-value of the added insulation(RADD).

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed insulation project.

#### **Savings Equation**

MMBTUannual = (((1/Rexist)-(1/Rnew)) x HDD x 24 x Area) / (1,000,000) X Nheat

kWhannual = MMBtuannaul x 293.1

kW = kWhannual x kW/kWh heating

Where:

Rexist = Existing effective R-value (R-ExistingInsulation + R-Assembly), ft2-°F/Btuh

Rnew = New total effective R-value (R-ProposedMeasure + R-ExistingInsulation + R-Assembly), ft2-°F/Btuh

Area = Square footage of insulated area

nheat = Efficiency of the heating system (AFUE or COP)

293.1 = Conversion constant (1MMBtu = 293.1 kWh)

24 = Conversion for hours per day

HDD = Heating Degree Days; dependent on location, see table below

1,000,000 = Conversion from Btu to MMBtu

kW/kWh heating = Average annual kW reduction per kWh reduction: 0.00050 kW/kWh

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

Hours Note: Heating hours are characterized by the heating degree days for the facility, 4644.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
MF Shell Insulation	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
MF Shell Insulation	25	1.00	1.00	1.00	1.00			0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
MF Shell Insulation	6.59%	3.85%	47.32%	42.24%

Measure Life Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
MF Shell Insulation	0.00	0.00	47.31	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
MF Shell Insulation	0.33	0.01	0.00	0.68

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

Incentive: EW MF Bundled costs (see Participant listing)

# **Participant**

Sector: ResidentialFuel: GasProgram Type: PrescriptiveMeasure Category: ParticipantMeasure Type: ParticipantMeasure Sub Type: EW MF

Program: A03b EnergyWise Multifamily

**Measure Description** 

This row identifies a participant for tracking and cost purposes.

**Baseline Description** 

**Savings Principle** 

**Savings Method** 

Unit

Per participant

**Savings Equation** 

N/A

Hours: N/A.

### **Measure Gross Savings per Unit**

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Participant	0	0	0.00	0.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Participant	20	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Participant	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Participant	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Participant	0.00	0.00	0.00	1.00

TRC: \$390.00 / participant Incentive: \$304.00 / participant

# **Pipe Wrap (Water Heating)**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Insulation Measure Sub Type: Pipe Insulation

Program: A03b EnergyWise Multifamily

**Measure Description** 

Installation of DHW pipe wraps.

**Baseline Description** 

The baseline efficiency case is the existing hot water equipment.

**Savings Principle** 

The high efficiency case includes pipe wrap.

**Savings Method** 

Deemed

Unit

Installed pipe wrap job

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# **Measure Gross Savings per Unit**

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Wrap (Water Heating)	0	0	0.00	0.15	0.00	0.00	0.00

Gas DHW MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Gas DHW MMBtu Note: 3 feet per piece

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pipe Wrap (Water Heating)	15	0.90	1.00	1.00	1.00				_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pipe Wrap (Water Heating)	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pipe Wrap (Water Heating)	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pipe Wrap (Water Heating)	0.08	0.01	0.00	0.93

 $NTG\ Source:\ RI-20-RX-EWMFImpact-Impact\ Evaluation\ of\ EnergyWise\ Multifamily\ Program$ 

TRC: EW MF Bundled costs (see Participant listing)

Incentive: EW MF Bundled costs (see Participant listing)

# **Programmable Thermostat**

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A03b EnergyWise Multifamily

#### **Measure Description**

Installation of a programmable thermostat which gives the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

### **Baseline Description**

For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating without a programmable thermostat. For the installation of a wi-fi programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating with a programmable thermostat.

## **Savings Principle**

The high efficiency case is an HVAC system that has a programmable thermostat or wi-fi programmable thermostat installed.

#### Savings Method

Deemed

#### Unit

Installation of programmable thermostat

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat	29.0	0.0461	1.50	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Gas Heat MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat	13	0.95	1.00	1.00	1.00		•	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat	6.59%	3.85%	47.32%	42.24%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat	0.00	0.00	14.35	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat	0.48	0.01	0.00	0.53

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

Incentive: EW MF Bundled costs (see Participant listing)

# Wi-Fi Programmable Tstat (Controls Gas Heat Only)

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: A03b EnergyWise Multifamily

#### **Measure Description**

Installation of a programmable thermostat which gives the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

### **Baseline Description**

For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating without a programmable thermostat. For the installation of a wi-fi programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating with a programmable thermostat.

### **Savings Principle**

The high efficiency case is an HVAC system that has a programmable thermostat or wi-fi programmable thermostat installed.

#### **Savings Method**

Deemed

#### Unit

Installation of programmable thermostat

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Wi-Fi Programmable Tstat (Controls Gas Heat Only)	31.0	0.0493	2.30	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

Gas Heat MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

### **Energy Impact Factors**

October 2022

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Wi-Fi Programmable Tstat (Controls Gas Heat Only)	15	0.95	1.00	1.00	1.00			0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Wi-Fi Programmable Tstat (Controls Gas Heat Only)	6.59%	3.85%	47.32%	42.24%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Wi-Fi Programmable Tstat (Controls Gas Heat Only)	0.00	0.00	14.35	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Wi-Fi Programmable Tstat (Controls Gas Heat Only)	0.48	0.01	0.00	0.53

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: EW MF Bundled costs (see Participant listing)

Incentive: EW MF Bundled costs (see Participant listing)

# Home Energy Report, Existing Dual Fuel

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Whole Home Measure Type: Behavior Measure Sub Type: Home Energy

Reports

Program: Behavior

Measure Description

A Home Energy report sent to electric and gas customers that displays home energy consumption in comparison with peers and prompts energy conserving behavior.

**Baseline Description** 

No Home Energy Report.

**Savings Principle** 

A home that receives Home Energy Reports.

**Savings Method** 

Calculated by comparing consumption of treatment (with reports) and control groups (no reports)

Unit

Per participant

**Savings Equation** 

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Home Energy Report, Existing Dual Fuel	0	0	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Note: Supplied by vendor

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Home Energy Report, Existing Dual Fuel	1	1.00	1.00	0.92					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Home Energy Report, Existing Dual Fuel	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Opinion Dynamics with Navigant Consulting (2012). Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report July 2012. Prepared for Massachusetts EEAC & Behavioral Research Team

ISR Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

ISR Note: In-service rates are set to 100% because savings represent average for all treatment household (including opt outs).

SPF Note: Savings persistence is 100% since measure life is 1 year.

RRe Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Home Energy Report, Existing Dual Fuel	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Home Energy Report, Existing Dual Fuel	0.00	0.00	0.00	1.00

NTG Note: Net-t-gross is set to 100% since the HER program is implemented as a randomized control trial (RCT). RCT produces net savings accounting for free-ridership.

TRC: \$2.78 / participant

Incentive: \$2.78 / participant

# **Home Energy Report, Existing Gas**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Whole Home Measure Type: Behavior Measure Sub Type: Home Energy

Reports

Program: Behavior

Measure Description

A Home Energy report sent to gas customers that displays home energy consumption in comparison with peers and prompts energy conserving behavior.

**Baseline Description** 

No Home Energy Report.

**Savings Principle** 

A home that receives Home Energy Reports.

**Savings Method** 

Calculated by comparing consumption of treatment (with reports) and control groups (no reports)

Unit

Per participant

**Savings Equation** 

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW wp custom

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Home Energy Report, Existing Gas	0	0	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Note: Supplied by vendor

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Home Energy Report, Existing Gas	1	1.00	1.00	0.92					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Home Energy Report, Existing Gas	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: Opinion Dynamics with Navigant Consulting (2012). Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report July 2012. Prepared for Massachusetts EEAC & Behavioral Research Team

ISR Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

ISR Note: In-service rates are set to 100% because savings represent average for all treatment household (including opt outs).

SPF Note: Savings persistence is 100% since measure life is 1 year.

RRe Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Home Energy Report, Existing Gas	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Home Energy Report, Existing Gas	0.00	0.00	0.00	1.00

NTG Note: Net-t-gross is set to 100% since the HER program is implemented as a randomized control trial (RCT). RCT produces net savings accounting for free-ridership.

TRC: \$2.78 / participant

Incentive: \$2.78 / participant

# Home Energy Report, New Movers Dual Fuel

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Whole Home Measure Type: Behavior Measure Sub Type: Home Energy

Reports

Program: Behavior

Measure Description

A Home Energy report sent to electric and gas customers that displays home energy consumption in comparison with peers and prompts energy conserving behavior.

**Baseline Description** 

No Home Energy Report.

**Savings Principle** 

A home that receives Home Energy Reports.

**Savings Method** 

Calculated by comparing consumption of treatment (with reports) and control groups (no reports)

Unit

Per participant

**Savings Equation** 

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Home Energy Report, New Movers Dual Fuel	0	0	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Note: Supplied by vendor

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Home Energy Report, New Movers Dual Fuel	1	1.00	1.00	0.50					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Home Energy Report, New Movers Dual Fuel	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Opinion Dynamics with Navigant Consulting (2012). Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report July 2012. Prepared for Massachusetts EEAC & Behavioral Research Team

ISR Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

ISR Note: In-service rates are set to 100% because savings represent average for all treatment household (including opt outs).

SPF Note: Savings persistence is 100% since measure life is 1 year.

RRe Source: Cadeo/Illume (2020). 2017-2019 Impact Evaluation of the Home Energy Reports Program

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Home Energy Report, New Movers Dual Fuel	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Home Energy Report, New Movers Dual Fuel	0.00	0.00	0.00	1.00

NTG Note: Net-t-gross is set to 100% since the HER program is implemented as a randomized control trial (RCT). RCT produces net savings accounting for free-ridership.

TRC: \$2.78 / participant

Incentive: \$2.78 / participant

#### **Aerator**

 Sector: Residential
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: Water Heating
 Measure Type: Flow Control
 Measure Sub Type: Aerator

Program: Energy Wise Single Family

### **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a residential setting with service water heated by gas.

### **Baseline Description**

The baseline efficiency case is 2.2 GPM or greater flow rate.

#### **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less installed.

### **Savings Method**

Deemed

### Unit

Installed aerator

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Aerator	0	0	0.00	0.14	0.00	0.00	0.00

Gas DHW MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Aerator	7	0.98	1.00	1.00	1.00	•			

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Aerator	0.00%	0.00%	0.00%	0.00%

Measure Life Note: Massachusetts Common Assumption

ISR Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

ISR Note: For mailed-in faucet aerators, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Aerator	296.00	0.00	0	0

Water/Sewer Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Aerator	0.27	0.01	0.04	0.78

NTG Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

TRC: \$7.00 / unit

Incentive: \$7.00 / unit

# Air Sealing Kit, Gas

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Building ShellMeasure Type: Air SealingMeasure Sub Type: AirSealing/Infiltration

**Program:** Energy Wise Single Family

### **Measure Description**

The installation of recessed lighting cans that provide air sealing benefits.

### **Baseline Description**

The baseline is leaky recessed lighting cans.

#### **Savings Principle**

The high efficiency case is the existing building after the air sealing measure is implemented.

### **Savings Method**

Deemed

### Unit

Installed kit

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Air Sealing Kit, Gas	0	0	0.37	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Sealing Kit, Gas	12	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Air Sealing Kit, Gas	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Rise Engineering (2015). Memo on Pilot Findings for LED inserts for Recessed Light Cans.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Air Sealing Kit, Gas	0.00	0.00	2.34	16.45

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Air Sealing Kit, Gas	0.00	0.00	0.04	1.04

NTG Source: Guidehouse Inc., Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado

# **Pipe Wrap**

Fuel: Gas Sector: Residential Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Insulation Measure Sub Type: Pipe Insulation

Program: Energy Wise Single Family

### **Measure Description**

Installation of insulation to reduce water heating energy.

### **Baseline Description**

The baseline case is uninsulated heated water pipes.

#### **Savings Principle**

The high efficiency case is the installation of high-efficiency domestic hot water equipment such as low-flow showerheads and faucet aerators.

### **Savings Method**

Deemed

### Unit

Installed pipe wrap

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Wrap	0	0	0.00	0.30	0.00	0.00	0.00

Gas DHW MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pipe Wrap	7	0.98	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pipe Wrap	0.00%	0.00%	0.00%	0.00%

Measure Life Note: Massachusetts Common Assumption

ISR Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pipe Wrap	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pipe Wrap	0.27	0.01	0.04	0.78

NTG Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

TRC: \$13.00 / unit

Incentive: \$13.00 / unit

# **Programmable Thermostat**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: Energy Wise Single Family

#### **Measure Description**

Installation of a programmable thermostat which gives the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

### **Baseline Description**

For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating without a programmable thermostat.

### **Savings Principle**

The high efficiency case is an HVAC system with a programmable thermostat installed.

### **Savings Method**

Deemed

#### Unit

Installation of programmable thermostat

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat	27.0	0.0430	2.07	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Gas Heat MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat	19	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat	7.00%	3.80%	47.00%	42.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

ISR Note: For mailed-in thermostats, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat	0.00	0.00	3.63	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat	0.47	0.01	0.04	0.58

NTG Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

TRC: \$100.00 / unit

Incentive: \$100.00 / unit

## **Showerhead**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: LF Showerhead

Program: Energy Wise Single Family

### **Measure Description**

Installation of a low flow showerhead with a flow rate of 1.5 GPM or less.

### **Baseline Description**

The baseline efficiency case is a showerhead with a flow of 2.5 gpm. For home audit applications, the baseline is the existing showerhead.

#### **Savings Principle**

The high efficiency is a low-flow showerhead with a flow of 1.5 gpm or less.

# **Savings Method**

Deemed

### Unit

Installed showerhead.

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Showerhead	0	0	0.00	1.11	0.00	0.00	0.00

Gas DHW MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Showerhead	15	0.98	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Showerhead	0.00%	0.00%	0.00%	0.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Measure Life Note: Massachusetts Common Assumption

ISR Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

ISR Note: For mailed-in showerheads, ISR is assumed at 53% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Showerhead	1565.00	0.00	0	0.03	

Water/Sewer Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Showerhead	0.27	0.01	0.04	0.78

NTG Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

TRC: \$30.00 / unit

Incentive: \$30.00 / unit

# **Triple Pane Windows**

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, triple

pane

**Program:** Energy Wise Single Family

### **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

#### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Triple Pane Windows	7.0	0.0100	0.60	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM
Electric kW Source: MA 2022 TRM
Gas Heat MMBtu Source: MA 2022 TRM

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Triple Pane Windows	14	1.00	1.00		1.00	1.00	1.00	0.37	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Triple Pane Windows	4.00%	4.00%	50.00%	43.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption

RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study CFwp Source: Guidehouse, MA Residential Baseline Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Triple Pane Windows	0.00	0.00	6.72	0

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Triple Pane Windows	0.04	0.00	0.04	0.96

NTG Source: MA 2022 TRM

### Weatherization

 Sector: Residential
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: Whole Home
 Measure Type: Weatherization
 Measure Sub Type: EW SF

Program: Energy Wise Single Family

### **Measure Description**

Installation of weatherization measures such as air sealing and insulation in gas heated homes. Electric savings are achieved from reduced run time of the HVAC system fan(s).

### **Baseline Description**

The baseline efficiency case is the existing home shell.

### **Savings Principle**

The high efficiency case can be a combination of increased insulation, air sealing, duct sealing, and other improvements to the home shell.

### **Savings Method**

Deemed

#### Unit

Household with weatherization measures installed

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Weatherization	48.0	0.0370	9.60	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Gas Heat MMBtu Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Weatherization	25	1.00	1.00	1.00	1.00			0.34	0.21

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Weatherization	25.00%	30.00%	23.00%	22.00%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Weatherization	0.00	0.00	66.59	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Weatherization	0.14	0.01	0.04	0.91

NTG Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

TRC: \$4,700.00 / participant

Incentive: \$3,800.00 / participant

### WiFi Thermostat

Sector: Residential Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: Energy Wise Single Family

#### **Measure Description**

Installation of a wifi thermostat which gives the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

### **Baseline Description**

For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating without a programmable thermostat.

### **Savings Principle**

The high efficiency case is an HVAC system with a wi-fi programmable thermostat installed.

### **Savings Method**

Deemed

#### Unit

Installation of WiFi programmable thermostat

#### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Thermostat	27.0	0.0430	2.79	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Gas Heat MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Thermostat	15	1.00	1.00	1.00	1.00			0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
WiFi Thermostat	7.00%	4.00%	47.00%	42.00%	

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

ISR Note: For mailed-in thermostats, ISR is assumed at 59% based on MA VHEA Study (MA20R26-B-VHEA).

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
WiFi Thermostat	0.00	0.00	3.63	0	

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Thermostat	0.47	0.01	0.04	0.58

NTG Source: Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-VHEA).

TRC: \$300.00 / unit
Incentive: \$200.00 / unit

# **Adaptive Reuse**

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Adaptive Reuse

Program: Residential New Construction

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed ESH heating, cooling, or DHW project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Adaptive Reuse	Calc	Calc	Calc	Calc	Calc	Calc	Calc

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Adaptive Reuse	15	1.00	1.00	1.00	1.00	1.00	1.00		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Adaptive Reuse	0.90%	4.10%	53.80%	41.20%

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Adaptive Reuse	0.00	0.00	117.00	0	

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Adaptive Reuse	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

#### CODES AND STANDARDS

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Codes and Standards Measure Sub Type: Codes and

Standards

Program: Residential New Construction

### **Measure Description**

Energy efficiency code trainings and advocacy work to improve energy efficiency of buildings and equipment within Rhode Island.

### **Baseline Description**

Un-influenced adoption curve of federal minimum codes and standards.

#### **Savings Principle**

Accelerated adoption of advancing energy codes and equipment standards.

### **Savings Method**

Calculated based on attribution study

#### Unit

Adoption of advancing energy codes and equipment standards.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
CODES AND STANDARDS	Calc	0	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR - Rhode Island Code Compliance Enhancement Initiative Attribution and Savings Study

Gas Heat MMBtu Source: NMR - Rhode Island Code Compliance Enhancement Initiative Attribution and Savings Study

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CODES AND STANDARDS	11	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
CODES AND STANDARDS	0.00%	0.00%	0.00%	0.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

 ${\it CFsp\ Note: Coincidence\ factors\ are\ custom\ calculated\ based\ on\ project-specific\ detail.}$ 

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
CODES AND STANDARDS	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CODES AND STANDARDS	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$150k for res+C&I C&S

Incentive: \$150k for res+C&I C&S

# Cooling\_Tier1

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Insulation Measure Sub Type: Efficient Cooling

Program: Residential New Construction

#### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

### **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Per energy efficient home

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Cooling_Tier1	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Cooling_Tier1	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Cooling_Tier1	0.90%	4.12%	53.82%	41.17%

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Cooling_Tier1	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Cooling_Tier1	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

# Cooling\_Tier2

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Insulation Measure Sub Type: Efficient Cooling

Program: Residential New Construction

### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

## **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

## **Savings Method**

Calculated using site-specific inputs

### Unit

Per energy efficient home

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Cooling_Tier2	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Cooling_Tier2	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Cooling_Tier2	0.90%	4.12%	53.82%	41.17%

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Cooling_Tier2	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Cooling_Tier2	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

# Cooling\_Tier3

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Insulation Measure Sub Type: Efficient Cooling

Program: Residential New Construction

### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

## **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

#### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

## **Savings Method**

Calculated using site-specific inputs

### Unit

Per energy efficient home

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Cooling_Tier3	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Cooling_Tier3	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Cooling_Tier3	0.90%	4.12%	53.82%	41.17%	

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Cooling_Tier3	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Cooling_Tier3	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

## CP

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: Residential New Construction

### **Measure Description**

To capture lost opportunities, encourage the construction of energy-efficient homes, and drive the market to one in which new homes are moving towards net-zero energy.

## **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

## **Savings Method**

Calculated using site-specific inputs

### Unit

Per energy efficient home

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu			Propane MMBtu
СР	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
СР	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
СР	0.90%	4.12%	53.82%	41.17%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
СР	0.00	0.00	142.33	0

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
СР	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

### **CP-DHW**

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Flow Control

Measures

Program: Residential New Construction

## **Measure Description**

DHW measures including high-efficiency low-flow showerheads and faucet aerators save water and water heating energy.

## **Baseline Description**

The User Defined Reference Home was revised in 2012 as a result of a baseline study.

### **Savings Principle**

The high efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

## **Savings Method**

Calculated using site-specific inputs

### Unit

Per energy efficient home

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
CP-DHW	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CP-DHW	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
CP-DHW	35.84%	30.76%	17.26%	16.14%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
CP-DHW	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CP-DHW	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$1,074.00 / home
Incentive: \$310.00 / home

# Heating\_Tier1

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Heating Measure Sub Type: Efficient Heating

Program: Residential New Construction

### **Measure Description**

This measure involves the installation of a high-efficiency natural gas heating system.

## **Baseline Description**

The baseline efficiency case is a standard efficiency natural gas heating system.

### **Savings Principle**

The high efficiency case is the installation of a high-efficiency natural gas heating system.

## **Savings Method**

Deemed

### Unit

Installed high-efficiency natural gas heating system.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW wp custom

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating_Tier1	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating_Tier1	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak Summer Off-P		
	Energy %	Energy %	Energy % Energy %		
Heating_Tier1	37.81%	61.53%	0.17%	0.49%	

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heating_Tier1	0.00	0.00	117.00	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating_Tier1	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$1,630.00 / home
Incentive: \$1,050.00 / home

# Heating\_Tier2

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Heating Measure Sub Type: Efficient Heating

Program: Residential New Construction

### **Measure Description**

This measure involves the installation of a high-efficiency natural gas heating system.

## **Baseline Description**

The baseline efficiency case is a standard efficiency natural gas heating system.

### **Savings Principle**

The high efficiency case is the installation of a high-efficiency natural gas heating system.

## **Savings Method**

Deemed

### Unit

Installed high-efficiency natural gas heating system.

## **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW wp custom

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating_Tier2	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating_Tier2	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Heating_Tier2	37.81%	61.53%	0.17%	0.49%	

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heating_Tier2	0.00	0.00	117.00	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating_Tier2	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$4,860.00 / home
Incentive: \$1,975.00 / home

# Heating\_Tier3

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Heating Measure Sub Type: Efficient Heating

Program: Residential New Construction

### **Measure Description**

This measure involves the installation of a high-efficiency natural gas heating system.

## **Baseline Description**

The baseline efficiency case is a standard efficiency natural gas heating system.

### **Savings Principle**

The high efficiency case is the installation of a high-efficiency natural gas heating system.

## **Savings Method**

Deemed

### Unit

Installed high-efficiency natural gas heating system.

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating_Tier3	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating_Tier3	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Heating_Tier3	37.81%	61.53%	0.17%	0.49%	

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heating_Tier3	0.00	0.00	117.00	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating_Tier3	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$7,688.00 / home
Incentive: \$2,300.00 / home

# Hot Water Heating\_Tier1

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Flow Control

Measures

Program: Residential New Construction

## **Measure Description**

DHW measures including high-efficiency low-flow showerheads and faucet aerators save water and water heating energy.

## **Baseline Description**

The baseline efficiency case is the existing domestic hot water equipment.

### **Savings Principle**

The high efficiency case is the installation of high-efficiency domestic hot water equipment such as low-flow showerheads and faucet aerators.

## **Savings Method**

Deemed

### Unit

Installed DHW efficiency measure.

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Hot Water Heating_Tier1	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Hot Water Heating_Tier1	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Hot Water Heating_Tier1	35.84%	30.76%	17.26%	16.14%	

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

 ${\it CFsp\ Note: Coincidence\ factors\ are\ custom\ calculated\ based\ on\ project-specific\ detail.}$ 

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Hot Water Heating_Tier1	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Hot Water Heating_Tier1	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$400.00 / home
Incentive: \$50.00 / home

# Hot water heating\_Tier2

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Flow Control

Measures

Program: Residential New Construction

## **Measure Description**

DHW measures including high-efficiency low-flow showerheads and faucet aerators save water and water heating energy.

## **Baseline Description**

The baseline efficiency case is the existing domestic hot water equipment.

### **Savings Principle**

The high efficiency case is the installation of high-efficiency domestic hot water equipment such as low-flow showerheads and faucet aerators.

## **Savings Method**

Deemed

### Unit

Installed DHW efficiency measure.

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW\_wp\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Hot water heating_Tier2	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Hot water heating_Tier2	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Hot water heating_Tier2	35.84%	30.76%	17.26%	16.14%

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

 ${\it CFsp\ Note: Coincidence\ factors\ are\ custom\ calculated\ based\ on\ project-specific\ detail.}$ 

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Hot water heating_Tier2	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Hot water heating_Tier2	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$400.00 / home

Incentive: \$150.00 / home

# Hot water heating\_Tier3

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Flow Control

Measures

Program: Residential New Construction

## **Measure Description**

DHW measures including high-efficiency low-flow showerheads and faucet aerators save water and water heating energy.

## **Baseline Description**

The baseline efficiency case is the existing domestic hot water equipment.

### **Savings Principle**

The high efficiency case is the installation of high-efficiency domestic hot water equipment such as low-flow showerheads and faucet aerators.

## **Savings Method**

Deemed

### Unit

Installed DHW efficiency measure.

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom Gross Winter kW = deltakW wp custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Hot water heating_Tier3	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Hot water heating_Tier3	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Hot water heating_Tier3	35.84%	30.76%	17.26%	16.14%

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Hot water heating_Tier3	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Hot water heating_Tier3	0.25	0.00	0.00	0.75

NTG Source: NMR Group, Inc (2021). Low Rise NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$400.00 / home

Incentive: \$150.00 / home

## **Renovation Rehab CP**

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: Residential New Construction

## **Measure Description**

The heating savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

### Unit

Complete Renovation Rehab project

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab CP	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab CP	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab CP	0.90%	4.12%	53.82%	41.17%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab CP	0.00	0.00	142.33	0

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab CP	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: ESH Bundled costs

Incentive: ESH Bundled costs

## **Renovation Rehab CP Heating**

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Cooling

Program: Residential New Construction

## **Measure Description**

The cooling savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

### Unit

Complete Renovation Rehab project

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab CP Heating	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab CP Heating	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab CP Heating	37.81%	61.53%	0.17%	0.49%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab CP Heating	0.00	0.00	117.00	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab CP Heating	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$787.00 / home

Incentive: \$310.00 / home

# Renovation Rehab CP Heating\_Elec

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Cooling

Program: Residential New Construction

## **Measure Description**

The cooling savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

### Unit

Complete Renovation Rehab project

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab CP Heating_Elec	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

## **Energy Impact Factors**

October 2022

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab CP Heating_Elec	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak		Summer Peak	Summer Off-Peak	
	Energy %		Energy %	Energy %	
Renovation Rehab CP Heating_Elec	37.81%	61.53%	0.17%	0.49%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab CP Heating_Elec	0.00	0.00	117.00	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab CP Heating_Elec	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$787.00 / home

Incentive: \$310.00 / home

## Renovation Rehab CP Heating\_Gas

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Cooling

Program: Residential New Construction

## **Measure Description**

The cooling savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

### Unit

Complete Renovation Rehab project

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab CP Heating_Gas	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

## **Energy Impact Factors**

October 2022

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab CP Heating_Gas	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Renovation Rehab CP Heating_Gas	37.81%	61.53%	0.17%	0.49%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab CP Heating_Gas	0.00	0.00	117.00	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab CP Heating_Gas	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$787.00 / home

Incentive: \$310.00 / home

## **Renovation Rehab CP-DHW**

 Sector: Residential
 Fuel: Gas
 Program Type: Custom

 Measure Category: Whole Home
 Measure Type: Custom
 Measure Sub Type: DHW

Program: Residential New Construction

### **Measure Description**

The DHW savings resulting from Renovation Rehab projects that include more efficient water heating systems.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

## Unit

Complete Renovation Rehab project

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab CP-DHW	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab CP-DHW	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab CP-DHW	35.84%	30.76%	17.26%	16.14%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab CP-DHW	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab CP-DHW	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$100.00 / home
Incentive: \$75.00 / home

# Renovation Rehab Domestic Hot Water\_Tier1

 Sector: Residential
 Fuel: Gas
 Program Type: Custom

 Measure Category: Whole Home
 Measure Type: Custom
 Measure Sub Type: DHW

Program: Residential New Construction

### **Measure Description**

The DHW savings resulting from Renovation Rehab projects that include more efficient water heating systems.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

## Unit

Complete Renovation Rehab project

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Domestic Hot Water_Tier1	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Domestic Hot Water_Tier1	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Domestic Hot Water_Tier1	35.84%	30.76%	17.26%	16.14%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Domestic Hot Water_Tier1	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_Tier1	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$100.00 / home
Incentive: \$75.00 / home

# Renovation Rehab Domestic Hot Water\_Tier1 Gas

 Sector: Residential
 Fuel: Gas
 Program Type: Custom

 Measure Category: Whole Home
 Measure Type: Custom
 Measure Sub Type: DHW

**Program:** Residential New Construction

## **Measure Description**

The DHW savings resulting from Renovation Rehab projects that include more efficient water heating systems.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Domestic Hot Water_Tier1 Gas	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kWh Note: Supplied by vendor

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Note: Supplied by vendor

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Domestic Hot Water_Tier1 Gas	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Domestic Hot Water_Tier1 Gas	35.84%	30.76%	17.26%	16.14%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Domestic Hot Water_Tier1 Gas	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_Tier1 Gas	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$400.00 / home Incentive: \$50.00 / home

# Renovation Rehab Domestic Hot Water\_Tier2 Gas

 Sector: Residential
 Fuel: Gas
 Program Type: Custom

 Measure Category: Whole Home
 Measure Type: Custom
 Measure Sub Type: DHW

**Program:** Residential New Construction

### **Measure Description**

The DHW savings resulting from Renovation Rehab projects that include more efficient water heating systems.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Domestic Hot Water_Tier2 Gas	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kWh Note: Supplied by vendor

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Note: Supplied by vendor

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Domestic Hot Water_Tier2 Gas	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Domestic Hot Water_Tier2 Gas	35.84%	30.76%	17.26%	16.14%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Domestic Hot Water_Tier2 Gas	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_Tier2 Gas	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$400.00 / home
Incentive: \$150.00 / home

# Renovation Rehab Domestic Hot Water\_Tier3 Gas

 Sector: Residential
 Fuel: Gas
 Program Type: Custom

 Measure Category: Whole Home
 Measure Type: Custom
 Measure Sub Type: DHW

**Program:** Residential New Construction

## **Measure Description**

The DHW savings resulting from Renovation Rehab projects that include more efficient water heating systems.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

#### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Domestic Hot Water_Tier3 Gas	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kWh Note: Supplied by vendor

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Note: Supplied by vendor

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Domestic Hot Water_Tier3 Gas	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Domestic Hot Water_Tier3 Gas	35.84%	30.76%	17.26%	16.14%

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Domestic Hot Water_Tier3 Gas	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_Tier3 Gas	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$400.00 / home
Incentive: \$150.00 / home

# Renovation Rehab Heating\_Tier1

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: Residential New Construction

## **Measure Description**

The heating savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

#### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Heating_Tier1	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Note: Calculated, per 100ft2.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Heating_Tier1	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Heating_Tier1	37.81%	61.53%	0.17%	0.49%

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Renovation Rehab Heating_Tier1	0.00	0.00	142.33	0	

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_Tier1	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$1,838.00 / home
Incentive: \$1,050.00 / home

# Renovation Rehab Heating\_Tier1 Cooling

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: Residential New Construction

## **Measure Description**

The heating savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

#### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Heating_Tier1 Cooling	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Heating_Tier1 Cooling	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Heating_Tier1 Cooling	2.50%	4.80%	42.58%	50.13%

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Heating_Tier1 Cooling	0.00	0.00	142.33	0

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_Tier1 Cooling	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

# Renovation Rehab Heating\_Tier2

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: Residential New Construction

## **Measure Description**

The heating savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

#### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Heating_Tier2	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Note: Calculated, per 100ft2.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Heating_Tier2	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Heating_Tier2	37.81%	61.53%	0.17%	0.49%

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Renovation Rehab Heating_Tier2	0.00	0.00	142.33	0	

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_Tier2	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$2,767.00 / home
Incentive: \$1,450.00 / home

# Renovation Rehab Heating\_Tier2 Cooling Gas

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: Residential New Construction

## **Measure Description**

The heating savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

#### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Heating_Tier2 Cooling Gas	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Heating_Tier2 Cooling Gas	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Heating_Tier2 Cooling Gas	2.50%	4.80%	42.58%	50.13%

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Heating_Tier2 Cooling Gas	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_Tier2 Cooling Gas	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

# Renovation Rehab Heating\_Tier3

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: Residential New Construction

## **Measure Description**

The heating savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

#### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Heating_Tier3	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Note: Calculated, per 100ft2.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Heating_Tier3	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Heating_Tier3	37.81%	61.53%	0.17%	0.49%

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Heating_Tier3	0.00	0.00	142.33	0

Annual \$ Source: NMR Group, Inc (2021). Residential New Construction Quick Hit NEI Study

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_Tier3	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

TRC: \$9,330.00 / home
Incentive: \$2,535.00 / home

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# Renovation Rehab Heating\_Tier3 Cooling Gas

Sector: Residential Fuel: Gas Program Type: Custom

Measure Category: Whole Home Measure Type: Custom Measure Sub Type: Heating

Program: Residential New Construction

## **Measure Description**

The heating savings resulting from Renovation Rehab projects that include the installation of roof, wall, and basement insulation.

## **Baseline Description**

The baseline case is the current version of the RI energy code and/or UDRH performance.

#### **Savings Principle**

The efficient case is the post-retrofit performance of a house participating the program.

## **Savings Method**

Calculated using site-specific inputs

## Unit

Complete Renovation Rehab project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Renovation Rehab Heating_Tier3 Cooling Gas	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Electric kW Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

Gas Heat MMBtu Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Heating_Tier3 Cooling Gas	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Renovation Rehab Heating_Tier3 Cooling Gas	2.50%	4.80%	42.58%	50.13%

Measure Life Source: NMR Group, KEMA, The Cadmus Group, Dorothy Conant (2012). Rhode Island 2011 Baseline Study of Single-Family Residential New Construction. Prepared for National Grid.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Renovation Rehab Heating_Tier3 Cooling Gas	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_Tier3 Cooling Gas	0.22	0.02	0.12	0.92

NTG Source: NMR Group, Inc (2021). R&A NTG study

NTG Note: Net-to-gross negotiated with C-Team based on MA results.

# Income Eligible

# **Appliance Removal**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: Recycling Measure Sub Type: Refrigerator

Recycling

Program: B03a Single Family - Appliance Management

**Measure Description** 

This measure covers the removal of an existing inefficient refrigerator.

**Baseline Description** 

The baseline efficiency case is the old, inefficient working refrigerator or freezer.

**Savings Principle** 

The high efficiency case assumes no replacement of secondary unit.

**Savings Method** 

Calculated using deemed inputs

Unit

Installed high-efficiency refrigerator

**Savings Equation** 

Gross kWh = Qty × (kWh\_base - kWh\_ee)

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

kWh\_base = Deemed average demand per baseline unit.

kWh\_ee = Deemed average demand per high-efficiency unit.

DeltakW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Appliance Removal	1,036.0	0.1900	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Appliance Removal	5	1.00	1.00	•	1.00	1.00	1.00	0.79	0.65

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Appliance Removal	29.00%	32.00%	18.00%	21.00%

Measure Life Note: National Grid assumption based on regional PA working groups.

 $ISR\ Note:\ All\ installations\ have\ 100\%\ in-service\ rate\ since\ programs\ include\ verification\ of\ equipment\ installations.$ 

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Appliance Removal	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Appliance Removal	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

# **Basic Educational Measures**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Whole Home Measure Type: Audit Measure Sub Type: Educational Kit

Program: B03a Single Family - Appliance Management

# **Measure Description**

Installation of basic educational measures during an audit to help customers become more aware of energy efficiency.

## **Baseline Description**

The baseline efficiency case assumes no measures installed.

#### **Savings Principle**

The high efficiency case includes basic educational measures such as CFLs, low flow showerheads, pool and air conditioner timers, torchieres, and programmable thermostats.

#### **Savings Method**

Deemed

## Unit

Completed audit.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Basic Educational Measures	21.0	0.0040	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Basic Educational Measures	5	1.00	1.00		1.00	1.00	1.00	0.58	0.86

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Basic Educational Measures	32.00%	35.00%	15.00%	18.00%

Measure Life Note: National Grid assumption based on regional PA working groups.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Basic Educational Measures	0.00	0.00	10.37	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Basic Educational Measures	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

# **Dehumidifier Rebate**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: Dehumidifiers Measure Sub Type: Dehumidifier

Program: B03a Single Family - Appliance Management

#### **Measure Description**

The Installation of high efficiency dehumidifiers and the turn-in of existing inefficient dehumidifiers.

## **Baseline Description**

The baseline efficiency case is the existing dehumidifier. It is assumed that low-income customers would otherwise replace their dehumidifiers with a used inefficient unit.

## **Savings Principle**

The high efficiency case is an ENERGY STAR® replacement unit with an efficiency of 1.47 L/kWh. The high efficiency case is an ENERGY STAR® replacement unit with an efficiency of 1.47 L/kWh.

## **Savings Method**

Calculated using deemed inputs

#### Unit

Per dehumidifier

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dehumidifier Rebate	489.4	0.1100	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dehumidifier Rebate	17	1.00	1.00		1.00	1.00	1.00	0.82	0.17

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dehumidifier Rebate	22.00%	23.00%	25.00%	30.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dehumidifier Rebate	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dehumidifier Rebate	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$275.00 / measure

Incentive: \$275.00 / measure

# **Domestic Hot Water Measure, Electric**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Flow Control

Measures

Program: B03a Single Family - Appliance Management

## **Measure Description**

Domestic hot water measures include high-efficiency low-flow showerheads and faucet aerators that can save water and water heating energy.

## **Baseline Description**

The baseline efficiency case is the existing domestic hot water equipment.

#### **Savings Principle**

The high efficiency case is the installation of high-efficiency domestic hot water equipment such as low-flow showerheads and faucet aerators.

#### **Savings Method**

Deemed

#### Unit

Installed DHW efficiency measure.

## **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Domestic Hot Water Measure, Electric	160.0	0.0400	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Domestic Hot Water Measure, Electric	7	1.00	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Domestic Hot Water Measure, Electric	42.00%	31.00%	15.00%	12.00%

Measure Life Note: National Grid assumption based on regional PA working groups.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Domestic Hot Water Measure, Electric	4028.00	0.00	0	1.72

Water/Sewer Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Domestic Hot Water Measure, Electric	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$20.00 / measure

Incentive: \$20.00 / measure

# **Domestic Hot Water Measure, Gas**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Flow Control

Measures

Program: B03a Single Family - Appliance Management

## **Measure Description**

Domestic hot water measures include high-efficiency low-flow showerheads and faucet aerators that can save water and water heating energy.

## **Baseline Description**

The baseline efficiency case is the existing domestic hot water equipment.

#### **Savings Principle**

The high efficiency case is the installation of high-efficiency domestic hot water equipment such as low-flow showerheads and faucet aerators.

#### **Savings Method**

Deemed

#### Unit

Installed DHW efficiency measure.

## **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Domestic Hot Water Measure, Gas	0.0	0.0000	0.83	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Gas Heat MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Domestic Hot Water Measure, Gas	7	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Domestic Hot Water Measure, Gas	0.00%	0.00%	0.00%	0.00%

Measure Life Note: National Grid assumption based on regional PA working groups.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Domestic Hot Water Measure, Gas	4028.00	0.00	0	1.72

Water/Sewer Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Domestic Hot Water Measure, Gas	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$20.00 / measure

Incentive: \$20.00 / measure

# **Domestic Hot Water Measure, Oil**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Type: Flow Control Measure Category: Water Heating Measure Sub Type: Flow Control

Measures

Program: B03a Single Family - Appliance Management

## Measure Description

Domestic hot water measures include high-efficiency low-flow showerheads and faucet aerators that can save water and water heating energy.

## **Baseline Description**

The baseline efficiency case is the existing domestic hot water equipment.

#### **Savings Principle**

The high efficiency case is the installation of high-efficiency domestic hot water equipment such as low-flow showerheads and faucet aerators.

#### **Savings Method**

Deemed

#### Unit

Installed DHW efficiency measure.

## **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross  $kWh = Qty \times deltakWh$ 

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Domestic Hot Water Measure, Oil	0.0	0.0000	0.00	0.00	0.00	0.90	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Domestic Hot Water Measure, Oil	7	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Domestic Hot Water Measure, Oil	0.00%	0.00%	0.00%	0.00%	

Measure Life Note: National Grid assumption based on regional PA working groups.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Domestic Hot Water Measure, Oil	4028.00	0.00	0	1.72

Water/Sewer Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Domestic Hot Water Measure, Oil	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$20.00 / measure

Incentive: \$20.00 / measure

# Early Retirement Clothes Washer Elec DHW & Elec Dryer

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: ER CW & Dryer Measure Sub Type: ER ele DHW

washer & ele dryer

Program: B03a Single Family - Appliance Management

# **Measure Description**

The replacement and recycling of a working top-loading clothes washer with an agitator with an Energy Star rated washing machine.

#### **Baseline Description**

The baseline efficiency case is the existing clothes washer & dryer.

## **Savings Principle**

The high efficiency case is a new high efficiency washer & dryer.

## **Savings Method**

Calculated using deemed inputs

#### Unit

Installed high-efficiency washer & dryer.

#### **Savings Equation**

 $\Delta kWh = [(Capacity \times 1/IMEFbase \times Ncycles) * (%CWkwhbase + %DHWkwhbase + %Dryerkwhbase)] - [(Capacity \times 1/IMEFeff \times Ncycles) \times (%CWkwheff + %DHWkwheff + %Dryerkwheff)]$ 

 $\Delta \mathsf{MMBTUs} = [(\mathsf{Capacity} \times 1/\mathsf{MEFbase} \times \mathsf{Ncycles}) \times ((\mathsf{MDHWffbase} \times \mathsf{reff}) + (\mathsf{MDHWffbase}) - [(\mathsf{Capacity} \times 1/\mathsf{MEFeff} \times \mathsf{Ncycles}) \times ((\mathsf{MDHWffeff} \times \mathsf{reff}) + (\mathsf{MDHWffeff} \times \mathsf{reff}) + (\mathsf{MDHWffeff} \times \mathsf{Ncycles}) \times ((\mathsf{MDHWffeff} \times \mathsf{Ncycles}) \times ((\mathsf{MDHWfeff} \times \mathsf{Ncycles}) \times ((\mathsf{$ 

#### where

Capacity = washer volume in ft3. Existing top loading washer is 3.09 ft3, new standard efficiency top loading washer is 3.38 ft3, ENERGY STAR front loading is 3.90 ft

IMEF = Integrated Modified Energy Factor and is measured in ft3 /kWh/cycle

Ncycles = 283 loads per year

%CWkwh = % of total kWh energy consumption for clothes washer operation (different for baseline and efficient unit).

%DHWkwh = % of total kWh energy consumption used for water heating (different for baseline and efficient unit). If water is heated by gas or propane this is 0%

%DHWff = % of total kWh energy consumption for dryer operation (different for baseline and efficient unit). If the dryer is gas this is 0%

%Dryerkwh = % of total fossil fuel energy consumption used for water heating (different for baseline and efficient unit). If water is heated by electric this is 0%.

%Dryerff = % of total fossil fuel energy consumption for dryer operation (different for baseline and efficient unit). If the dryer is electric this is 0%.

r\_eff = recovery energy factor used to account for the difference in recovery efficiencies of electric and gas/oil/propane hot water heaters. Electric water heaters are 100% efficient while other water heaters are 75% efficient. The ratio is 1.33 (100%/75%)

MMBTU\_convert = Conversion factor from kWh to MMBTU is 0.003412

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Early Retirement Clothes Washer Elec DHW & Elec Dryer	588.0	0.1600	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Early Retirement Clothes Washer Elec DHW & Elec Dryer	12	1.00	1.00		1.00	1.00	1.00	0.49	0.52

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Early Retirement Clothes Washer Elec DHW & Elec Dryer	36.44%	29.90%	18.29%	15.36%

Measure Life Source: Washer & Dryer savings references

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Early Retirement Clothes Washer Elec DHW & Elec Dryer	4777.00	0.00	0	0

Water/Sewer Source: Washer & Dryer savings references

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Early Retirement Clothes Washer Elec DHW & Elec Dryer	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$770.00 / measure

Incentive: \$770.00 / measure

# Early Retirement Clothes Washer Elec DHW & Gas Dryer

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: ER CW & Dryer Measure Sub Type: ER ele DHW

washer & gas dryer

Program: B03a Single Family - Appliance Management

# **Measure Description**

The replacement and recycling of a working top-loading clothes washer with an agitator with an Energy Star rated washing machine.

#### **Baseline Description**

The baseline efficiency case is the existing clothes washer & dryer.

## **Savings Principle**

The high efficiency case is a new high efficiency washer & dryer.

## **Savings Method**

Calculated using deemed inputs

#### Unit

Installed high-efficiency washer & dryer.

#### **Savings Equation**

 $\Delta kWh = [(Capacity \times 1/IMEFbase \times Ncycles) * (%CWkwhbase + %DHWkwhbase + %Dryerkwhbase)] - [(Capacity \times 1/IMEFeff \times Ncycles) \times (%CWkwheff + %DHWkwheff + %Dryerkwheff)]$ 

 $\Delta$ MMBTUs = [(Capacity x 1/MEFbase x Ncycles) x ( (%DHWffbase x reff) + %Dryerffbase] - [(Capacity x 1/MEFeff x Ncycles) x (%DHWffeff x reff) + %Dryergaseff]xMMBTUconvert

#### where:

Capacity = washer volume in ft3. Existing top loading washer is 3.09 ft3, new standard efficiency top loading washer is 3.38 ft3, ENERGY STAR front loading is 3.90 ft

IMEF = Integrated Modified Energy Factor and is measured in ft3 /kWh/cycle

Ncycles = 283 loads per year

%CWkwh = % of total kWh energy consumption for clothes washer operation (different for baseline and efficient unit).

%DHWkwh = % of total kWh energy consumption used for water heating (different for baseline and efficient unit). If water is heated by gas or propane this is 0%

%DHWff = % of total kWh energy consumption for dryer operation (different for baseline and efficient unit). If the dryer is gas this is 0%

%Dryerkwh = % of total fossil fuel energy consumption used for water heating (different for baseline and efficient unit). If water is heated by electric this is 0%.

%Dryerff = % of total fossil fuel energy consumption for dryer operation (different for baseline and efficient unit). If the dryer is electric this is 0%.

r\_eff = recovery energy factor used to account for the difference in recovery efficiencies of electric and gas/oil/propane hot water heaters. Electric water heaters are 100% efficient while other water heaters are 75% efficient. The ratio is 1.33 (100%/75%)

MMBTU\_convert = Conversion factor from kWh to MMBTU is 0.003412

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Early Retirement Clothes Washer Elec DHW & Gas Dryer	307.0	0.0800	0.00	0.96	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Gas DHW MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Early Retirement Clothes Washer Elec DHW & Gas Dryer	12	1.00	1.00		1.00	1.00	1.00	0.49	0.52

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Early Retirement Clothes Washer Elec DHW & Gas Dryer	36.44%	29.90%	18.29%	15.36%

Measure Life Source: Washer & Dryer savings references

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# Non-Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Early Retirement Clothes Washer Elec DHW & Gas Dryer	4777.00	0.00	0	0

Water/Sewer Source: Washer & Dryer savings references

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Early Retirement Clothes Washer Elec DHW & Gas Dryer	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$770.00 / measure

Incentive: \$770.00 / measure

# Early Retirement Clothes Washer Gas DHW & Elec Dryer

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: ER CW & Dryer Measure Sub Type: ER gas DHW

washer & ele dryer

Program: B03a Single Family - Appliance Management

# **Measure Description**

The replacement and recycling of a working top-loading clothes washer with an agitator with an Energy Star rated washing machine.

#### **Baseline Description**

The baseline efficiency case is the existing clothes washer & dryer.

## **Savings Principle**

The high efficiency case is a new high efficiency washer & dryer.

## **Savings Method**

Calculated using deemed inputs

#### Unit

Installed high-efficiency washer & dryer.

#### **Savings Equation**

 $\Delta kWh = [(Capacity \times 1/IMEFbase \times Ncycles) * (%CWkwhbase + %DHWkwhbase + %Dryerkwhbase)] - [(Capacity \times 1/IMEFeff \times Ncycles) \times (%CWkwheff + %DHWkwheff + %Dryerkwheff)]$ 

 $\Delta \mathsf{MMBTUs} = [(\mathsf{Capacity} \times 1/\mathsf{MEFbase} \times \mathsf{Ncycles}) \times ((\mathsf{MDHWffbase} \times \mathsf{reff}) + \mathsf{MDryerffbase}] - [(\mathsf{Capacity} \times 1/\mathsf{MEFeff} \times \mathsf{Ncycles}) \times ((\mathsf{MDHWffeff} \times \mathsf{reff}) + \mathsf{MDryergaseff}] \times \mathsf{MMBTUconvert}]$ 

#### where

Capacity = washer volume in ft3. Existing top loading washer is 3.09 ft3, new standard efficiency top loading washer is 3.38 ft3, ENERGY STAR front loading is 3.90 ft

IMEF = Integrated Modified Energy Factor and is measured in ft3 /kWh/cycle

Ncycles = 283 loads per year

%CWkwh = % of total kWh energy consumption for clothes washer operation (different for baseline and efficient unit).

%DHWkwh = % of total kWh energy consumption used for water heating (different for baseline and efficient unit). If water is heated by gas or propane this is 0%

%DHWff = % of total kWh energy consumption for dryer operation (different for baseline and efficient unit). If the dryer is gas this is 0%

%Dryerkwh = % of total fossil fuel energy consumption used for water heating (different for baseline and efficient unit). If water is heated by electric this is 0%.

%Dryerff = % of total fossil fuel energy consumption for dryer operation (different for baseline and efficient unit). If the dryer is electric this is 0%.

r\_eff = recovery energy factor used to account for the difference in recovery efficiencies of electric and gas/oil/propane hot water heaters. Electric water heaters are 100% efficient while other water heaters are 75% efficient. The ratio is 1.33 (100%/75%)

MMBTU\_convert = Conversion factor from kWh to MMBTU is 0.003412

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Early Retirement Clothes Washer Gas DHW & Elec Dryer	327.0	0.0900	0.00	1.28	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Gas DHW MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Early Retirement Clothes Washer Gas DHW & Elec Dryer	12	1.00	1.00		1.00	1.00	1.00	0.49	0.52

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Early Retirement Clothes Washer Gas DHW & Elec Dryer	36.44%	29.90%	18.29%	15.36%

Measure Life Source: Washer & Dryer savings references

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Early Retirement Clothes Washer Gas DHW & Elec Dryer	4777.00	0.00	0	0

Water/Sewer Source: Washer & Dryer savings references

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Early Retirement Clothes Washer Gas DHW & Elec Dryer	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$770.00 / measure

Incentive: \$770.00 / measure

# Early Retirement Clothes Washer Gas DHW & Gas Dryer

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: ER CW & Dryer Measure Sub Type: ER gas DHW

washer & gas dryer

Program: B03a Single Family - Appliance Management

# **Measure Description**

The replacement and recycling of a working top-loading clothes washer with an agitator with an Energy Star rated washing machine.

#### **Baseline Description**

The baseline efficiency case is the existing clothes washer & dryer.

## **Savings Principle**

The high efficiency case is a new high efficiency washer & dryer.

## **Savings Method**

Calculated using deemed inputs

#### Unit

Installed high-efficiency washer & dryer.

#### **Savings Equation**

 $\Delta kWh = [(Capacity \times 1/IMEFbase \times Ncycles) * (%CWkwhbase + %DHWkwhbase + %Dryerkwhbase)] - [(Capacity \times 1/IMEFeff \times Ncycles) \times (%CWkwheff + %DHWkwheff + %Dryerkwheff)]$ 

 $\Delta \mathsf{MMBTUs} = [(\mathsf{Capacity} \times 1/\mathsf{MEFbase} \times \mathsf{Ncycles}) \times ((\mathsf{MDHWffbase} \times \mathsf{reff}) + \mathsf{MDryerffbase}] - [(\mathsf{Capacity} \times 1/\mathsf{MEFeff} \times \mathsf{Ncycles}) \times ((\mathsf{MDHWffeff} \times \mathsf{reff}) + \mathsf{MDryergaseff}] \times \mathsf{MMBTUconvert}]$ 

#### where

Capacity = washer volume in ft3. Existing top loading washer is 3.09 ft3, new standard efficiency top loading washer is 3.38 ft3, ENERGY STAR front loading is 3.90 ft

IMEF = Integrated Modified Energy Factor and is measured in ft3 /kWh/cycle

Ncycles = 283 loads per year

%CWkwh = % of total kWh energy consumption for clothes washer operation (different for baseline and efficient unit).

%DHWkwh = % of total kWh energy consumption used for water heating (different for baseline and efficient unit). If water is heated by gas or propane this is 0%

%DHWff = % of total kWh energy consumption for dryer operation (different for baseline and efficient unit). If the dryer is gas this is 0%

%Dryerkwh = % of total fossil fuel energy consumption used for water heating (different for baseline and efficient unit). If water is heated by electric this is 0%.

%Dryerff = % of total fossil fuel energy consumption for dryer operation (different for baseline and efficient unit). If the dryer is electric this is 0%.

r\_eff = recovery energy factor used to account for the difference in recovery efficiencies of electric and gas/oil/propane hot water heaters. Electric water heaters are 100% efficient while other water heaters are 75% efficient. The ratio is 1.33 (100%/75%)

MMBTU\_convert = Conversion factor from kWh to MMBTU is 0.003412

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Early Retirement Clothes Washer Gas DHW & Gas Dryer	46.0	0.0100	0.00	2.24	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Gas DHW MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Early Retirement Clothes Washer Gas DHW & Gas Dryer	12	1.00	1.00		1.00	1.00	1.00	0.49	0.52

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Early Retirement Clothes Washer Gas DHW & Gas Dryer	36.44%	29.90%	18.29%	15.36%

Measure Life Source: Washer & Dryer savings references

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Early Retirement Clothes Washer Gas DHW & Gas Dryer	4777.00	0.00	0	0

Water/Sewer Source: Washer & Dryer savings references

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Early Retirement Clothes Washer Gas DHW & Gas Dryer	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$770.00 / measure

Incentive: \$770.00 / measure

# Early Retirement Clothes Washer Oil DHW & Elec Dryer

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: ER CW & Dryer Measure Sub Type: ER oil DHW

washer & ele dryer

Program: B03a Single Family - Appliance Management

# **Measure Description**

The replacement and recycling of a working top-loading clothes washer with an agitator with an Energy Star rated washing machine.

#### **Baseline Description**

The baseline efficiency case is the existing clothes washer & dryer.

## **Savings Principle**

The high efficiency case is a new high efficiency washer & dryer.

## **Savings Method**

Calculated using deemed inputs

#### Unit

Installed high-efficiency washer & dryer.

#### **Savings Equation**

 $\Delta kWh = [(Capacity \times 1/IMEFbase \times Ncycles) * (%CWkwhbase + %DHWkwhbase + %Dryerkwhbase)] - [(Capacity \times 1/IMEFeff \times Ncycles) \times (%CWkwheff + %DHWkwheff + %Dryerkwheff)]$ 

 $\Delta \mathsf{MMBTUs} = [(\mathsf{Capacity} \times 1/\mathsf{MEFbase} \times \mathsf{Ncycles}) \times (\ (\%\mathsf{DHWffbase} \times \mathsf{reff}) + \%\mathsf{Dryerffbase}] - [(\mathsf{Capacity} \times 1/\mathsf{MEFeff} \times \mathsf{Ncycles}) \times (\%\mathsf{DHWffeff} \times \mathsf{reff}) + \%\mathsf{Dryergaseff}] \times \mathsf{MMBTUconvert}$ 

#### where

Capacity = washer volume in ft3. Existing top loading washer is 3.09 ft3, new standard efficiency top loading washer is 3.38 ft3, ENERGY STAR front loading is 3.90 ft

IMEF = Integrated Modified Energy Factor and is measured in ft3 /kWh/cycle

Ncycles = 283 loads per year

%CWkwh = % of total kWh energy consumption for clothes washer operation (different for baseline and efficient unit).

%DHWkwh = % of total kWh energy consumption used for water heating (different for baseline and efficient unit). If water is heated by gas or propane this is 0%

%DHWff = % of total kWh energy consumption for dryer operation (different for baseline and efficient unit). If the dryer is gas this is 0%

%Dryerkwh = % of total fossil fuel energy consumption used for water heating (different for baseline and efficient unit). If water is heated by electric this is 0%.

%Dryerff = % of total fossil fuel energy consumption for dryer operation (different for baseline and efficient unit). If the dryer is electric this is 0%.

r\_eff = recovery energy factor used to account for the difference in recovery efficiencies of electric and gas/oil/propane hot water heaters. Electric water heaters are 100% efficient while other water heaters are 75% efficient. The ratio is 1.33 (100%/75%)

MMBTU\_convert = Conversion factor from kWh to MMBTU is 0.003412

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Early Retirement Clothes Washer Oil DHW & Elec Dryer	327.0	0.0900	0.00	0.00	0.00	1.28	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Early Retirement Clothes Washer Oil DHW & Elec Dryer	12	1.00	1.00		1.00	1.00	1.00	0.49	0.52

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Early Retirement Clothes Washer Oil DHW & Elec Dryer	36.44%	29.90%	18.29%	15.36%

Measure Life Source: Washer & Dryer savings references

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# Non-Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Early Retirement Clothes Washer Oil DHW & Elec Dryer	4777.00	0.00	0	0

Water/Sewer Source: Washer & Dryer savings references

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Early Retirement Clothes Washer Oil DHW & Elec Dryer	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$770.00 / measure

Incentive: \$770.00 / measure

# Early Retirement Clothes Washer Propane DHW & Elec Dryer

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: ER CW & Dryer Measure Sub Type: ER propane DHW

washer & ele dryer

Program: B03a Single Family - Appliance Management

# **Measure Description**

The replacement and recycling of a working top-loading clothes washer with an agitator with an Energy Star rated washing machine.

#### **Baseline Description**

The baseline efficiency case is the existing clothes washer & dryer.

## **Savings Principle**

The high efficiency case is a new high efficiency washer & dryer.

## **Savings Method**

Calculated using deemed inputs

#### Unit

Installed high-efficiency washer & dryer.

### **Savings Equation**

ΔkWh = [(Capacity x 1/IMEFbase x Ncycles) \* (%CWkwhbase + %DHWkwhbase + %Dryerkwhbase)] - [(Capacity x 1/IMEFeff x Ncycles) x (%CWkwheff + %DHWkwheff + %Dryerkwheff)]

 $\Delta$ MMBTUs = [(Capacity x 1/MEFbase x Ncycles) x ( (%DHWffbase x reff) + %Dryerffbase] - [(Capacity x 1/MEFeff x Ncycles) x (%DHWffeff x reff) + %Dryergaseff]xMMBTUconvert

#### where:

Capacity = washer volume in ft3. Existing top loading washer is 3.09 ft3, new standard efficiency top loading washer is 3.38 ft3, ENERGY STAR front loading is 3.90 ft

IMEF = Integrated Modified Energy Factor and is measured in ft3 /kWh/cycle

Ncycles = 283 loads per year

%CWkwh = % of total kWh energy consumption for clothes washer operation (different for baseline and efficient unit).

%DHWkwh = % of total kWh energy consumption used for water heating (different for baseline and efficient unit). If water is heated by gas or propane this is 0%

%DHWff = % of total kWh energy consumption for dryer operation (different for baseline and efficient unit). If the dryer is gas this is 0%

%Dryerkwh = % of total fossil fuel energy consumption used for water heating (different for baseline and efficient unit). If water is heated by electric this is 0%.

%Dryerff = % of total fossil fuel energy consumption for dryer operation (different for baseline and efficient unit). If the dryer is electric this is 0%.

r\_eff = recovery energy factor used to account for the difference in recovery efficiencies of electric and gas/oil/propane hot water heaters. Electric water heaters are 100% efficient while other water heaters are 75% efficient. The ratio is 1.33 (100%/75%)

MMBTU\_convert = Conversion factor from kWh to MMBTU is 0.003412

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Early Retirement Clothes Washer Propane DHW & Elec Dryer	327.0	0.0900	0.00	0.00	0.00	0.00	1.28

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Propane MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Early Retirement Clothes Washer Propane DHW & Elec Dryer	12	1.00	1.00		1.00	1.00	1.00	0.49	0.52

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Early Retirement Clothes Washer Propane DHW & Elec Dryer	36.44%	29.90%	18.29%	15.36%

Measure Life Source: Washer & Dryer savings references

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# Non-Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Early Retirement Clothes Washer Propane DHW & Elec Dryer	4777.00	0.00	0	0

Water/Sewer Source: Washer & Dryer savings references

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Early Retirement Clothes Washer Propane DHW & Elec Dryer	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$770.00 / measure

Incentive: \$770.00 / measure

# **Heating System Replacement, Oil**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heating Measure Sub Type: Efficient Heating

**Program:** B03a Single Family - Appliance Management

#### **Measure Description**

Replacement of existing oil heating system with a new high efficiency system. Electric savings can be attributed to reduced fan run time and reduced usage of electric space heaters.

## **Baseline Description**

The baseline efficiency case is the existing inefficient heating equipment.

#### **Savings Principle**

The high efficiency case is the new efficient heating equipment.

# Savings Method

Deemed

#### Unit

Installed high-efficiency heating system.

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating System Replacement, Oil	10.0	0.0100	0.00	0.00	0.00	8.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating System Replacement, Oil	18	1.00	1.00		1.00	1.00	1.00	0.34	0.21

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heating System Replacement, Oil	26.00%	31.00%	23.00%	21.00%

Measure Life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for an ENERGY STAR Qualified Gas Residential Furnace.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heating System Replacement, Oil	0.00	0.00	310.82	0

Annual \$ Source: Massachusetts Special and Cross-Cutting Research Area: Low-Income Single-Family Health- and Safety-Related Non-Energy Impacts (NEIs) Study, August 5, 2016. Prepared by: Three3, Inc. and NMR Group

NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating System Replacement, Oil	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$5,500.00 / measure
Incentive: \$5,500.00 / measure

# **Heat Pumps - Oil**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heat Pumps Measure Sub Type: Heat Pump

Electrification

Program: B03a Single Family - Appliance Management

## **Measure Description**

Full displacement of an existing inefficient propane or oil furnace with a high efficiency central ducted heat pump.

## **Baseline Description**

The baseline is an existing inefficient furnace at 77.7% AFUE for a properly functioning unit and 83% AFUE when the customer would have installed a new furnace without program intervention.

## **Savings Principle**

The high efficiency case is a new 4.7 ton 16 SEER/9.5 HSPF ducted central heat pump.

## **Savings Method**

Deemed

#### Unit

Installation of a high efficiency central ducted heat pump

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heat Pumps - Oil	-8,437.0	-3.5300	83.91	0.00	0.00	0.00	0.00

Electric kWh Source: Guidehouse, Energy Optimization Fuel Displacement Impact and Process Study, MA20R24-B-EOEVAL

Electric kW Source: Guidehouse, Energy Optimization Fuel Displacement Impact and Process Study, MA20R24-B-EOEVAL

Gas Heat MMBtu Source: Guidehouse, Energy Optimization Fuel Displacement Impact and Process Study, MA20R24-B-EOEVAL

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heat Pumps - Oil	15	1.00	1.00		1.00	1.00	1.00	-0.02	0.65

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heat Pumps - Oil	44.30%	55.00%	0.40%	0.30%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Note: Consistent with MA TRM
CFwp Note: Consistent with MA TRM

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Heat Pumps - Oil	0.00	0.00	0.04	0.01	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

One-time \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

One-time \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heat Pumps - Oil	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

### **HP Water Heaters**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: Heat Pump Water Measure Sub Type: Heat Pump Water

Heaters Heaters

Program: B03a Single Family - Appliance Management

# **Measure Description**

Installation of a heat pump water heater (HPWH) instead of an electric resistance water heater.

## **Baseline Description**

The baseline efficiency case is a new, standard efficiency electric resistance hot water heater.

#### **Savings Principle**

The high efficiency case is a high efficiency heat pump water heater.

## **Savings Method**

Deemed

## Unit

Per Water Heater

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
HP Water Heaters	814.0	0.1800	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
HP Water Heaters	10	1.00	1.00		1.00	1.00	1.00	0.47	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
HP Water Heaters	39.00%	33.00%	15.00%	13.00%

Measure Life Source: Steven Winter Associates, Inc (2012). Heat Pump Water Heaters Evaluation of Field Installed Performance. Sponsored by National Grid and NSTAR

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
HP Water Heaters	0.00	0.00	4.64	0	

Annual \$ Source: Massachusetts Special and Cross-Cutting Research Area: Low-Income Single-Family Health- and Safety-Related Non-Energy Impacts (NEIs) Study, August 5, 2016. Prepared by: Three3, Inc. and NMR Group

NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
HP Water Heaters	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$1,800.00 / measure

Incentive: \$1,800.00 / measure

# **LED Bulbs**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Interior Measure Sub Type: LED Screw Base

Program: B03a Single Family - Appliance Management

#### **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

## **Baseline Description**

The baseline efficiency case is a combination of an incandescent bulb and halogen bulb.

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED lamp.

## **Savings Method**

Deemed

#### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 1,022.0.

Hours Source: Nexus Market Research, RLW Analytics and GDS Associates (2009). Residential Lighting Markdown Impact Evaluation. Prepared for Markdown and Buydown Program Sponsors in CT, MA, RI, and VT.

Hours Note: The average annual operating hours are 1,022 hours/year for rebated lights and calculated by vendor for home audit applications.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LED Bulbs	18.0	0.0050	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Bulbs	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
LED Bulbs	35.00%	31.00%	19.00%	15.00%	

Measure Life Note: Based on MA EUL assumptions

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
LED Bulbs	0.00	0.00	0	3.00	

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

# Net-to-Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Bulbs	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$8.50 / measure
Incentive: \$8.50 / measure

# **Minisplit Heat Pumps - Electric Resistance**

Sector: Income EligibleFuel: ElectricProgram Type: PrescriptiveMeasure Category: AppliancesMeasure Type: Heat PumpsMeasure Sub Type: Ductless

Program: B03a Single Family - Appliance Management

# **Measure Description**

The purchase and installation of high efficiency mini-split heat pump system to replace an electric resistance heating system.

## **Baseline Description**

The baseline efficiency case for heating is a residential electric resistance heating system.

The baseline efficiency case for cooling is a residential window AC unit with EER 9.8.

#### **Savings Principle**

The high efficiency case is an ENERGY STAR® qualified air-source heat pump.

#### Savings Method

Deemed

## Unit

Installed high-efficiency air-source heat pump system for heating and cooling.

# **Savings Equation**

Heating Gross kWh = Qty\*deltakWh\_heating

Cooling Gross kWh = Qty\*deltakWh\_cooling

Cooling Gross kW = Qty\*deltakW

Where:

Qty = Total number of units.

deltakWh\_heating = Average annual heating kWh reduction per unit.

deltakWh\_cooling = Average annual cooling kWh reduction per unit.

deltakW = Average annual kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Minisplit Heat Pumps - Electric Resistance	6,549.0	2.8300	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI\_2022 Annual PLan Electric H&C Savings Workbook\_06-14-2021

Electric kW Source: RI 2022 Annual PLan Electric H&C Savings Workbook 06-14-2021

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Minisplit Heat Pumps - Electric Resistance	18	1.00	1.00		1.00	1.00	1.00	0.00	0.62

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Minisplit Heat Pumps - Electric Resistance	42.90%	57.10%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Minisplit Heat Pumps - Electric Resistance	0.00	0.00	310.82	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Minisplit Heat Pumps - Electric Resistance	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$16,000.00 / job
Incentive: \$16,000.00 / job

# **Programmable Thermostat, Electric**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

**Program:** B03a Single Family - Appliance Management

#### **Measure Description**

In stall at ion of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a stall according to a sta

pre-set schedule.

## **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

## **Savings Method**

Deemed

#### Unit

Installed programmable thermostat.

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat, Electric	251.7	0.1900	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat, Electric	19	1.00	1.00		1.00	1.00	1.00	0.34	0.21

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat, Electric	25.00%	30.00%	23.00%	22.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat, Electric	0.00	0.00	44.53	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat, Electric	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$150.00 / measure
Incentive: \$150.00 / measure

# **Programmable Thermostat, Gas**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: Controls Measure Sub Type: Thermostat

Program: B03a Single Family - Appliance Management

### **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

## **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

## **Savings Method**

Deemed

#### Unit

Installed programmable thermostat.

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat, Gas	11.2	0.0200	2.07	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Gas Heat MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat, Gas	19	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat, Gas	7.00%	4.00%	47.00%	42.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat, Gas	0.00	0.00	44.53	0

Annual \$ Note: NEI per unit

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat, Gas	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$150.00 / measure
Incentive: \$150.00 / measure

# **Programmable Thermostat, Oil**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: Controls Measure Sub Type: Thermostat

Program: B03a Single Family - Appliance Management

#### **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

## **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

## **Savings Method**

Deemed

#### Unit

Installed programmable thermostat.

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat, Oil	8.7	0.0100	0.00	0.00	0.00	2.07	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat, Oil	19	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat, Oil	7.00%	4.00%	47.00%	42.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat, Oil	0.00	0.00	44.53	0

Annual \$ Note: NEI per unit

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat, Oil	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$150.00 / measure
Incentive: \$150.00 / measure

# **Programmable Thermostat, Other**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: Controls Measure Sub Type: Thermostat

Program: B03a Single Family - Appliance Management

#### Measure Description

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

## **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

## **Savings Method**

Deemed

#### Unit

Installed programmable thermostat.

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat, Other	11.2	0.0200	0.00	0.00	0.00	0.00	2.07

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Propane MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat, Other	19	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat, Other	7.00%	4.00%	47.00%	42.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat, Other	0.00	0.00	44.53	0

Annual \$ Note: NEI per unit

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat, Other	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$150.00 / measure
Incentive: \$150.00 / measure

# **Replacement Freezer**

 Sector: Income Eligible
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Appliances
 Measure Type: Freezers
 Measure Sub Type: Freezer

Program: B03a Single Family - Appliance Management

### **Measure Description**

This measure covers the replacement of an existing inefficient freezer with a new energy efficient model.

## **Baseline Description**

The baseline efficiency case for both the replaced and baseline new freezer is represented by the existing freezer. It is assumed that low-income customers would replace their freezers with a used inefficient unit.

## **Savings Principle**

The high efficiency case is a new high efficiency freezer.

## **Savings Method**

Calculated using deemed inputs

#### Unit

Installed high-efficiency freezer.

# **Savings Equation**

Gross kWh = Qty × (kWh\_base - kWh\_ee)

Gross kW = Qty × (kWh\_base - kWh\_ee) / Hours

Where:

Qty = Total number of units.

kW\_base = Deemed average demand per baseline unit.

kW ee = Deemed average demand per high-efficiency unit.

Hours = Deemed average annual operating hours.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Replacement Freezer	333.0	0.0500	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Replacement Freezer	19	1.00	1.00		1.00	1.00	1.00	0.91	0.68

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Replacement Freezer	29.00%	34.00%	17.00%	21.00%

Measure Life Note: National Grid assumption based on regional PA working groups.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Replacement Freezer	0.00	0.00	1.40	26.61

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Replacement Freezer	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$550.00 / measure

Incentive: \$550.00 / measure

# **Replacement Refrigerator**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Appliances Measure Type: Refrigerators Measure Sub Type: Refrigerator

Program: B03a Single Family - Appliance Management

#### **Measure Description**

This measure covers the replacement of an existing inefficient refrigerator with a new ENERGY STAR® rated refrigerator.

## **Baseline Description**

The baseline efficiency case is the existing refrigerator. It is assumed that low-income customers would otherwise replace their refrigerators with a used inefficient unit.

## **Savings Principle**

The high efficiency case is an ENERGY STAR® rated refrigerator that meets the ENERGY STAR® criteria for full-sized refrigerators (7.75 cubic feet), using at least 20% less energy than models meeting the minimum Federal government standard.

### **Savings Method**

Calculated using deemed inputs

## Unit

Installed high-efficiency refrigerator.

# **Savings Equation**

Gross kWh = Qty × (kWh\_base - kWh\_ee)

Gross kW = Qty × (kWh\_base - kWh\_ee) / Hours

Where:

Qty = Total number of units.

kW\_base = Deemed average demand per baseline unit.

kW\_ee = Deemed average demand per high-efficiency unit.

Hours = Deemed average annual operating hours.

Hours: 8,760.0.

Hours Note: The average annual operating hours are 8760 hours/year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Replacement Refrigerator	467.0	0.0800	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Replacement Refrigerator	19	1.00	1.00		1.00	1.00	1.00	0.79	0.65

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Replacement Refrigerator	29.00%	32.00%	18.00%	21.00%

Measure Life Note: National Grid assumption based on regional PA working groups.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# Non-Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Replacement Refrigerator	0.00	0.00	1.40	26.61

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

One-time \$ Note: NEI per unit

# Net-to-Gross Factors

Measure	FR	Sop	Sonp	NTG
Replacement Refrigerator	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$1,100.00 / measure
Incentive: \$1,100.00 / measure

# **Smart Strips**

Sector: Income EligibleFuel: ElectricProgram Type: PrescriptiveMeasure Category: Plug LoadMeasure Type: Smart StripsMeasure Sub Type: Smart Strip

Program: B03a Single Family - Appliance Management

#### **Measure Description**

The basic measures switches off plug load using current sensors and switching devices which turn off plug load when electrical current drops below threshold low levels. The advanced measure shuts devices off after it no longer senses activity from their infrared controls.

## **Baseline Description**

The baseline efficiency case is the absence power strip and leaving peripheral devices plugged in or using a power surge protector and leaving peripheral devices on.

# **Savings Principle**

The high efficiency case is the use of a smart strip or advanced smart strip.

### **Savings Method**

Calculated using deemed inputs

#### Unit

Rebated smart strip.

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: Since the power strip is assumed to be plugged in all year, the savings are based on 8,760 operational hours per

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Smart Strips	105.0	0.0200	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study-Revised

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Smart Strips	5	0.81	1.00		0.92	0.92	0.92	0.58	0.86

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Smart Strips	32.00%	35.00%	15.00%	18.00%

Measure Life Note: Massachusetts Common Assumption

ISR Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised RRsp Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised RRwp Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Smart Strips	0.00	0.00	0	0	

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Smart Strips	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$20.00 / measure

Incentive: \$20.00 / measure

# **Waterbed Mattress Replacement**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Flow Control

Measures

Program: B03a Single Family - Appliance Management

**Measure Description** 

Replacement of waterbed mattress with a standard mattress.

**Baseline Description** 

The baseline efficiency case is an existing waterbed mattress.

**Savings Principle** 

The high efficiency case is a new standard mattress.

**Savings Method** 

Deemed

Unit

Replacement of existing waterbed mattress with new standard mattress.

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Waterbed Mattress Replacement	872.0	0.1600	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Waterbed Mattress Replacement	10	1.00	1.00		1.00	1.00	1.00	0.58	0.86

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Waterbed Mattress Replacement	32.00%	35.00%	15.00%	18.00%

Measure Life Source: http://www.serta.com/best-mattress-FAQs-mattresses-Serta-Number--1-Best-Selling-Mattress.html ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Waterbed Mattress Replacement	0.00	0.00	0	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Waterbed Mattress Replacement	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$650.00 / measure
Incentive: \$650.00 / measure

# Weatherization, Electric

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Insulation & Air Measure Sub Type: Weatherization

sealing

Program: B03a Single Family - Appliance Management

## **Measure Description**

Installation of weatherization measures such as air sealing and insulation in homes heated with electricity, oil, or propane. Non-heating electric savings are achieved from reduced fan run time for heating and cooling systems.

## **Baseline Description**

The baseline efficiency case is any existing home shell measures.

## **Savings Principle**

The high efficiency case can be a combination of increased insulation, air sealing, duct sealing, and other improvements to the home shell.

### **Savings Method**

Deemed

#### Unit

Completed weatherization project.

# **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross  $kWh = Qty \times deltakWh$ 

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Weatherization, Electric	1,231.0	0.9500	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Weatherization, Electric	20	1.00	1.00		1.00	1.00	1.00	0.34	0.21

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Weatherization, Electric	25.00%	30.00%	23.00%	22.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Weatherization, Electric	0.00	0.00	558.21	0

Annual \$ Source: Massachusetts Special and Cross-Cutting Research Area: Low-Income Single-Family Health- and Safety-Related Non-Energy Impacts (NEIs) Study, August 5, 2016. Prepared by: Three3, Inc. and NMR Group

NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Weatherization, Electric	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$5,500.00 / job
Incentive: \$5,500.00 / job

# Weatherization, Oil

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Insulation & Air Measure Sub Type: Weatherization

sealing

Program: B03a Single Family - Appliance Management

## **Measure Description**

Installation of weatherization measures such as air sealing and insulation in homes heated with electricity, oil, or propane. Non-heating electric savings are achieved from reduced fan run time for heating and cooling systems.

## **Baseline Description**

The baseline efficiency case is any existing home shell measures.

## **Savings Principle**

The high efficiency case can be a combination of increased insulation, air sealing, duct sealing, and other improvements to the home shell.

# **Savings Method**

Deemed

#### Unit

Completed weatherization project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Gross MMBtu\_Oil = Qty × deltaMMBtu\_Oil

Gross MMBtu\_Propane = Qty× deltaMMBtu\_Propane

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu Gas = Average annual natural gas reduction per unit.

deltaMMBtu\_Oil = Average annual oil reduction per unit

deltaMMBtu\_Propane = Average annual propane reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Weatherization, Oil	95.0	0.0700	0.00	0.00	0.00	13.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Weatherization, Oil	20	1.00	1.00		1.00	1.00	1.00	0.34	0.21

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Weatherization, Oil	25.30%	29.90%	23.10%	21.70%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Weatherization, Oil	0.00	0.00	558.21	0

Annual \$ Source: Massachusetts Special and Cross-Cutting Research Area: Low-Income Single-Family Health- and Safety-Related Non-Energy Impacts (NEIs) Study, August 5, 2016. Prepared by: Three3, Inc. and NMR Group

NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Weatherization, Oil	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$5,500.00 / job
Incentive: \$5,500.00 / job

# Window - Electric Resistance

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, electric

resistance

Program: B03a Single Family - Appliance Management

## **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

## **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

## **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

## **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Electric Resistance	254.0	0.1300	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM Electric kW Source: MA 2022 TRM

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Electric Resistance	25	1.00	1.00		1.00	1.00	1.00	0.33	0.43

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Electric Resistance	45.00%	44.00%	6.00%	5.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption

RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Window - Electric Resistance	0.00	0.00	6.72	0	

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Electric Resistance	0.00	0.00	0.00	1.00

NTG Source: MA 2022 TRM

# Window - Heat Pump

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, heat

pump

Program: B03a Single Family - Appliance Management

## **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

## **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

## **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

## **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Heat Pump	127.0	0.0900	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM Electric kW Source: MA 2022 TRM

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Heat Pump	25	1.00	1.00		1.00	1.00	1.00	0.37	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Heat Pump	26.00%	29.00%	24.00%	21.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption

RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Window - Heat Pump	0.00	0.00	6.72	0

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Heat Pump	0.00	0.00	0.00	1.00

NTG Source: MA 2022 TRM

## Window - Oil

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, oil

Program: B03a Single Family - Appliance Management

## **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

## **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

### **Savings Equation**

Gross kWh =  $Qty \times deltakWh$ 

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Oil	7.0	0.0100	1.27	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM
Electric kW Source: MA 2022 TRM
Gas Heat MMBtu Source: MA 2022 TRM

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Oil	25	1.00	1.00	•	1.00	1.00	1.00	0.37	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Oil	49.80%	42.60%	3.60%	4.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption
RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study CFwp Source: Guidehouse, MA Residential Baseline Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Window - Oil	0.00	0.00	6.72	0	

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Oil	0.00	0.00	0.00	1.00

NTG Source: MA 2022 TRM

## Window - Propane

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows,

propane

Program: B03a Single Family - Appliance Management

## **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Propane	7.0	0.0100	1.27	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM
Electric kW Source: MA 2022 TRM
Gas Heat MMBtu Source: MA 2022 TRM

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Propane	25	1.00	1.00		1.00	1.00	1.00	0.37	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Propane	49.80%	42.60%	3.60%	4.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption
RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study CFwp Source: Guidehouse, MA Residential Baseline Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Window - Propane	0.00	0.00	6.72	0

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Propane	0.00	0.00	0.00	1.00

NTG Source: MA 2022 TRM

# **Window AC Replacements**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Cooling Measure Sub Type: Window AC

Program: B03a Single Family - Appliance Management

## **Measure Description**

Replacement of existing inefficient room air conditioners with more efficient models. This is only offered as a measure when an AC timer would not reduce usage during the peak period.

### **Baseline Description**

The baseline efficiency case is the existing air conditioning unit.

#### **Savings Principle**

The high efficiency case is the high efficiency room air conditioning unit.

### **Savings Method**

Deemed

#### Unit

Replacement of existing window AC with high-efficiency window AC.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

Hours Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Hours Note: Calculated for Multifamily applications and not applicable for single family.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window AC Replacements	71.0	0.1100	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window AC Replacements	12	1.00	1.00		1.00	1.00	1.00	0.33	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window AC Replacements	3.00%	2.00%	48.00%	47.00%

Measure Life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR Room Air

Conditioner. Interactive Excel Spreadsheet found at

www.energystar.gov/ia/business/bulk\_purchasing/bpsavings\_calc/CalculatorConsumerRoomAC.xls

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Window AC Replacements	0.00	0.00	49.50	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per unit

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window AC Replacements	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$385.00 / measure

Incentive: \$385.00 / measure

## **AERATOR Elec**

Fuel: Electric Sector: Income Eligible Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: B03b Low Income Retrofit Multifamily

### **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a commercial setting with service water heated by electricity.

## **Baseline Description**

The baseline efficiency case is 2.2 GPM or greater faucet.

### **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less aerator installed.

### **Savings Method**

Deemed

### Unit

Installed faucet aerator.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
AERATOR Elec	38.0	0.0091	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
AERATOR Elec	7	0.90	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
AERATOR Elec	41.50%	31.40%	15.20%	11.90%

ISR Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

RRsp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

RRwp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
AERATOR Elec	359.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

Annual \$ Source: NMR (2018, 2019). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). TXC50 - LIMF Market Rate MF NEI - Phase I.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
AERATOR Elec	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **AERATOR OIL**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: B03b Low Income Retrofit Multifamily

### **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a commercial setting with service water heated by electricity.

## **Baseline Description**

The baseline efficiency case is 2.2 GPM or greater faucet.

### **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less aerator installed.

### **Savings Method**

Deemed

### Unit

Installed faucet aerator.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
AERATOR Oil	0	0	0.00	0.00	0.00	0.20	0.00

Oil MMBtu Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
AERATOR Oil	7	0.90	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
AERATOR Oil	0.00%	0.00%	0.00%	0.00%

Measure Life Note: Massachusetts Common Assumption

ISR Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

 $RRsp\ Source:\ RI-20-RX-IEMFImpact-Impact\ Evaluation\ of\ Income\ Eligible\ Multifamily\ Program$ 

RRwp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
AERATOR Oil	359.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

Annual \$ Source: NMR (2018, 2019). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). TXC50 - LIMF Market Rate MF NEI - Phase I.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
AERATOR Oil	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## AIR SEALING ELEC WITH AC

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Building Shell Measure Type: Air Sealing Measure Sub Type: Electric with AC

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

Thermal shell air leaks are sealed through strategic use and location of air-tight materials.

### **Baseline Description**

The baseline efficiency case is the existing building before the air sealing measure is implemented. The baseline building is characterized by the existing CFM50 measurement (CFM50PRE) for single family homes, or the existing air changes per hour (ACHPRE).

## **Savings Principle**

The high efficiency case is the existing building after the air sealing measure is implemented. The high efficiency building is characterized by the new CFM50 measurement for single family homes (CFM50POST), or the new air changes per hour (ACHPOST) for multi-family facilities, which is measured after the air sealing measure is implemented.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed air sealing project.

### **Savings Equation**

Gross kWh = Stories × SQFT × (CFM/SQFT\_pre - CFM/SQFT\_post) × deltakWh/CFM

Gross kW = Gross kWh × kW/kWh

Where:

Stories = Total stories in the multi-family building

SQFT = Area of building in square feet

CFM/SQFT\_pre = Estimate of pre-retrofit air leakagein CFM/SQFT based on number of stories in the building and air-tightness ratings of the existing roof and floor

CFM/SQFT\_post = Estimate of post-retrofit air leakage in CFM/SQFT based on number of stories in the building and airtightness ratings of theimproved roof and floor

deltakWh/CFM = Average annual kWh reduction per CFM

Gross kWh = Stories × SQFT × (CFM/SQFT\_pre - CFM/SQFT\_post) × deltakWh/CFM

kW/kWh = Average kW reduction per kWh reduction

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
AIR SEALING ELEC WITH AC	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
AIR SEALING ELEC WITH AC	20	1.00	1.00		1.00	1.00	1.00	0.33	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
AIR SEALING ELEC WITH AC	25.40%	30.60%	22.40%	21.60%

Measure Life Source: 'ComEd Effective Useful Life Research Report', May 2018

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
AIR SEALING ELEC WITH AC	0.00	0.00	368.88	0

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
AIR SEALING ELEC WITH AC	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

#### AIR SEALING OIL

 Sector: Income Eligible
 Fuel: Electric
 Program Type: Custom

 Measure Category: Building Shell
 Measure Type: Air Sealing
 Measure Sub Type: Oil

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

Thermal shell air leaks are sealed through strategic use and location of air-tight materials.

### **Baseline Description**

The baseline efficiency case is the existing building before the air sealing measure is implemented. The baseline building is characterized by the existing CFM50 measurement (CFM50PRE) for single family homes, or the existing air changes per hour (ACHPRE).

## **Savings Principle**

The high efficiency case is the existing building after the air sealing measure is implemented. The high efficiency building is characterized by the new CFM50 measurement for single family homes (CFM50POST), or the new air changes per hour (ACHPOST) for multi-family facilities, which is measured after the air sealing measure is implemented.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed air sealing project.

### **Savings Equation**

Gross kWh = Stories × SQFT × (CFM/SQFT\_pre - CFM/SQFT\_post) × deltakWh/CFM

Gross  $kW = Gross kWh \times kW/kWh$ 

Where:

Stories = Total stories in the multi-family building

SQFT = Area of building in square feet

CFM/SQFT\_pre = Estimate of pre-retrofit air leakagein CFM/SQFT based on number of stories in the building and air-tightness ratings of the existing roof and floor

CFM/SQFT\_post = Estimate of post-retrofit air leakage in CFM/SQFT based on number of stories in the building and airtightness ratings of theimproved roof and floor

deltakWh/CFM = Average annual kWh reduction per CFM

Gross kWh = Stories × SQFT × (CFM/SQFT\_pre - CFM/SQFT\_post) × deltakWh/CFM

kW/kWh = Average kW reduction per kWh reduction

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
AIR SEALING OIL	Calc	Calc	0.00	0.00	0.00	Calc	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Oil MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
AIR SEALING OIL	20	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
AIR SEALING OIL	6.59%	3.85%	47.32%	42.24%

Measure Life Source: 'ComEd Effective Useful Life Research Report', May 2018

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
AIR SEALING OIL	0.00	0.00	368.88	0

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
AIR SEALING OIL	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **Common Ext LED Bulbs**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Exterior Measure Sub Type: Common LED

Program: B03b Low Income Retrofit Multifamily

**Measure Description** 

The installation of ENERGY STAR® LED outdoor bulbs.

**Baseline Description** 

The baseline efficiency case is the existing installed bulb.

**Savings Principle** 

The high efficiency case is bulbs that use fewer watts.

**Savings Method** 

Deemed

Unit

Installed bulb

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Ext LED Bulbs	162.0	0.0405	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Ext LED Bulbs	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Ext LED Bulbs	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

SPF Note: Savings persistence is assumed to be 100%.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Ext LED Bulbs	0.00	0.00	17.39	10.83

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Ext LED Bulbs	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **Common Ext LED Fixture**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Common LED

Program: B03b Low Income Retrofit Multifamily

### **Measure Description**

The installation of ENERGY STAR® compact fluorescent (CFL) indoor fixtures. Compact fluorescent fixtures offer comparable luminosity to incandescent fixtures at significantly

less wattage and significantly longer lifetimes. Hardwired fluorescent fixturesoffer comparable luminosity to incandescent fixtures at significantly lower wattage and offer significantly longer lifespan.

## **Baseline Description**

The baseline efficiency case is the existing lighting hours of use.

## **Savings Principle**

The high efficiency case is lights that are using fewer hours, reducing energy.

#### **Savings Method**

Calculated using site-specific inputs

## Unit

Rebated lamp or fixture.

### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY ee = Quantity of efficient fixtures/bulbs installed

Watts pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Note: Multifamily common area hours are site specific

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Ext LED Fixture	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Ext LED Fixture	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Ext LED Fixture	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Ext LED Fixture	0.00	0.00	17.39	11.33

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Ext LED Fixture	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **Common Ext Reflector**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Exterior Measure Sub Type: Common

Reflector

Program: B03b Low Income Retrofit Multifamily

## **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Note: Multifamily common area hours are site specific

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Ext Reflector	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Ext Reflector	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Ext Reflector	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Ext Reflector	0.00	0.00	17.39	10.83

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Ext Reflector	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **Common Int EISA Exempt**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Common EISA

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

#### **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

## **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Rebated lamp or fixture.

### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts pre = Rated watts of pre-retrofit fixtures/bulbs

Watts ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Note: Multifamily common area hours are site specific

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Int EISA Exempt	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Int EISA Exempt	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Int EISA Exempt	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Int EISA Exempt	0.00	0.00	17.39	10.83

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Int EISA Exempt	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **Common Int LED Bulbs**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Common LED

Program: B03b Low Income Retrofit Multifamily

**Measure Description** 

The installation of ENERGY STAR® LED indoor bulbs.

**Baseline Description** 

The baseline efficiency case is the existing installed bulb.

**Savings Principle** 

The high efficiency case is bulbs that use fewer watts.

**Savings Method** 

Deemed

Unit

Installed bulb

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Int LED Bulbs	179.0	0.0448	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Int LED Bulbs	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Int LED Bulbs	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

SPF Note: Savings persistence is assumed to be 100%.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Int LED Bulbs	0.00	0.00	17.39	10.83

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Int LED Bulbs	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

### **Common Int LED Fixture**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Common LED

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

The installation of ENERGY STAR® compact fluorescent (CFL) indoor fixtures. Compact fluorescent fixtures offer comparable luminosity to incandescent fixtures at significantly

less wattage and significantly longer lifetimes. Hardwired fluorescent fixturesoffer comparable luminosity to incandescent fixtures at significantly lower wattage and offer significantly longer lifespan.

### **Baseline Description**

The baseline efficiency case is a blend of incandescent, compact fluorescent, and halogen lamps. For home audit applications, the baseline is the existing fixture.

## **Savings Principle**

The high efficiency case is an ENERGY STAR® qualified compact fluorescent light fixture wired for exclusive use with pin-based CFLs.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Rebated lamp or fixture

#### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts\_pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Note: Multifamily common area hours are site specific

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Int LED Fixture	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Int LED Fixture	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Int LED Fixture	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Int LED Fixture	0.00	0.00	17.39	11.33

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## Net-to-Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Int LED Fixture	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **Common Int Reflector**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Common

Reflector

Program: B03b Low Income Retrofit Multifamily

## **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014

Hours Note: Multifamily common area hours are site specific

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Common Int Reflector	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Int Reflector	1	1.00	1.00	•	1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Common Int Reflector	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Common Int Reflector	0.00	0.00	17.39	10.83

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Common Int Reflector	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

### Custom

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Multi-family Measure Sub Type: Low Income

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

Vendors install a variety of measures at multifamily facilities. Includes custom low income retrofit multifamily measures.

### **Baseline Description**

For retrofit projects, the baseline efficiency case is the same as the existing, or pre-retrofit, case for the custom low income retrofit multifamily measures.

#### **Savings Principle**

The high efficiency scenario is specific to the facility and may include one or more energy efficiency

# **Savings Method**

Calc

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom	Calc	Calc	Calc	Calc	0.00	Calc	Calc

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom	multi	1.00	1.00		0.86	1.00	1.00	0.00	0.43

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Custom	43.13%	56.87%	0.00%	0.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Custom	0.00	0.00	799.24	0

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Dwelling Ext LED Fixture**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Exterior Measure Sub Type: Dwelling LED

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

The installation of ENERGY STAR® compact fluorescent (CFL) indoor fixtures. Compact fluorescent fixtures offer comparable luminosity to incandescent fixtures at significantly

less wattage and significantly longer lifetimes. Hardwired fluorescent fixturesoffer comparable luminosity to incandescent fixtures at significantly lower wattage and offer significantly longer lifespan.

### **Baseline Description**

The baseline efficiency case is a blend of incandescent, compact fluorescent, and halogen lamps. For home audit applications, the baseline is the existing fixture.

## **Savings Principle**

The high efficiency case is an ENERGY STAR® qualified compact fluorescent light fixture wired for exclusive use with pinbased CFLs.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts\_pre = Rated watts of pre-retrofit fixtures/bulbs

Watts ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014

Hours Note: Multifamily dwelling unit hours defined by room type from NMR HOU study.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dwelling Ext LED Fixture	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Ext LED Fixture	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dwelling Ext LED Fixture	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dwelling Ext LED Fixture	0.00	0.00	17.39	11.33

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dwelling Ext LED Fixture	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **Dwelling Ext Reflector**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Exterior Measure Sub Type: Dwelling

Reflector

Program: B03b Low Income Retrofit Multifamily

## **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Rebated lamp or fixture.

#### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Note: Multifamily dwelling unit hours defined by room type from NMR HOU study.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dwelling Ext Reflector	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Ext Reflector	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dwelling Ext Reflector	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Dwelling Ext Reflector	0.00	0.00	17.39	10.83	

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dwelling Ext Reflector	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Dwelling Int EISA Exempt**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Dwelling EISA

Program: B03b Low Income Retrofit Multifamily

### **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

## **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Rebated lamp or fixture.

### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts\_pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014

Hours Note: Multifamily dwelling unit hours defined by room type from NMR HOU study.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dwelling Int EISA Exempt	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int EISA Exempt	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dwelling Int EISA Exempt	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dwelling Int EISA Exempt	0.00	0.00	17.39	10.83

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dwelling Int EISA Exempt	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Dwelling Int LED Bulbs**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Dwelling LED

Program: B03b Low Income Retrofit Multifamily

**Measure Description** 

The installation of ENERGY STAR® LED indoor bulbs.

**Baseline Description** 

The baseline efficiency case is the existing installed bulb.

**Savings Principle** 

The high efficiency case is bulbs that use fewer watts.

**Savings Method** 

Deemed

Unit

Installed bulb

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dwelling Int LED Bulbs	18.0	0.0045	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int LED Bulbs	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dwelling Int LED Bulbs	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

SPF Note: Savings persistence is assumed to be 100%.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study

CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dwelling Int LED Bulbs	0.00	0.00	17.39	10.83

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dwelling Int LED Bulbs	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Dwelling Int LED Fixture**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Dwelling LED

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, CFLs and other bulbs types, as provided by market research or for a home energy audit, the base line is a 65 Watt incandescent.

## **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Rebated lamp or fixture.

### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts\_pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014

Hours Note: Multifamily dwelling unit hours defined by room type from NMR HOU study.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dwelling Int LED Fixture	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int LED Fixture	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dwelling Int LED Fixture	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dwelling Int LED Fixture	0.00	0.00	17.39	11.33

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dwelling Int LED Fixture	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Dwelling Int Reflector**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Dwelling

Reflector

Program: B03b Low Income Retrofit Multifamily

## **Measure Description**

The installation of Light-Emitting Diode (LED) screw-in bulbs and fixtures. LEDs offer comparable luminosity to incandescent bulbs at significantly less wattage and significantly longer lamp lifetimes.

### **Baseline Description**

The baseline efficiency case is blend of incandescent, halogens, CFLs and other bulbs types, as provided by market research or for EISA exempt bulbs and bulbs installed through an home energy audit, the base line is a 65 Watt incandescent.

#### **Savings Principle**

The high efficiency case is and ENERGY STAR® qualified LED fixture.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Rebated lamp or fixture.

### **Savings Equation**

Gross kWh = [(QTY\_pre × Watts\_pre × Hours\_base) - (QTY\_ee × Watts\_ee × Hours\_ee)]/1000 × 52

Gross kW = [(QTY\_pre × Watts\_pre) - (QTY\_ee × Watts\_ee)]/1000

Where:

QTY\_pre = Quantity of pre-retrofit fixtures/bulbs

QTY\_ee = Quantity of efficient fixtures/bulbs installed

Watts pre = Rated watts of pre-retrofit fixtures/bulbs

Watts\_ee = Rated watts of efficient fixtures/bulbs installed

Hours\_pre = Weekly hours of operation for pre-retrofit case lighting fixtures/bulbs

Hours\_ee = Weekly hours of operation for efficient lighting fixtures/bulbs

1000 = Watts per kW

52 = Weeks per year

Hours: N/A.

Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014

Hours Note: Multifamily dwelling unit hours defined by room type from NMR HOU study.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dwelling Int Reflector	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int Reflector	1	1.00	1.00		1.00	1.00	1.00	0.55	0.85

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dwelling Int Reflector	35.11%	30.72%	19.04%	15.12%

Measure Life Note: Based on MA EUL assumptions

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dwelling Int Reflector	0.00	0.00	17.39	10.83

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

One-time \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dwelling Int Reflector	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Heating System Retrofit-Boiler**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heating Measure Sub Type: Retrofit Boiler

Program: B03b Low Income Retrofit Multifamily

**Measure Description** 

The installation of high efficiency heating systems.

**Baseline Description** 

The baseline is the existing heating system.

**Savings Principle** 

The high efficiency case includes replacing heating systems with higher efficiency systems.

**Savings Method** 

Calculated using site-specific inputs

Unit

Heating system

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating System Retrofit-Boiler	0	0	0.00	0.00	0.00	20.40	0.00

Oil MMBtu Source: The Cadmus Group, Inc. (2012). Low Income Single Family Impact Evaluation. Prepared for the Electric and Gas Program Administrators of Massachusetts.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating System Retrofit-Boiler	23	1.00	1.00		0.86	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heating System Retrofit-Boiler	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heating System Retrofit-Boiler	0.00	0.00	799.24	0

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating System Retrofit-Boiler	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Heating System Retrofit-Furnace**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heating Measure Sub Type: Retrofit Furnace

Program: B03b Low Income Retrofit Multifamily

**Measure Description** 

The installation of high efficiency heating systems.

**Baseline Description** 

The baseline is the existing heating system.

**Savings Principle** 

The high efficiency case includes replacing heating systems with higher efficiency systems.

**Savings Method** 

Calculated using site-specific inputs

Unit

Heating system

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating System Retrofit-Furnace	132.0	0.0840	0.00	0.00	0.00	14.30	0.00

Electric kWh Source: The Cadmus Group, Inc. (2012). Low Income Single Family Impact Evaluation. Prepared for the Electric and Gas Program Administrators of Massachusetts.

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Oil MMBtu Source: The Cadmus Group, Inc. (2012). Low Income Single Family Impact Evaluation. Prepared for the Electric and Gas Program Administrators of Massachusetts.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating System Retrofit-Furnace	17	1.00	1.00		0.86	1.00	1.00	0.00	0.45

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heating System Retrofit-Furnace	44.60%	55.40%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heating System Retrofit-Furnace	0.00	0.00	799.24	0

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating System Retrofit-Furnace	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

### **INSULATION ELEC WITH AC**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Building Shell Measure Type: Insulation Measure Sub Type: Electric with AC

Program: B03b Low Income Retrofit Multifamily

### **Measure Description**

Shell insulation upgrades applied in existing facilities including improved insulation in attics, basements and sidewalls.

### **Baseline Description**

The baseline efficiency case is any existing home shell measures.

### **Savings Principle**

The high efficiency case includes increased weatherization insulation levels.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed insulation project.

### **Savings Equation**

Gross kWh =  $SQFT \times deltakWh/SQFT \times (1/R_pre - 1/R_post)$ 

Gross kW = Gross kWh × kW/kWh

Where:

SQFT = Square feet of insulation installed

deltakWh/SQFT = Average annual kWh reduction per SQFT of insulation

R\_pre = R-Value of the existing insulation

R post =R-Value of the new installed insulation

Gross kWh = Stories × SQFT × (CFM/SQFT\_pre - CFM/SQFT\_post) × deltakWh/CFM

kW/kWh = Average annual kW reduction per kWh reduction

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
INSULATION ELEC WITH AC	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
INSULATION ELEC WITH AC	25	1.00	1.00		0.86	1.00	1.00	0.33	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
INSULATION ELEC WITH AC	25.42%	30.57%	22.44%	21.58%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons		Annual \$	One-time \$
INSULATION ELEC WITH AC	0.00	0.00	368.88	0

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
INSULATION ELEC WITH AC	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

### **INSULATION OIL**

Sector: Income EligibleFuel: ElectricProgram Type: CustomMeasure Category: Building ShellMeasure Type: InsulationMeasure Sub Type: Oil

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

Shell insulation upgrades applied in existing facilities including improved insulation in attics, basements and sidewalls.

### **Baseline Description**

The baseline efficiency case is any existing home shell measures.

### **Savings Principle**

The high efficiency case includes increased weatherization insulation levels.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed insulation project.

#### **Savings Equation**

Gross kWh = SQFT × deltakWh/SQFT × (1/R pre - 1/R post)

Gross kW = Gross kWh × kW/kWh

Where:

SQFT = Square feet of insulation installed

deltakWh/SQFT = Average annual kWh reduction per SQFT of insulation

R\_pre = R-Value of the existing insulation

R\_post =R-Value of the new installed insulation

Gross kWh = Stories × SQFT × (CFM/SQFT\_pre - CFM/SQFT\_post) × deltakWh/CFM

kW/kWh = Average annual kW reduction per kWh reduction

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
INSULATION OIL	Calc	Calc	0.00	0.00	0.00	Calc	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Oil MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
INSULATION OIL	25	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
INSULATION OIL	6.59%	3.85%	47.32%	42.24%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
INSULATION OIL	0.00	0.00	368.88	0

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
INSULATION OIL	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# Participant (NEB)

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Participant Measure Type: NEI Measure Sub Type: Low Income

Program: B03b Low Income Retrofit Multifamily

**Measure Description** 

This row identifies a participant for tracking and cost purposes.

**Baseline Description** 

N/A

**Savings Principle** 

N/A

**Savings Method** 

N/A

Unit

N/A

**Savings Equation** 

N/A

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Participant (NEB)	0	0	0.00	0.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Participant (NEB)	11	1.00	1.00		0.86	1.00	1.00	0.58	0.86

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Participant (NEB)	32.24%	34.78%	15.36%	17.62%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

**Non-Energy Impact Factors** 

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Participant (NEB)	0.00	0.00	7.70	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Participant (NEB)	0.00	0.00	0.00	1.00

TRC: \$758.00 / participant

Incentive: \$758.00 / participant

# Pipe Wrap DHW Elec

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Insulation Measure Sub Type: Pipe Insulation

Program: B03b Low Income Retrofit Multifamily

### **Measure Description**

Installation of insulation to reduce water heating energy.

### **Baseline Description**

The baseline case is uninsulated heated water pipes.

### **Savings Principle**

The high efficiency case is the installation of high-efficiency domestic hot water equipment such as low-flow showerheads and faucet aerators.

### **Savings Method**

Deemed

### Unit

Linear Foot

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Wrap DHW Elec	38.0	0.0060	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pipe Wrap DHW Elec	15	0.90	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pipe Wrap DHW Elec	41.52%	31.39%	15.22%	11.88%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

Measure Life Note: Massachusetts Common Assumption

ISR Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

RRsp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program
RRwp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pipe Wrap DHW Elec	0.00	0.00	6.61	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pipe Wrap DHW Elec	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# Pipe Wrap DHW Oil

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Insulation Measure Sub Type: Pipe Insulation

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

Installation of insulation to reduce water heating energy.

### **Baseline Description**

The baseline case is uninsulated heated water pipes.

### **Savings Principle**

The high efficiency case is the installation of high-efficiency domestic hot water equipment such as low-flow showerheads and faucet aerators.

### **Savings Method**

Deemed

### Unit

Linear Foot

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Wrap DHW Oil	0	0	0.00	0.00	0.00	0.15	0.00

Oil MMBtu Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pipe Wrap DHW Oil	15	0.90	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pipe Wrap DHW Oil	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

Measure Life Note: Massachusetts Common Assumption

ISR Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pipe Wrap DHW Oil	0.00	0.00	6.61	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pipe Wrap DHW Oil	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Pipe Wrap Heating Oil**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: HVAC Measure Type: Insulation Measure Sub Type: Pipe Insulation

Program: B03b Low Income Retrofit Multifamily

## **Measure Description**

Installation of insulation to reduce water heating energy.

### **Baseline Description**

The baseline case is uninsulated heated water pipes.

### **Savings Principle**

The high efficiency case is the installation of high-efficiency domestic hot water equipment such as low-flow showerheads and faucet aerators.

# **Savings Method**

Deemed

### Unit

Linear Foot

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Wrap Heating Oil	0	0	0.00	0.00	0.00	0.16	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pipe Wrap Heating Oil	15	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Pipe Wrap Heating Oil	0.00%	0.00%	0.00%	0.00%	

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pipe Wrap Heating Oil	0.00	0.00	6.61	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pipe Wrap Heating Oil	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# Refrigerator

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Appliances Measure Type: Refrigerators Measure Sub Type: Refrigerator

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

This measure covers the replacement of an existing inefficient refrigerator with a new ENERGY STAR® rated refrigerator. ENERGY STAR® qualified refrigerators use at least 20% less energy than non-qualified models.

#### **Baseline Description**

The baseline efficiency case is the existing refrigerator. It is assumed that low-income customers would otherwise replace their refrigerators with a used inefficient unit.

### **Savings Principle**

The high efficiency case is an ENERGY STAR® rated refrigerator that meets the ENERGY STAR® criteria for full-sized refrigerators (7.75 cubic feet), using at least 20% less energy than models meeting the minimum Federal government standard.

## **Savings Method**

Calculated using deemed inputs

#### Unit

Installed high-efficiency refrigerator.

### **Savings Equation**

delta kWh = ((kWhpre-kWhes) x (RUL/EUL)) + (((kWhstd+kWhused)/2 - kWhes) x ((EUL-RUL)/EUL)) x Focc

Where:

kWhpre = Annual kWh consumption of existing equipment. Value is based on metering or AHAM database. The default value is 874 kWh

kWhES = Annual kWhconsumption of new ENERGY STAR qualified refrigerator or freezer. This is from the nameplate on the new unit. The default value is 358 kWh.

STD Average annual consumption of equipment meeting federal standard: Calculated by dividing the kWhES by 0.9 (i.e., the Energy Star units are assumed to be 10% more efficient than the kWhstd units). The default value is

398 kWh

kWhused Average annual consumption of used equipment. Default value is 475 kWh.34

RUL = Remaining Useful life assumed to be 6 years

EUL = Estimated useful life for a new refrigerator is 12 years35

Focc = Occupant adjustment factor used to adjust the energy savings according to the number of occupants in the dwelling unit. See table below. Default is 2.3 occupants per tenant unit

ΔkWh = 330, using the default assumptions

Hours: 8,760.0.

Hours Note: The average annual operating hours are 8760 hours/year.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Refrigerator	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Refrigerator	12	1.00	1.00		1.00	1.00	1.00	0.79	0.65

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Refrigerator	29.00%	31.95%	18.18%	20.87%	

Measure Life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR Qualified Residential Refrigerator.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rates are 100% since savings estimates are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Refrigerator	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Refrigerator	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: LI MF Bundled costs (see Participant listing)

## **SHOWERHEAD Elec**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: B03b Low Income Retrofit Multifamily

## **Measure Description**

Installation of a low flow showerhead with a flow rate of 1.5 GPM or less.

### **Baseline Description**

The baseline efficiency case is a showerhead with a flow of 2.5 gpm. For home audit applications, the baseline is the existing showerhead.

### **Savings Principle**

The high efficiency is a low-flow showerhead with a flow of 1.5 gpm or less.

### **Savings Method**

Deemed

#### Unit

Installed showerhead.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
SHOWERHEAD Elec	246.0	0.0590	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
SHOWERHEAD Elec	15	0.90	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
SHOWERHEAD Elec	41.52%	31.39%	15.22%	11.88%	

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Measure Life Note: National Grid assumption based on regional PA working groups.

ISR Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

 $RRsp\ Source:\ RI-20-RX-IEMFImpact-Impact\ Evaluation\ of\ Income\ Eligible\ Multifamily\ Program$ 

RRwp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
SHOWERHEAD Elec	1786.00	0.00	0.58	0	

Water/Sewer Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
SHOWERHEAD Elec	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **SHOWERHEAD OIL**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: B03b Low Income Retrofit Multifamily

## **Measure Description**

Installation of a low flow showerhead with a flow rate of 1.5 GPM or less.

### **Baseline Description**

The baseline efficiency case is a showerhead with a flow of 2.5 gpm. For home audit applications, the baseline is the existing showerhead.

## **Savings Principle**

The high efficiency is a low-flow showerhead with a flow of 1.5 gpm or less.

## **Savings Method**

Deemed

#### Unit

Installed showerhead.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
SHOWERHEAD Oil	0	0	0.00	0.00	0.00	1.40	0.00

Oil MMBtu Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
SHOWERHEAD Oil	15	0.90	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
SHOWERHEAD Oil	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

Measure Life Note: National Grid assumption based on regional PA working groups.

ISR Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
SHOWERHEAD OIL	1786.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
SHOWERHEAD OIL	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Smart Strips**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Plug Load Measure Type: Smart Strips Measure Sub Type: Smart Strip

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

The basic measures switches off plug load using current sensors and switching devices which turn off plug load when electrical current drops below threshold low levels. The advanced measure shuts devices off after it no longer senses activity from their infrared controls.

### **Baseline Description**

The baseline efficiency case is the absence power strip and leaving peripheral devices plugged in or using a power surge protector and leaving peripheral devices on.

# **Savings Principle**

The high efficiency case is the use of a smart strip or advanced smart strip.

#### Savings Method

Deemed

#### Unit

Rebated smart strip.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: Since the power strip is assumed to be plugged in all year, the savings are based on 8,760 operational hours per year.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Smart Strips	105.0	0.0189	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study-Revised

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Smart Strips	6	0.84	1.00		0.92	0.92	0.92	0.58	0.86

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Smart Strips	32.24%	34.78%	15.36%	17.62%

Measure Life Source: Nexus Market Research and RLW Analytics (2008). Residential Lighting Measure Life Study. Prepared for New England Residential Lighting Program Sponsors.

ISR Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised RRsp Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised RRwp Source: NMR Group, Inc. (2019). Advanced Power Strip Metering Study- Revised

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Smart Strips	0.00	0.00	0	0	

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Smart Strips	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## Standalone WH Oil

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Water Heater

Program: B03b Low Income Retrofit Multifamily

**Measure Description** 

Installation of high efficiency water heating system.

**Baseline Description** 

The baseline is the existing water heating system.

**Savings Principle** 

The high efficiency case includes replacing water heating systems with higher efficiency systems.

**Savings Method** 

Calculated using site-specific inputs

Unit

Water Heating System

**Savings Equation** 

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Standalone WH Oil	Calc	Calc	0.00	0.00	0.00	Calc	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Standalone WH Oil	13	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Standalone WH Oil	0.00%	0.00%	0.00%	0.00%

Measure Life Source: DOE (2008). ENERGY STAR® Residential Water Heaters: Final Criteria Analysis. Prepared for the DOE; Page 10.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Standalone WH Oil	0.00	0.00	1.19	0	

Annual \$ Source: NMR (2018, 2019). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). TXC50 - LIMF Market Rate MF NEI - Phase I.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Standalone WH Oil	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## Standalone WH Other

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Water Heater

Program: B03b Low Income Retrofit Multifamily

**Measure Description** 

Installation of high efficiency water heating system.

**Baseline Description** 

The baseline is the existing water heating system.

**Savings Principle** 

The high efficiency case includes replacing water heating systems with higher efficiency systems.

**Savings Method** 

Calculated using site-specific inputs

Unit

Water Heating System

**Savings Equation** 

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Standalone WH Other	Calc	Calc	0.00	0.00	0.00	Calc	Calc

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Standalone WH Other	13	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Standalone WH Other	0.00%	0.00%	0.00%	0.00%

Measure Life Source: DOE (2008). ENERGY STAR® Residential Water Heaters: Final Criteria Analysis. Prepared for the DOE; Page 10.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Standalone WH Other	0.00	0.00	1.19	0

Annual \$ Source: NMR (2018, 2019). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). TXC50 - LIMF Market Rate MF NEI - Phase I.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Standalone WH Other	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **Tankless WH Oil**

Sector: Income Eligible Fuel: Electric Program Type: Custom

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Water Heater

Program: B03b Low Income Retrofit Multifamily

**Measure Description** 

Installation of high efficiency water heating system.

**Baseline Description** 

The baseline is the existing water heating system.

**Savings Principle** 

The high efficiency case includes replacing water heating systems with higher efficiency systems.

**Savings Method** 

Calculated using site-specific inputs

Unit

Water Heating System

**Savings Equation** 

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Tankless WH Oil	Calc	Calc	0.00	0.00	0.00	Calc	0.00

Electric kWh Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

Electric kW Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Tankless WH Oil	20	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Tankless WH Oil	0.00%	0.00%	0.00%	0.00%

Measure Life Source: DOE (2008). ENERGY STAR® Residential Water Heaters: Final Criteria Analysis. Prepared for the DOE; Page 10.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

CFsp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

CFwp Source: Cadmus Demand Impact Model (2012). Estimated using the demand allocation methodology, Prepared for the Massachusetts Program Administrators.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Tankless WH Oil	0.00	0.00	1.19	0	

Annual \$ Source: NMR (2018, 2019). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). TXC50 - LIMF Market Rate MF NEI - Phase I.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Tankless WH Oil	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **THERMOSTAT AC Only**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

### **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

# **Savings Method**

Deemed

### Unit

Installed thermostat

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
THERMOSTAT AC Only	15.0	0.0110	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
THERMOSTAT AC Only	19	0.95	1.00		1.00	1.00	1.00	0.00	0.43

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
THERMOSTAT AC Only	43.13%	56.87%	0.00%	0.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program
RRsp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program
RRwp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
THERMOSTAT AC Only	0.00	0.00	16.02	0	

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
THERMOSTAT AC Only	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## THERMOSTAT Elec with AC

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

### **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

# **Savings Method**

Deemed

### Unit

Installed thermostat

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
THERMOSTAT Elec with AC	278.0	0.2363	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
THERMOSTAT Elec with AC	19	0.95	1.00		1.00	1.00	1.00	0.33	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
THERMOSTAT Elec with AC	25.42%	30.57%	22.44%	21.58%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program
RRsp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program
RRwp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
THERMOSTAT Elec with AC	0.00	0.00	16.02	0	

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
THERMOSTAT Elec with AC	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **THERMOSTAT Heat Pump**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

### **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

# **Savings Method**

Deemed

### Unit

Installed thermostat

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
THERMOSTAT Heat Pump	278.0	0.2363	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
THERMOSTAT Heat Pump	19	0.95	1.00		1.00	1.00	1.00	0.33	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
THERMOSTAT Heat Pump	25.42%	30.57%	22.44%	21.58%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program
RRsp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program
RRwp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
THERMOSTAT Heat Pump	0.00	0.00	16.02	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
THERMOSTAT Heat Pump	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## THERMOSTAT OIL

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

### **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.

# **Savings Method**

Deemed

### Unit

Installed thermostat

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
THERMOSTAT OIL	29.0	0.0247	0.00	0.00	0.00	1.60	0.00

Electric kWh Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Oil MMBtu Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
THERMOSTAT OIL	19	0.95	1.00		1.00	1.00	1.00	0.33	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
THERMOSTAT OIL	25.42%	30.57%	22.44%	21.58%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program
RRsp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program
RRwp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
THERMOSTAT OIL	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
THERMOSTAT OIL	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## TSV Showerhead Elec

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: B03b Low Income Retrofit Multifamily

### **Measure Description**

A showerhead with a control that limits flow once water is heated.

### **Baseline Description**

The baseline efficiency case is a showerhead with a flow of 2.5 gpm. For home audit applications, the baseline is the existing showerhead.

## **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

### **Savings Method**

Deemed

#### Unit

Installed showerhead.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
TSV Showerhead Elec	315.0	0.0756	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
TSV Showerhead Elec	15	0.90	1.00		1.00	1.00	1.00	0.31	0.81

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
TSV Showerhead Elec	41.52%	31.39%	15.22%	11.88%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

RRsp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

RRwp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
TSV Showerhead Elec	2254.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
TSV Showerhead Elec	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Vending Miser**

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Vending Miser Measure Type: Vending Miser Measure Sub Type: Vending Miser

Program: B03b Low Income Retrofit Multifamily

#### **Measure Description**

Controls significantly reduce the energy consumption of refrigerated beverage vending machine lighting and refrigeration systems by powering down these systems during periods of inactivity while maintaining a refrigerated product. This measure applies torefrigerated beverage vending machines and glass front refrigerated coolers. This measure does not apply to ENERGY STAR® qualified vending machines, as they already have built-in controls.

# **Baseline Description**

The baseline efficiency case is a standard efficiency refrigerated beverage vending machine, or glass front refrigerated cooler without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

### **Savings Principle**

The high efficiency case is a standard efficiency refrigerated beverage vending machine, or glass front refrigerated cooler with a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

#### **Savings Method**

Deemed

#### Unit

Installed vending miser.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: It is assumed that the connected equipment operates 24 hours per day, 7 days per week for a total annual operating hours of 8,760.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Vending Miser	1,612.0	0.0000	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Vending Miser	5	1.00	1.00	•	1.00	1.00	1.00	0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Vending Miser	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program
RRsp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program
RRwp Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Vending Miser	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Vending Miser	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## Window - Electric Resistance

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, electric

resistance

Program: B03b Low Income Retrofit Multifamily

### **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Electric Resistance	254.0	0.1300	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM Electric kW Source: MA 2022 TRM

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Electric Resistance	25	1.00	1.00		1.00	1.00	1.00	0.33	0.43

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Electric Resistance	45.00%	44.00%	6.00%	5.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption

RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Window - Electric Resistance	0.00	0.00	6.72	0	

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Electric Resistance	0.00	0.00	0.00	1.00

NTG Source: MA 2022 TRM

TRC: \$700.00 / measure

Incentive: \$700.00 / measure

# Window - Heat Pump

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, heat

pump

Program: B03b Low Income Retrofit Multifamily

# **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Heat Pump	127.0	0.0900	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM Electric kW Source: MA 2022 TRM

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Heat Pump	25	1.00	1.00		1.00	1.00	1.00	0.37	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Heat Pump	26.00%	29.00%	24.00%	21.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption

RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Window - Heat Pump	0.00	0.00	6.72	0

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Heat Pump	0.00	0.00	0.00	1.00

NTG Source: MA 2022 TRM

TRC: \$700.00 / measure

Incentive: \$700.00 / measure

# Window - Oil

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, oil

Program: B03b Low Income Retrofit Multifamily

## **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

### **Savings Equation**

Gross kWh =  $Qty \times deltakWh$ 

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Oil	7.0	0.0100	1.27	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM
Electric kW Source: MA 2022 TRM
Gas Heat MMBtu Source: MA 2022 TRM

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Oil	25	1.00	1.00		1.00	1.00	1.00	0.37	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Oil	49.80%	42.60%	3.60%	4.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption
RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Window - Oil	0.00	0.00	6.72	0

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Oil	0.00	0.00	0.00	1.00

NTG Source: MA 2022 TRM
TRC: \$700.00 / measure
Incentive: \$700.00 / measure

# Window - Propane

Sector: Income Eligible Fuel: Electric Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows,

propane

Program: B03b Low Income Retrofit Multifamily

# **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Window - Propane	7.0	0.0100	1.27	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM
Electric kW Source: MA 2022 TRM
Gas Heat MMBtu Source: MA 2022 TRM

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Window - Propane	25	1.00	1.00		1.00	1.00	1.00	0.37	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Window - Propane	49.80%	42.60%	3.60%	4.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption
RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study CFwp Source: Guidehouse, MA Residential Baseline Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Window - Propane	0.00	0.00	6.72	0	

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Window - Propane	0.00	0.00	0.00	1.00

NTG Source: MA 2022 TRM
TRC: \$700.00 / measure

# **Participants**

Sector: Income Eligible Fuel: Gas Program Type: Prescriptive

Measure Category: Participant Measure Type: Participant Measure Sub Type: Participant

Program: B03a Low Income Retrofit 1-4

**Measure Description** 

This row identifies a participant for tracking and cost purposes.

**Baseline Description** 

N/A

**Savings Principle** 

N/A

**Savings Method** 

N/A

Unit

N/A

**Savings Equation** 

N/A

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Participants	0	0	0.00	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Participants	5	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Participants	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Participants	0.00	0.00	7.70	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per participant / treated unit

**Net-to-Gross Factors** 

Measure	FR	Sop	Sonp	NTG
Participants	0.00	0.00	0.00	1.00

# **Programmable Thermostat, Gas**

Sector: Income Eligible Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Theromstat

Program: B03a Low Income Retrofit 1-4

## **Measure Description**

Installation of a programmable thermostat which gives the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

### **Baseline Description**

The baseline efficiency case is an HVAC system without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system that has a programmable thermostat installed.

# **Savings Method**

Deemed

### Unit

Installation of programmable thermostat

## **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat, Gas	27.0	0.0400	2.07	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Gas Heat MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat, Gas	19	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat, Gas	7.00%	4.00%	47.00%	42.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Guidehouse, MA Residential Baseline Study CFwp Source: Guidehouse, MA Residential Baseline Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat, Gas	0.00	0.00	44.53	0

Annual \$ Note: NEI per unit

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat, Gas	0.00	0.00	0.00	1.00

# **Triple Pane Windows**

Sector: Income Eligible Fuel: Gas Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, triple

pane

Program: B03a Low Income Retrofit 1-4

## **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

### **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

#### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

### **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

## **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Triple Pane Windows	7.0	0.0100	1.27	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM
Electric kW Source: MA 2022 TRM
Gas Heat MMBtu Source: MA 2022 TRM

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Triple Pane Windows	25	1.00	1.00		1.00	1.00	1.00	0.37	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Triple Pane Windows	4.00%	4.00%	49.50%	43.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption

RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study CFwp Source: Guidehouse, MA Residential Baseline Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Triple Pane Windows	0.00	0.00	6.72	0	

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Triple Pane Windows	0.00	0.00	0.00	1.00

NTG Source: MA 2022 TRM

## Weatherization

Sector: Income Eligible Fuel: Gas Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Insulation & Air Measure Sub Type: Weatherization

sealing

Program: B03a Low Income Retrofit 1-4

### **Measure Description**

Installation of weatherization measures such as air sealing and insulation in gas heated homes. Electric savings are achieved from reduced run time of the HVAC system fan(s).

### **Baseline Description**

The baseline efficiency case is the existing home shell.

#### **Savings Principle**

The high efficiency case can be a combination of increased insulation, air sealing, duct sealing, and other improvements to the home shell.

#### **Savings Method**

Deemed

#### Unit

Household with weatherization measures installed

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Weatherization	93.0	0.0700	12.40	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Gas Heat MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Weatherization	20	1.00	1.00		1.00	1.00	1.00	0.34	0.21

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Weatherization	25.00%	30.00%	23.00%	22.00%

Measure Life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR Qualified Boiler.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## Non-Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Weatherization	0.00	0.00	558.21	0

Annual \$ Source: Massachusetts Special and Cross-Cutting Research Area: Low-Income Single-Family Health- and Safety-Related Non-Energy Impacts (NEIs) Study, August 5, 2016. Prepared by: Three3, Inc. and NMR Group

NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per participant / treated unit

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Weatherization	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$5,500.00 / job

Incentive: \$5,500.00 / job

# Wi-Fi Thermostat, Gas

 Sector: Income Eligible
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Controls
 Measure Sub Type: WiFi T-stat

Program: B03a Low Income Retrofit 1-4

#### **Measure Description**

A communicating thermostat which allows remote set point adjustment and control via remote application. System requires an outdoor air temperature algorithm in the control logic to operate heating and cooling systems Primary Energy Impact: Natural Gas.

# **Baseline Description**

The baseline efficiency case is an HVAC system without a wifi thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system that has a wifi thermostat installed.

### **Savings Method**

Deemed

#### Unit

Installation of WiFi programmable thermostat

#### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Wi-Fi Thermostat, Gas	20.0	0.0300	2.79	0.00	0.00	0.00	0.00

Electric kWh Source: Cadeo/Illume (2020). 2017-2018 Impact Evaluation of EnergyWise Single Family Program

Electric kW Source: Navigant Consulting (2018). Baseline Loadshape Study

Gas Heat MMBtu Source: MA Smart Thermostat Impact Study (RES 24) - Final Results

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Wi-Fi Thermostat, Gas	15	1.00	1.00		1.00	1.00	1.00	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Wi-Fi Thermostat, Gas	7.00%	4.00%	47.00%	42.00%	

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Wi-Fi Thermostat, Gas	0.00	0.00	44.53	0	

# Annual \$ Note: NEI per unit

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Wi-Fi Thermostat, Gas	0.00	0.00	0.00	1.00

# Air Sealing

 Sector: Income Eligible
 Fuel: Gas
 Program Type: Custom

 Measure Category: Building Shell
 Measure Type: Air Sealing
 Measure Sub Type: Air Sealing/Infiltration

**Program:** Low Income Multifamily

## **Measure Description**

Thermal shell air leaks are sealed through strategic use and location of air-tight materials.

#### **Baseline Description**

The baseline efficiency case is the existing building before the air sealing measure is implemented. The baseline building is characterized by the existing CFM50 measurement (CFM50PRE) for single family homes, or the existing air changes per hour (ACHPRE)

## **Savings Principle**

The high efficiency case is the existing building after the air sealing measure is implemented. The high efficiency building is characterized by the new CFM50 measurement for single family homes (CFM50POST), or the new air changes per hour (ACHPOST) for multi-family facilities, which is measured after the air sealing measure is implemented.

#### Savings Method

Calculated using site-specific inputs

#### Unit

Completed air sealing project.

#### **Savings Equation**

Gross MMBtu Gas = (CFM50\_pre - CFM50\_post) / LBL  $\times$  HDD  $\times$  (Hours per Day)  $\times$  (Minutes per Hour)  $\times$  (Btu/ft3-°F)  $\times$  CorrectionFactor / SeasonalEff / (Btu per MMBtu)

# Where:

CFM50\_pre = CFM50 measurement before air sealing

CFM50\_post = CFM50 measurement after air sealing (cu.ft./min)

LBL = LBL factor - This factor is determined as the product of the N-factor and a Height Correction Factor according to BPI Protocol

4644 HDD = Heating degree days (deg. F-day); This value is an average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data. http://www.ncdc.noaa.gov

24 Hours per Day = Conversion factor

60 Minutes per Hour = Conversion factor

0.018 Btu/ft3-°F = Heat capacity of 1 cubic foot of air at 70 °F

1 CorrectionFactor = Correction factor determined by auditor (e.g. for seasonal homes): Default

0.7 SeasonalEff = Heating system seasonal efficiency factor determined by auditor for homes heated with natural gas: Default

1,000,000 Btuper MMBtu = Conversion factor

Hours: 4,644.0.

October 2022

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

Hours Note: Heating hours are characterized by the heating degree days for the facility, 4644.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Air Sealing	0	0.0000	Calc	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Sealing	20	1.00	1.00	1.00	1.00				_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Air Sealing	0.00%	0.00%	0.00%	0.00%

Measure Life Source: 'ComEd Effective Useful Life Research Report', May 2018

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Air Sealing	0.00	0.00	368.88	0

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Air Sealing	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

### Custom

Sector: Income Eligible Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Custom Measure Sub Type: Custom

Program: Low Income Multifamily

## **Measure Description**

Vendors install a variety of measures at multifamily facilities. Includes custom non-lighting measures.

## **Baseline Description**

For retrofit projects, the baseline efficiency case is the same as the existing, or pre-retrofit, case for the custom non-lighting measures.

### **Savings Principle**

The high efficiency scenario is specific to the facility and may include one or more energy efficiency custom non-lighting measures.

## **Savings Method**

Calc

### Unit

Completed custom project

## **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom	0	Calc	Calc	Calc	Calc	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom	15	1.00	1.00	0.99	0.99			Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Custom	0.00%	0.00%	0.00%	0.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Custom	0.00	0.00	799.24	0	

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **Demand Circulator**

Sector: Income Eligible Fuel: Gas Program Type: Custom

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Demand

Circulator

**Program:** Low Income Multifamily

### **Measure Description**

Installation of a demand controller on a re-circulation loop.

### **Baseline Description**

Full time operation of re-circ pump.

### **Savings Principle**

The re-circulation pump is controlled by a demand signal or timer to reduce operating hours when no hot water usage occurs.

### **Savings Method**

Calc

#### Unit

Installed recirculation controller

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Demand Circulator	0	0	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Demand Circulator	15	1.00	1.00	1.00	1.00				_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Demand Circulator	0.00%	0.00%	0.00%	0.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Demand Circulator	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Demand Circulator	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Duct Sealing**

Sector: Income Eligible Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Ducting Measure Sub Type: Duct Sealing

Program: Low Income Multifamily

## **Measure Description**

Ducts are sealed by reconnecting disconnected duct joints and sealing gaps or seams with mastic and fiber-mesh tape as appropriate.

## **Baseline Description**

The baseline efficiency case is the existing facility or equipment prior to the implementation of duct sealing.

#### **Savings Principle**

The baseline efficiency case is the existing facility or equipment after the implementation of duct sealing.

## **Savings Method**

Calc

#### Unit

Installation of duct sealing

## **Savings Equation**

MMBtu = Annualheatingconsumption x %SAVE x (1/1000000)

Where

Annual Heating Consumption = The total annual heating consumption for the facility (Btu)

%SAVE = Average reduction in energy consumption.

1/1,000,000 = Conversion from Btu to MMBtu

Savings Factors for Multifamily Duct Sealing

Measure Type %SAVE158

Savings Factors for Multifamily Duct Sealing

Surface Area < 50 SQFT 7%

Surface Area > 50 SQFT and < 200 SQFT 3%

Surface Area > 200 SQFT 1%

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Duct Sealing	0	0	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Duct Sealing	20	1.00	1.00	1.00	1.00				_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Duct Sealing	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Duct Sealing	0.00	0.00	1.04	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Duct Sealing	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **Faucet Aerator**

Sector: Income Eligible Fuel: Gas Program Type: Custom

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: Low Income Multifamily

#### **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow.

## **Baseline Description**

The baseline efficiency case is an existing faucet with a high flow.

## **Savings Principle**

The high efficiency is a low-flow faucet aerator.

## **Savings Method**

Deemed

#### Unit

Installed faucet aerator.

## **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Faucet Aerator	0	0	0.00	0.20	0.00	0.00	0.00

Gas DHW MMBtu Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Faucet Aerator	7	0.90	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Faucet Aerator	0.00%	0.00%	0.00%	0.00%

Measure Life Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

ISR Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Faucet Aerator	359.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Faucet Aerator	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Heating System Retrofit, Boiler**

Sector: Income Eligible Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Heating System Measure Sub Type: Retrofit Boiler

Program: Low Income Multifamily

#### **Measure Description**

Installation of high efficiency heating equipment to replace the existing inefficient furnace, hydronic boiler or steam boiler.

## **Baseline Description**

The baseline efficiency is determined based on the type of heating equipment installed. For boilers it is 75% AFUE and for furnaces it is 78% AFUE..

#### **Savings Principle**

The high efficiency case is characterized by the rated efficiency (AFUEEE) of the new high efficiency furnace or boiler.

## **Savings Method**

Calc

## Unit

Heating system

#### **Savings Equation**

Delta MMBtu = (Btu/hr) x ((1/AFUEbase)-(1/AFUEee)) X EFLHheat x (1/1000000)

Where

Btu/hr = Nominal heating capacity of the installed equipment (Btu/hr)

AFUEBASE = Average fuel utilization efficiency of the existing equipment (%)

AFUEEE = Average fuel utilization efficiency of the efficient equipment (%)

EFLHHeat = Equivalent full load heating hours for the facility (Hr)

1/1,000,000 = Conversion from Btu to MMBtu

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating System Retrofit, Boiler	0	0	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating System Retrofit, Boiler	23	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heating System Retrofit, Boiler	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heating System Retrofit, Boiler	0.00	0.00	799.24	0

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating System Retrofit, Boiler	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Heating System Retrofit, Commercial Boiler**

Sector: Income Eligible Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Heating System Measure Sub Type: Retrofit Boiler

Program: Low Income Multifamily

#### **Measure Description**

Installation of high efficiency heating equipment to replace the existing inefficient furnace, hydronic boiler or steam boiler.

## **Baseline Description**

The baseline efficiency is determined based on the type of heating equipment installed. For boilers it is 75% AFUE and for furnaces it is 78% AFUE.

#### **Savings Principle**

The high efficiency case is characterized by the rated efficiency (AFUEEE) of the new high efficiency furnace or boiler.

## **Savings Method**

Calc

## Unit

Heating system

## **Savings Equation**

Delta MMBtu = (Btu/hr) x ((1/AFUEbase)-(1/AFUEee)) X EFLHheat x (1/1000000)

Where

Btu/hr = Nominal heating capacity of the installed equipment (Btu/hr)

AFUEBASE = Average fuel utilization efficiency of the existing equipment (%)

AFUEEE = Average fuel utilization efficiency of the efficient equipment (%)

EFLHHeat = Equivalent full load heating hours for the facility (Hr)

1/1,000,000 = Conversion from Btu to MMBtu

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating System Retrofit, Commercial Boiler	0	0	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating System Retrofit, Commercial Boiler	25	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heating System Retrofit, Commercial Boiler	0.00%	0.00%	0.00%	0.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heating System Retrofit, Commercial Boiler	0.00	0.00	799.24	0

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating System Retrofit, Commercial Boiler	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Heating System Retrofit, Furnace**

Sector: Income Eligible Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Heating System Measure Sub Type: Retrofit Furnace

Program: Low Income Multifamily

#### **Measure Description**

Installation of high efficiency heating equipment to replace the existing inefficient furnace, hydronic boiler or steam boiler.

## **Baseline Description**

The baseline efficiency is determined based on the type of heating equipment installed. For boilers it is 75% AFUE and for furnaces it is 78% AFUE.

#### **Savings Principle**

The high efficiency case is characterized by the rated efficiency (AFUEEE) of the new high efficiency furnace or boiler.

## **Savings Method**

Calc

#### Unit

Installation of new high efficiency furnace or boiler.

#### **Savings Equation**

Delta MMBtu = (Btu/hr) x ((1/AFUEbase)-(1/AFUEee)) X EFLHheat x (1/1000000)

Where:

Btu/hr = Nominal heating capacity of the installed equipment (Btu/hr)

AFUEBASE = Average fuel utilization efficiency of the existing equipment (%)

AFUEEE = Average fuel utilization efficiency of the efficient equipment (%)

EFLHHeat = Equivalent full load heating hours for the facility (Hr)

1/1,000,000 = Conversion from Btu to MMBtu

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heating System Retrofit, Furnace	0	0	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating System Retrofit, Furnace	17	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heating System Retrofit, Furnace	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heating System Retrofit, Furnace	0.00	0.00	799.24	0

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heating System Retrofit, Furnace	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## Low-Flow Showerhead

Sector: Income Eligible Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

**Program:** Low Income Multifamily

## **Measure Description**

Installation of a low flow showerhead with a flow rate of 1.5 GPM or less.

## **Baseline Description**

The baseline efficiency case is a showerhead with a flow of 2.5 gpm. For home audit applications, the baseline is the existing showerhead.

## **Savings Principle**

The high efficiency is a low-flow showerhead with a flow of 1.5 gpm or less.

## **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

#### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow Showerhead	0	0	0.00	1.30	0.00	0.00	0.00

Gas DHW MMBtu Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow Showerhead	15	0.90	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Flow Showerhead	0.00%	0.00%	0.00%	0.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Low-Flow Showerhead	1786.00	0.00	0.58	0	

Water/Sewer Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# Low-Flow Showerhead with Thermo Control (Ladybug gas DHW)

Sector: Income Eligible Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

**Program:** Low Income Multifamily

## **Measure Description**

A showerhead with a control that limits flow once water is heated.

## **Baseline Description**

The baseline case is a showerhead with a flow of 2.5 gallons per minute, or for the case of the adapter, a low flow showerhead with flow of 1.5 gpm or less.

## **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

## **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

## **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow Showerhead with Thermo Control (Ladybug gas DHW)	0	0	0.00	0.34	0.00	0.00	0.00

Gas DHW MMBtu Source: National Grid (2014). Review of ShowerStart evolve.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow Showerhead with Thermo Control (Ladybug gas DHW)	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Flow Showerhead with Thermo Control (Ladybug gas DHW)	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low-Flow Showerhead with Thermo Control (Ladybug gas DHW)	558.00	0.00	0	0

Water/Sewer Source: National Grid (2014). Review of ShowerStart evolve.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead with Thermo Control (Ladybug gas DHW)	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# Low-Flow Showerhead with Thermo Control (Roadrunner Gas DHW)

Sector: Income Eligible Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

**Program:** Low Income Multifamily

## **Measure Description**

A showerhead with a control that limits flow once water is heated.

## **Baseline Description**

The baseline case is a showerhead with a flow of 2.5 gallons per minute, or for the case of the adapter, a low flow showerhead with flow of 1.5 gpm or less.

## **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

## **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

## **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	0	0	0.00	1.60	0.00	0.00	0.00

Gas DHW MMBtu Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	15	0.90	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low-Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	2254.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Participant**

Sector: Income Eligible Fuel: Gas Program Type: Prescriptive

Measure Category: Participant Measure Type: Participant Measure Sub Type: Participant

Program: Low Income Multifamily

**Measure Description** 

This row identifies a participant for tracking and cost purposes.

**Baseline Description** 

**Savings Principle** 

**Savings Method** 

Unit

Per participant

Savings Equation

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Participant	0	0	0.00	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Participant	1	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Participant	0.00%	0.00%	0.00%	0.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Participant	0.00	0.00	7.70	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Participant	0.00	0.00	0.00	1.00

TRC: \$707.00 / participant

Incentive: \$707.00 / participant

# **Pipe Wrap (Water Heating)**

Sector: Income Eligible Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Insulation Measure Sub Type: Pipe Insulation

Program: Low Income Multifamily

**Measure Description** 

Installation of DHW pipe wraps.

**Baseline Description** 

The baseline efficiency case is the existing hot water equipment.

**Savings Principle** 

The high efficiency case includes pipe wrap.

**Savings Method** 

Deemed

Unit

Installation of a DHW pipe wrap

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# **Measure Gross Savings per Unit**

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Wrap (Water Heating)	0	0	0.00	0.15	0.00	0.00	0.00

Gas DHW MMBtu Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Gas DHW MMBtu Note: 3 feet per piece

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pipe Wrap (Water Heating)	15	0.90	1.00	1.00	1.00				_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pipe Wrap (Water Heating)	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

 $ISR\ Note:\ All\ installations\ have\ 100\%\ in-service\ rate\ since\ programs\ include\ verification\ of\ equipment\ installations.$ 

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pipe Wrap (Water Heating)	0.00	0.00	6.61	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pipe Wrap (Water Heating)	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Programmable Thermostat**

Sector: Income Eligible Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: Low Income Multifamily

#### **Measure Description**

Installation of a programmable thermostat which gives the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

## **Baseline Description**

For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating without a programmable thermostat. For the installation of a wi-fi programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating with a programmable thermostat.

## **Savings Principle**

The high efficiency case is an HVAC system that has a programmable thermostat or wi-fi programmable thermostat installed.

#### Savings Method

Deemed

#### Unit

Installation of programmable thermostat

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat	29.0	0.0461	1.50	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Gas Heat MMBtu Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat	19	0.95	1.00	1.00	1.00		•	0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat	6.59%	3.85%	47.32%	42.24%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat	0.00	0.00	13.35	0

Annual \$ Source: NMR (2018, 2019). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). TXC50 - LIMF Market Rate MF NEI - Phase I.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

## **Shell Insulation**

 Sector: Income Eligible
 Fuel: Gas
 Program Type: Custom

 Measure Category: Building Shell
 Measure Type: Insulation
 Measure Sub Type: Shell

Program: Low Income Multifamily

#### **Measure Description**

Insulation upgrades are applied in existing multifamily facilities.

## **Baseline Description**

The baseline efficiency case is characterized by the total R-value of the existing attic, basement or sidewall (Rexisit). This is calculated as the R-value of the existing insulation, estimated by the program contractor, plus the R-value of the ceiling, floor, or wall (for all projects: RCEILING = 3.36; RFLOOR = 6.16; RWALL = 6.65)

## **Savings Principle**

The high efficiency case is characterized by the total R-value of the attic after the installation of additional attic, basement or sidewall insulation. This is calculated as the sum of the existing R-value (RBASE) plus the R-value of the added insulation(RADD).

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed insulation project.

#### **Savings Equation**

MMBTUannual = (((1/Rexist)-(1/Rnew)) x HDD x 24 x Area) / (1,000,000) X Nheat

kWhannual = MMBtuannaul x 293.1

kW = kWhannual x kW/kWh heating

Where:

Rexist = Existing effective R-value (R-ExistingInsulation + R-Assembly), ft2-°F/Btuh

Rnew = New total effective R-value (R-ProposedMeasure + R-ExistingInsulation + R-Assembly), ft2-°F/Btuh

Area = Square footage of insulated area

ηheat = Efficiency of the heating system (AFUE or COP)

293.1 = Conversion constant (1MMBtu = 293.1 kWh)

24 = Conversion for hours per day

HDD = Heating Degree Days; dependent on location, see table below

1,000,000 = Conversion from Btu to MMBtu

kW/kWh heating = Average annual kW reduction per kWh reduction: 0.00050 kW/kWh

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

Hours Note: Heating hours are characterized by the heating degree days for the facility, 4644.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Shell Insulation	0	0.0000	Calc	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Shell Insulation	25	1.00	1.00	1.00	1.00			0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Shell Insulation	6.59%	3.85%	47.32%	42.24%

Measure Life Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Shell Insulation	0.00	0.00	368.88	0

Annual \$ Source: NMR Group, Inc (2021). TXC50 Low Income Multifamily NEI Study

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Shell Insulation	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# **Triple Pane Windows**

Sector: Income Eligible Fuel: Gas Program Type: Prescriptive

Measure Category: Building Shell Measure Type: Windows Measure Sub Type: Windows, triple

pane

**Program:** Low Income Multifamily

## **Measure Description**

Early replacement of a single pane window either with or without a storm with a triple pane window.

## **Baseline Description**

The baseline efficiency case is a single pane window with or without a storm.

#### **Savings Principle**

The high efficiency case is an Energy Star qualified triple pane window.

## **Savings Method**

Deemed

#### Unit

Replacement of window with single pane either with or without a storm with a triple pane window.

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Triple Pane Windows	7.0	0.0100	1.27	0.00	0.00	0.00	0.00

Electric kWh Source: MA 2022 TRM
Electric kW Source: MA 2022 TRM
Gas Heat MMBtu Source: MA 2022 TRM

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Triple Pane Windows	25	1.00	1.00		1.00	1.00	1.00	0.37	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Triple Pane Windows	4.00%	4.00%	49.50%	43.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Massachusetts Common Assumption

RRwp Note: Massachusetts Common Assumption

CFsp Source: Guidehouse, MA Residential Baseline Study CFwp Source: Guidehouse, MA Residential Baseline Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Triple Pane Windows	0.00	0.00	6.72	0	

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Triple Pane Windows	0.00	0.00	0.00	1.00

NTG Source: MA 2022 TRM

# Wi-Fi Thermostat (Controls Gas Heat Only)

Sector: Income Eligible Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: Low Income Multifamily

#### **Measure Description**

A communicating thermostat which allows remote set point adjustment and control via remote application. System requires an outdoor air temperature algorithm in the control logic to operate heating and cooling systems Primary Energy Impact: Natural Gas.

# **Baseline Description**

The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.

#### Savings Principle

The high efficiency case is an HVAC system that has a Wi-Fi thermostat installed.

## **Savings Method**

Deemed

#### Unit

Installation of WiFi programmable thermostat

#### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Wi-Fi Thermostat (Controls Gas Heat Only)	31.0	0.0493	2.30	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

Electric kW Source: RI-20-RX-IEMFImpact - Impact Evaluation of Income Eligible Multifamily Program

Gas Heat MMBtu Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Wi-Fi Thermostat (Controls Gas Heat Only)	15	0.95	1.00	1.00	1.00			0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Wi-Fi Thermostat (Controls Gas Heat Only)	6.59%	3.85%	47.32%	42.24%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Source: RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Wi-Fi Thermostat (Controls Gas Heat Only)	0.00	0.00	13.35	0

Annual \$ Source: NMR (2018, 2019). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). TXC50 - LIMF Market Rate MF NEI - Phase I.

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Wi-Fi Thermostat (Controls Gas Heat Only)	0.00	0.00	0.00	1.00

TRC: LI MF Bundled costs (see Participant listing)

# Commerical and Industrial

## **Advanced Building**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Advanced Building Measure Sub Type: Advanced

**Building** 

Program: C02a Design 2000plus

## **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### **Savings Method**

Custom

#### Unit

Installed custom energy-efficiency project.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW sp custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Advanced Building	Calc	Calc	Calc	0.00	0.00	Calc	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Advanced Building	multi	1.00	1.00		0.47	0.49	0.25		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Advanced Building	31.30%	35.40%	15.60%	17.70%	

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI C&I Impact Evaluation of 2013-2015 Custom CDA RRsp Source: RI C&I Impact Evaluation of 2013-2015 Custom CDA RRwp Source: RI C&I Impact Evaluation of 2013-2015 Custom CDA

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Advanced Building	Calc	Calc	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Advanced Building	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.69 / Gross kWh

Incentive: \$0.45 / Gross kWh

## Air Cooled AC

 Sector: C&I
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: AC
 Measure Sub Type: Air cooled

Program: C02a Design 2000plus

#### **Measure Description**

This measure applies to the installation of high-efficiency single package or split system air source, water source, ground source (closed loop) and groundwater source (open loop) heat pump systems for space conditioning applications.

## **Baseline Description**

Appendix A details the specific efficiency requirements by equipment type.

#### **Savings Principle**

The high efficiency case assumes the HVAC equipment exceeds the requirements of the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed unitary AC system for space cooling.

#### **Savings Equation**

Gross kWh = Tons × (kBtu/hr per ton) × (1/SEER base - 1/SEER ee) × Hours C

Gross kW = Tons × (kBtu/hr per ton) × (1/EER\_base - 1/EER\_ee)

#### Where:

Tons = Rated cooling capacity of the installed equipment: site-specific.

12 kBtu/hr per ton = Conversion factor

SEER\_base = Seasonal Energy Efficiency Ratio of the baseline equipment: code

SEER\_ee = Seasonal energy efficiency ratio of the high-efficiency unit: site-specific.

Hours C = Equivalent full load cooling hours

EER\_ee = Energy Efficiency Ratio of the new efficient equipment: site-specific. For equipment < 5.4 tons, assume the following conversion: EER≈SEER/1.1

EER\_base = Energy Efficiency Ratio of baseline equipment: code. Since IECC 2012 does not provide EER requirements for equipment < 5.4 tons, assume the following conversion: EER ≈ SEER/1.1

#### Hours: N/A.

Hours Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

Hours Note: If site-specific data is unavailable, the average cooling EFLHs are taken as 855 hours while the average heating EFLHs are taken as 1137 hours.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Air Cooled AC	Calc	Calc	0.00	0.00	0.00	0.00	0.00

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Cooled AC	20	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Air Cooled AC	11.30%	10.80%	39.40%	38.50%	

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

RRsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

RRwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Air Cooled AC	0.00	0.00	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Air Cooled AC	0.47	0.00	0.00	0.53

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

# **Building Shell**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: BLD SHELL Measure Sub Type: BLD SHELL

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

## **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom energy-efficiency project.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Building Shell	Calc	Calc	Calc	0.00	0.00	Calc	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Building Shell	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Building Shell	0.00%	0.00%	50.00%	50.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Building Shell	Calc	Calc	0.04	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Building Shell	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.77 / Gross kWh

Incentive: \$0.50 / Gross kWh

# **CAIR Nozzle**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Compressed Air Measure Type: CAIR Nozzle Measure Sub Type: CAIR Nozzle

Program: C02a Design 2000plus

**Measure Description** 

The installation of an efficient CAIR nozzle.

**Baseline Description** 

The baseline efficiency case is the installation of a standard CAIR nozzle.

**Savings Principle** 

The high efficiency case is the installation of an efficient CAIR nozzle.

**Savings Method** 

Calculated using site-specific inputs

Unit

Installed CAIR nozzle.

**Savings Equation** 

Gross kWh = CFM\_pipe × deltaCFM/CFM\_pipe × deltakW/CFM × Hours

Gross kW = CFM\_pipe × deltaCFM/CFM\_pipe × deltakW/CFM

Where:

CFM\_pipe = CFM capacity of piping: site-specific

0.049 deltaCFM/CFM\_pipe = Average CFM saved per CFM of piping capacity

0.24386 deltakW/CFM = Average demand savings per CFM; Based on regional analysis assuming a typical timed drain settings discharge scenario.

Hours = Annual operating hours of the zero loss condensate drain: site-specific

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW Gas Other MMBtu		Oil MMBtu	Propane MMBtu
CAIR Nozzle	Calc	Calc	0.00	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CAIR Nozzle	15	1.00	1.00		1.00	1.00	1.00	0.80	0.54

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
CAIR Nozzle	24.50%	25.80%	24.50%	25.10%	

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

RRsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

RRwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
CAIR Nozzle	0.00	0.00	0.04	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CAIR Nozzle	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

# Chiller

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: CHILLER Measure Sub Type: CHILLER

Program: C02a Design 2000plus

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

## **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Chiller	Calc	Calc	0.00	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Chiller	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Chiller	11.30%	10.80%	39.40%	38.50%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Chiller	Calc	Calc	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Chiller	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.81 / Gross kWh

Incentive: \$0.53 / Gross kWh

### **CHP**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: CHP
 Measure Sub Type: CHP

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

## **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
СНР	Calc	Calc	0.00	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
СНР	multi	1.00	1.00		1.00	1.00	1.00		_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
CHP	0.00%	0.00%	50.00%	50.00%

 $Measure\ Life\ Source: Energy\ \&\ Resource\ Solutions\ (2005).\ Measure\ Life\ Study.\ Prepared\ for\ The\ Massachusetts\ Joint\ Utilities.$ 

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
СНР	Calc	Calc	-0.01	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
СНР	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **CODES AND STANDARDS**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Codes and Measure Type: Codes and Standards Measure Sub Type: Codes and

Standards Standards

Program: C02a Design 2000plus

# **Measure Description**

Energy efficiency code trainings and advocacy work to improve energy efficiency of buildings and equipment within Rhode Island.

## **Baseline Description**

Un-influenced adoption curve of federal minimum codes and standards.

#### **Savings Principle**

Accelerated adoption of advancing energy codes and equipment standards.

## **Savings Method**

Calculated based on attribution study

#### Unit

Adoption of advancing energy codes and equipment standards.

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
CODES AND STANDARDS	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: NMR - Rhode Island Code Compliance Enhancement Initiative Attribution and Savings Study

Gas Heat MMBtu Source: NMR - Rhode Island Code Compliance Enhancement Initiative Attribution and Savings Study

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CODES AND STANDARDS	20	1.00	1.00		1.00	0.91	0.76		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
CODES AND STANDARDS	37.11%	29.56%	18.55%	14.78%

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRsp Note: Realization rate is assumed 100% because energy savings are custom calculated.

RRwp Note: Realization rate is assumed 100% because energy savings are custom calculated.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
CODES AND STANDARDS	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CODES AND STANDARDS	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

# **Commercial Electric Combination Oven**

 Sector: C&I
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Oven

Program: C02a Design 2000plus

#### **Measure Description**

Installation of a qualified ENERGY STAR® commercial oven. ENERGY STAR® commercial ovens save energy during preheat, cooking and idle times due to improved cooking efficiency, and preheat and idle energy rates.

#### **Baseline Description**

The baseline efficiency case for a combination oven is a commercial combination oven with a cooking energy efficiency of 65% with a production capacity of 100 pounds per hour for oven mode and 40% steam cooking energy efficiency, with a production capacity of 150 pounds per hour for steam mode. Idle energy is assumed to be 3.7 kW for oven mode and 12.5 kW for steam mode.

## **Savings Principle**

The high efficiency case for a combination oven is a commercial combination oven with a cooking energy efficiency of 70% with a production capacity of 125 pounds per hour for oven mode, and 70% cooking energy efficiency with a production capacity of 200 pounds per hour for steam mode, and idle energy rate of 2.5 kW for convection mode and 6.0 kW for steam mode.

# **Savings Method**

Deemed

#### Unit

Installed high-efficiency commercial electric oven.

### **Savings Equation**

Gross kWh = Qty  $\times$  deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Commercial Electric Combination Oven	15,095.0	3.5000	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

## **Energy Impact Factors**

October 2022

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Commercial Electric Combination Oven	12	1.00	1.00		1.00	1.00	1.00	0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Commercial Electric Combination Oven	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Pacific Gas & Electric Company – Customer Energy Efficiency Department (2007). Work Paper PGECOFST101, Commercial Convection Oven, Revision #0.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

RRsp Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

RRwp Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

CFsp Source: P72 Prescriptive C&I Loadshapes of Savings

CFsp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

CFwp Source: P72 Prescriptive C&I Loadshapes of SavingsCFwp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Commercial Electric Combination Oven	0.00	0.00	0.23	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Commercial Electric Combination Oven	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.28 / Gross kWh

Incentive: \$0.18 / Gross kWh

# **Commercial Electric Convection Oven**

 Sector: C&I
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Oven

Program: C02a Design 2000plus

# **Measure Description**

Installation of a qualified ENERGY STAR® commercial oven. ENERGY STAR® commercial ovens save energy during preheat, cooking and idle times due to improved cooking efficiency, and preheat and idle energy rates.

## **Baseline Description**

The baseline efficiency case is a convection oven with a cooking energy efficiency of 65%, production capacity of 90 pounds per hour, and idle energy rate of 2.0 kW.

## **Savings Principle**

The high efficiency case is a convection oven with a cooking energy efficiency of 74%, production capacity of 85 pounds per hour, and idle energy rate of 1.4 kW.

### **Savings Method**

Deemed

#### Unit

Installed high-efficiency commercial electric oven.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Commercial Electric Convection Oven	2,787.0	0.7000	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Commercial Electric Convection Oven	12	1.00	1.00		1.00	1.00	1.00	0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Commercial Electric Convection Oven	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Pacific Gas & Electric Company – Customer Energy Efficiency Department (2007). Work Paper PGECOFST101, Commercial Convection Oven, Revision #0.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

RRsp Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

RRwp Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

CFsp Source: P72 Prescriptive C&I Loadshapes of Savings

CFsp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

CFwp Source: P72 Prescriptive C&I Loadshapes of SavingsCFwp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Commercial Electric Convection Oven	0.00	0.00	0.23	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Commercial Electric Convection Oven	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.28 / Gross kWh

Incentive: \$0.18 / Gross kWh

# **Commercial Electric Fryer - Large**

 Sector: C&I
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Fryer

Program: C02a Design 2000plus

## **Measure Description**

Installation of a qualified ENERGY STAR® commercial fryer, which saves energy during preheating, cooking, and idling.

## **Baseline Description**

The baseline efficiency case is a deep-fat fryer with a cooking efficiency of 70%, a shortening capacity of up to 100 pounds, and an idle energy rate of 1.35 kW.

# **Savings Principle**

The high efficiency case is a deep-fat fryer with a cooking energy efficiency of 85%, a shortening capacity of over 70 pounds, and an idle energy rate of 1.10 kW.

## **Savings Method**

Deemed

#### Unit

Installed high-efficiency electric fryer.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 3,756.0.

Hours Note: Fryers are assumed to operate 313 days per year, or 6 days per week, based on a MA common assumption.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Commercial Electric Fryer - Large	2,841.0	0.5000	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Commercial Electric Fryer - Large	12	1.00	1.00	•	1.00	1.00	1.00	0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Commercial Electric Fryer - Large	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Pacific Gas & Electric Company – Customer Energy Efficiency Department (2007). Work Paper PGECOFST101, Commercial Convection Oven, Revision #0.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: All PAs use 100% savings persistence factors.

RRe Note: Realization rate is assumed to be 100%.

RRsp Note: Realization rate is assumed to be 100%.

RRwp Note: Realization rate is assumed to be 100%.

CFsp Source: P72 Prescriptive C&I Loadshapes of Savings

CFsp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

CFwp Source: P72 Prescriptive C&I Loadshapes of SavingsCFwp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Commercial Electric Fryer - Large	0.00	0.00	0.23	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Commercial Electric Fryer - Large	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.14 / Gross kWh

Incentive: \$0.09 / Gross kWh

# **Commercial Electric Fryer - Standard**

 Sector: C&I
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Fryer

Program: C02a Design 2000plus

#### **Measure Description**

Installation of a qualified ENERGY STAR® commercial fryer, which saves energy during preheating, cooking, and idling.

## **Baseline Description**

The baseline efficiency case is a deep-fat fryer with a cooking efficiency of 75%, a shortening capacity of up to 65 pounds, and an idle energy rate of 1.20 kW.

## **Savings Principle**

The high efficiency case is a deep-fat fryer with a cooking energy efficiency of 85%, a shortening capacity of up to 70 pounds, and an idle energy rate of 0.86 kW.

## **Savings Method**

Deemed

#### Unit

Installed high-efficiency electric fryer.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 3,756.0.

Hours Note: Fryers are assumed to operate 313 days per year, or 6 days per week, based on a MA common assumption.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Commercial Electric Fryer - Standard	2,976.0	0.5000	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Commercial Electric Fryer - Standard	12	1.00	1.00		1.00	1.00	1.00	0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Commercial Electric Fryer - Standard	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Pacific Gas & Electric Company – Customer Energy Efficiency Department (2007). Work Paper PGECOFST101, Commercial Convection Oven, Revision #0.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: All PAs use 100% savings persistence factors.

RRe Note: Realization rate is assumed to be 100%.

RRsp Note: Realization rate is assumed to be 100%.

RRwp Note: Realization rate is assumed to be 100%.

CFsp Source: P72 Prescriptive C&I Loadshapes of Savings

CFsp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

CFwp Source: P72 Prescriptive C&I Loadshapes of SavingsCFwp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Commercial Electric Fryer - Standard	0.00	0.00	0.23	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Commercial Electric Fryer - Standard	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.14 / Gross kWh

Incentive: \$0.09 / Gross kWh

# **Commercial Electric Griddle**

 Sector: C&I
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Griddle

Program: C02a Design 2000plus

### **Measure Description**

Installation of a qualified ENERGY STAR® griddle. ENERGY STAR® griddles save energy during preheat, cooking and idle times due to improved cooking efficiency, and preheat and idle energy rates.

## **Baseline Description**

The baseline efficiency case is a typically sized, 6 sq. ft. commercial griddle with a cooking energy efficiency of 65%, production capacity of 35 pounds per hour, and idle energy rate of 400 W/sq. ft.

## **Savings Principle**

The high efficiency case is a typically sized, 6 sq. ft. commercial griddle with a cooking energy efficiency of 75%, production capacity of 49.2 pounds per hour, and idle energy rate of 293 W/sq. ft.

### **Savings Method**

Deemed

#### Unit

Installed high-efficiency commercial electric griddle.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 3,756.0.

Hours Source: Technical Assessment of Commercial Ovens

<a href="http://www.fishnick.com/equipment/techassessment/7\_ovens.pdf">http://www.fishnick.com/equipment/techassessment/7\_ovens.pdf</a>, pg.23

Hours Note: Griddles are assumed to operate 313 days per year. Combination ovens are assumed to operate 12 hours a day, or 3756 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Commercial Electric Griddle	3,965.0	0.9000	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Commercial Electric Griddle	12	1.00	1.00		1.00	1.00	1.00	0.90	0.90

Measure	Winter Peak Energy %			Summer Off-Peak Energy %
Commercial Electric Griddle	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Food Service Technology Center (2011). Electric Griddle Life-Cycle Cost Calculator. Accessed on 10/12/2011.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

RRsp Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

RRwp Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

CFsp Source: P72 Prescriptive C&I Loadshapes of Savings

CFsp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

CFwp Source: P72 Prescriptive C&I Loadshapes of SavingsCFwp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Commercial Electric Griddle	0.00	0.00	0.23	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Commercial Electric Griddle	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.48 / Gross kWh

Incentive: \$0.31 / Gross kWh

# **Commercial Electric Steamer**

 Sector: C&I
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Steamer

Program: C02a Design 2000plus

#### **Measure Description**

Installation of a qualified ENERGY STAR® commercial steam cooker. ENERGY STAR® steam cookers save energy during cooling and idle times due to improved cooking efficiency and idle energy rates.

#### **Baseline Description**

The Baseline Efficiency case is an electric steam cooker with a cooking efficiency of 26%, pan production capacity of 70.0 pounds per hour, preheat energy of 1.5 kWh, and idle energy rate of 1.0 kW

## **Savings Principle**

The High Efficiency case is an ENERGY STAR® electric steam cooker with a cooking energy efficiency of 68%, pan production capacity of 88.0 pounds per hour, preheat energy of 1.5 kWh, and an idle energy rate of 0.26 kW.

### **Savings Method**

Deemed

#### Unit

Installed high-efficiency commercial electric steamer.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Commercial Electric Steamer	30,156.0	6.8900	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Commercial Electric Steamer	12	1.00	1.00		1.00	1.00	1.00	0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Commercial Electric Steamer	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Environmental Protection Agency (2011). Savings Calculator for ENERGY Star Qualified Commercial Kitchen Equipment: Steam Cooker Calcs. Accessed on 10/12/2011.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

RRsp Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

RRwp Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

CFsp Source: P72 Prescriptive C&I Loadshapes of Savings

CFsp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

CFwp Source: P72 Prescriptive C&I Loadshapes of SavingsCFwp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Commercial Electric Steamer	0.00	0.00	0.23	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Commercial Electric Steamer	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.12 / Gross kWh

Incentive: \$0.08 / Gross kWh

# **Commercial Refrigeration**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: REFRG COMM Measure Sub Type: REFRG COMM

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

# **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

# **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Commercial Refrigeration	Calc	Calc	Calc	0.00	0.00	Calc	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Commercial Refrigeration	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Commercial Refrigeration	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Commercial Refrigeration	Calc	Calc	0.01	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Commercial Refrigeration	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.71 / Gross kWh

Incentive: \$0.46 / Gross kWh

# **Comprehensive Design**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: COMP DESIGN Measure Sub Type: COMP DESIGN

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

## **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Comprehensive Design	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Comprehensive Design	multi	1.00	1.00		0.47	0.49	0.25		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Comprehensive Design	31.30%	35.40%	15.60%	17.70%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI C&I Impact Evaluation of 2013-2015 Custom CDA
RRsp Source: RI C&I Impact Evaluation of 2013-2015 Custom CDA
RRwp Source: RI C&I Impact Evaluation of 2013-2015 Custom CDA

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Comprehensive Design	Calc	Calc	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Comprehensive Design	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.68 / Gross kWh
Incentive: \$0.44 / Gross kWh

# **Compressed Air**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: COMP AIR Measure Sub Type: COMP AIR

Program: C02a Design 2000plus

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

## **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Compressed Air	Calc	Calc	0.00	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Compressed Air	multi	1.00	1.00		0.81	0.71	0.86		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Compressed Air	41.70%	24.90%	20.90%	12.50%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

 $RRsp\ Source:\ RI-19-CE-Cust Elec\ and\ RI-20-CE-Cust Elec\ PY19-Impact\ Evaluation\ of\ PY2018\ and\ PY2019\ Custom\ Electric$ 

Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Compressed Air	Calc	Calc	0.03	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Compressed Air	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.60 / Gross kWh

Incentive: \$0.39 / Gross kWh

# Conveyor Broiler, <22" wide

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Broiler Measure Sub Type: Conveyor Broiler

Program: C02a Design 2000plus

#### **Measure Description**

Installation of a energy efficiency underfired broiler to replace a conventional automatic constant input rate conveyor broiler. This measure has both electric and gas savings.

#### **Baseline Description**

Baseline broiler must be an automatic conveyor broiler capable of maintaining a temperature above 600 F with a tested idle rate greater than 40 kBtu/h.

## **Savings Principle**

The high efficiency case for a conveyor broiler must have a catalyst and an input rate less than 80 kBtu/h or a dual stage or modulating gas valve with a capability of throttling the input rate below 80 kBtu/h. Baseline broiler must be replaced by a broiler similar in size or smaller. Must be installed under a Type II Hood.

## **Savings Method**

Deemed

## Unit

Installation of conveyor broiler

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Conveyor Broiler, <22" wide	7,144.0	0.2800	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: SoCalGas Commercial Conveyor Broilers workpaper WPSCGNRCC171226A11, December 27, 2017.

Electric kW Source: SoCalGas Commercial Conveyor Broilers workpaper WPSCGNRCC171226A11, December 27, 2017.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Conveyor Broiler, <22" wide	12	1.00	1.00		1.00			0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Conveyor Broiler, <22" wide	32.00%	35.00%	16.00%	17.00%	

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

CFsp Source: P72 Prescriptive C&I Loadshapes of Savings

CFsp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

CFwp Source: P72 Prescriptive C&I Loadshapes of SavingsCFwp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Conveyor Broiler, <22" wide	0.00	0.00	0.23	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Conveyor Broiler, <22" wide	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

# Conveyor Broiler, >28" wide

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Broiler Measure Sub Type: Conveyor Broiler

Program: C02a Design 2000plus

#### **Measure Description**

Installation of a energy efficiency underfired broiler to replace a conventional automatic constant input rate conveyor broiler. This measure has both electric and gas savings.

#### **Baseline Description**

Baseline broiler must be an automatic conveyor broiler capable of maintaining a temperature above 600 F with a tested idle rate greater than 70 kBtu/h.

## **Savings Principle**

The high efficiency case for a conveyor broiler must have a catalyst and an input rate less than 80 kBtu/h or a dual stage or modulating gas valve with a capability of throttling the input rate below 80 kBtu/h. Baseline broiler must be replaced by a broiler similar in size or smaller. Must be installed under a Type II Hood.

## **Savings Method**

Deemed

## Unit

Installation of conveyor broiler

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Conveyor Broiler, >28" wide	23,849.0	0.2800	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: SoCalGas Commercial Conveyor Broilers workpaper WPSCGNRCC171226A11, December 27, 2017.

Electric kW Source: SoCalGas Commercial Conveyor Broilers workpaper WPSCGNRCC171226A11, December 27, 2017.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Conveyor Broiler, >28" wide	12	1.00	1.00		1.00			0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Conveyor Broiler, >28" wide	32.00%	35.00%	16.00%	17.00%

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

CFsp Source: P72 Prescriptive C&I Loadshapes of Savings

CFsp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

CFwp Source: P72 Prescriptive C&I Loadshapes of SavingsCFwp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Conveyor Broiler, >28" wide	0.00	0.00	0.23	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Conveyor Broiler, >28" wide	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$1.51 / Gross kWh

Incentive: \$0.98 / Gross kWh

# Conveyor Broiler, 22-28" wide

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Broiler Measure Sub Type: Conveyor Broiler

Program: C02a Design 2000plus

## **Measure Description**

Installation of a energy efficiency underfired broiler to replace a conventional automatic constant input rate conveyor broiler. This measure has both electric and gas savings.

#### **Baseline Description**

Baseline broiler must be an automatic conveyor broiler capable of maintaining a temperature above 600 F with a tested idle rate greater than 60 kBtu/h.

## **Savings Principle**

The high efficiency case for a conveyor broiler must have a catalyst and an input rate less than 80 kBtu/h or a dual stage or modulating gas valve with a capability of throttling the input rate below 80 kBtu/h. Baseline broiler must be replaced by a broiler similar in size or smaller. Must be installed under a Type II Hood.

## **Savings Method**

Deemed

## Unit

Installation of conveyor broiler

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Conveyor Broiler, 22-28" wide	6,403.0	0.2800	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: SoCalGas Commercial Conveyor Broilers workpaper WPSCGNRCC171226A11, December 27, 2017.

Electric kW Source: SoCalGas Commercial Conveyor Broilers workpaper WPSCGNRCC171226A11, December 27, 2017.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Conveyor Broiler, 22-28" wide	12	1.00	1.00		1.00			0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Conveyor Broiler, 22-28" wide	32.00%	35.00%	16.00%	17.00%

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

CFsp Source: P72 Prescriptive C&I Loadshapes of Savings

CFsp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

CFwp Source: P72 Prescriptive C&I Loadshapes of SavingsCFwp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Conveyor Broiler, 22-28" wide	0.00	0.00	0.23	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Conveyor Broiler, 22-28" wide	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Custom HVAC**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: HVAC
 Measure Sub Type: HVAC

Program: C02a Design 2000plus

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

## **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom HVAC	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom HVAC	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Custom HVAC	45.80%	20.90%	22.90%	10.40%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Custom HVAC	Calc	Calc	0.00	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom HVAC	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.81 / Gross kWh

Incentive: \$0.53 / Gross kWh

# **Dishwasher - High Temperature Door Type**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Dishwasher Measure Sub Type: High Temp, Door

Type

Program: C02a Design 2000plus

## **Measure Description**

Installation of a qualified ENERGY STAR® high temperature commercial dishwasher in a building with gas domestic hot water. High temperature dishwashers use a

booster heater to raise the rinse water temperature to 1800 F – hot enough to sterilize dishes and assist in drying. Electric savings are achieved through savings to the electric booster.

## **Baseline Description**

The baseline efficiency case is a commercial dishwasher with 0.87 kW idle energy rate and 1.29 gal/rack water consumption.

## **Savings Principle**

The high efficiency case is a commercial dishwasher with 0.70 kW idle energy rate and 0.89 gal/rack water consumption or lower following ENERGY STAR efficiency requirements.

### Savings Method

Deemed

#### Unit

Installed Dishwasher

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,634.0.

Hours Note: Dishwashers are assumed to operate 313 days per year. The average dishwasher is assumed to operate 18 hours per day, or 5,634 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dishwasher - High Temperature Door Type	4,151.0	0.7400	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dishwasher - High Temperature Door Type	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dishwasher - High Temperature Door Type	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <a href="http://www.energystar.gov/buildings/sites/default/uploads/files/commercial\_kitchen\_equipment\_calculator.xlsx">http://www.energystar.gov/buildings/sites/default/uploads/files/commercial\_kitchen\_equipment\_calculator.xlsx</a>

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dishwasher - High Temperature Door Type	35000.00	35000.00	0.23	0

Water/Sewer Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dishwasher - High Temperature Door Type	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.34 / Gross kWh

Incentive: \$0.22 / Gross kWh

# **Dishwasher - High Temperature Multi Tank Conveyor**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Dishwasher Measure Sub Type: High Temp, Door

Type

Program: C02a Design 2000plus

## **Measure Description**

Installation of a qualified ENERGY STAR® high temperature commercial dishwasher in a building with gas domestic hot water. High temperature dishwashers use a

booster heater to raise the rinse water temperature to 1800 F – hot enough to sterilize dishes and assist in drying. Electric savings are achieved through savings to the electric booster.

## **Baseline Description**

The baseline efficiency case is a commercial dishwasher with 2.59 kW idle energy rate and 0.97 gal/rack water consumption.

## **Savings Principle**

The high efficiency case is a commercial dishwasher with 2.25 kW idle energy rate and 0.54 gal/rack water consumption or lower following ENERGY STAR efficiency requirements.

### Savings Method

Deemed

### Unit

Installed Dishwasher

### **Savings Equation**

Gross  $kWh = Qty \times deltakWh$ 

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,634.0.

Hours Note: Dishwashers are assumed to operate 313 days per year. The average dishwasher is assumed to operate 18 hours per day, or 5,634 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dishwasher - High Temperature Multi Tank Conveyor	9,630.0	1.7100	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dishwasher - High Temperature Multi Tank Conveyor	20	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dishwasher - High Temperature Multi Tank Conveyor	32.00%	35.00%	16.00%	17.00%

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dishwasher - High Temperature Multi Tank Conveyor	80754.00	80754.00	0.23	0

Water/Sewer Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dishwasher - High Temperature Multi Tank Conveyor	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.15 / Gross kWh

Incentive: \$0.10 / Gross kWh

# **Dishwasher - High Temperature Pots and Pans**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Dishwasher Measure Sub Type: High Temp, Door

Type

Program: C02a Design 2000plus

## **Measure Description**

Installation of a qualified ENERGY STAR® high temperature commercial dishwasher in a building with gas domestic hot water. High temperature dishwashers use a

booster heater to raise the rinse water temperature to 1800 F – hot enough to sterilize dishes and assist in drying. Electric savings are achieved through savings to the electric booster.

### **Baseline Description**

The baseline efficiency case is a commercial dishwasher with 1.20 kW idle energy rate and 0.70 gal/rack water consumption.

## **Savings Principle**

The high efficiency case is a commercial dishwasher with 1.20 kW idle energy rate and 0.58 gal/rack water consumption or lower following ENERGY STAR efficiency requirements.

### Savings Method

Deemed

### Unit

Installed Dishwasher

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,634.0.

Hours Note: Dishwashers are assumed to operate 313 days per year. The average dishwasher is assumed to operate 18 hours per day, or 5,634 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dishwasher - High Temperature Pots and Pans	1,032.0	0.1800	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dishwasher - High Temperature Pots and Pans	10	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dishwasher - High Temperature Pots and Pans	32.00%	35.00%	16.00%	17.00%

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dishwasher - High Temperature Pots and Pans	10517.00	10517.00	0.23	0

Water/Sewer Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dishwasher - High Temperature Pots and Pans	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$1.38 / Gross kWh

Incentive: \$0.90 / Gross kWh

# **Dishwasher - High Temperature Single Tank Conveyor**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Dishwasher Measure Sub Type: High Temp, Single

Tank

Program: C02a Design 2000plus

## **Measure Description**

Installation of a qualified ENERGY STAR® high temperature commercial dishwasher in a building with gas domestic hot water. High temperature dishwashers use a

booster heater to raise the rinse water temperature to 1800 F – hot enough to sterilize dishes and assist in drying. Electric savings are achieved through savings to the electric booster.

### **Baseline Description**

The baseline efficiency case is a commercial dishwasher with 1.93 kW idle energy rate and 0.87 gal/rack water consumption.

## **Savings Principle**

The high efficiency case is a commercial dishwasher with 1.50 kW idle energy rate and 0.70 gal/rack water consumption or lower following ENERGY STAR efficiency requirements.

### **Savings Method**

Deemed

### Unit

Installed Dishwasher

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,634.0.

Hours Note: Dishwashers are assumed to operate 313 days per year. The average dishwasher is assumed to operate 18 hours per day, or 5,634 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dishwasher - High Temperature Single Tank Conveyor	4,243.0	0.7500	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dishwasher - High Temperature Single Tank Conveyor	20	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dishwasher - High Temperature Single Tank Conveyor	32.00%	35.00%	16.00%	17.00%

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dishwasher - High Temperature Single Tank Conveyor	21300.00	21300.00	0.23	0

Water/Sewer Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dishwasher - High Temperature Single Tank Conveyor	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.55 / Gross kWh

Incentive: \$0.36 / Gross kWh

# **Dishwasher - High Temperature Under Counter**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Dishwasher Measure Sub Type: High Temp,

**Under Counter** 

Program: C02a Design 2000plus

## **Measure Description**

Installation of a qualified ENERGY STAR® high temperature commercial dishwasher in a building with gas domestic hot water. High temperature dishwashers use a

booster heater to raise the rinse water temperature to 1800 F – hot enough to sterilize dishes and assist in drying. Electric savings are achieved through savings to the electric booster.

### **Baseline Description**

The baseline efficiency case is a commercial dishwasher with 0.76 kW idle energy rate and 1.09 gal/rack water consumption.

## **Savings Principle**

The high efficiency case is a commercial dishwasher with 0.50 kW idle energy rate and 0.86 gal/rack water consumption or lower following ENERGY STAR efficiency requirements.

### **Savings Method**

Deemed

### Unit

Installed Dishwasher

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,634.0.

Hours Note: Dishwashers are assumed to operate 313 days per year. The average dishwasher is assumed to operate 18 hours per day, or 5,634 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dishwasher - High Temperature Under Counter	1,791.0	0.3200	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dishwasher - High Temperature Under Counter	10	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dishwasher - High Temperature Under Counter	32.00%	35.00%	16.00%	17.00%

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dishwasher - High Temperature Under Counter	5400.00	5400.00	0.23	0

Water/Sewer Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

impacts study

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dishwasher - High Temperature Under Counter	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.45 / Gross kWh

Incentive: \$0.29 / Gross kWh

# **Dishwasher - Low Temperature Door Type**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Dishwasher Measure Sub Type: Low Temp, Door

Type

Program: C02a Design 2000plus

## **Measure Description**

Installation of a qualified ENERGY STAR® low temperature commercial dishwasher in a facility with electric hot water heating. Low temperature dishwashers use the hot water supplied by the kitchen's existing water heater and use a chemical sanitizing agentin the final rinse cycle and sometimes a drying agent.

### **Baseline Description**

The baseline efficiency case is a commercial dishwasher with 0.60 kW idle energy rate and 2.10 gal/rack water consumption.

### **Savings Principle**

The high efficiency case is a commercial dishwasher with 0.60 kW idle energy rate and 1.18 gal/rack water consumption or lower following ENERGY STAR efficiency requirements.

## **Savings Method**

Deemed

### Unit

Installed Dishwasher

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,634.0.

Hours Note: Dishwashers are assumed to operate 313 days per year. The average dishwasher is assumed to operate 18 hours per day, or 5,634 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dishwasher - Low Temperature Door Type	13,851.0	2.4600	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dishwasher - Low Temperature Door Type	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dishwasher - Low Temperature Door Type	32.00%	35.00%	16.00%	17.00%

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dishwasher - Low Temperature Door Type	80600.00	80600.00	0.23	0

Water/Sewer Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dishwasher - Low Temperature Door Type	0.28	0.02	0.02	0.76

# **Dishwasher - Low Temperature Multi Tank Conveyor**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Dishwasher Measure Sub Type: Low Temp, Single

tank

Program: C02a Design 2000plus

## **Measure Description**

Installation of a qualified ENERGY STAR® low temperature commercial dishwasher in a facility with electric hot water heating. Low temperature dishwashers use the hot water supplied by the kitchen's existing water heater and use a chemical sanitizing agentin the final rinse cycle and sometimes a drying agent.

# **Baseline Description**

The baseline efficiency case is a commercial dishwasher with 2.00 kW idle energy rate and 1.04 gal/rack water consumption.

## **Savings Principle**

The high efficiency case is a commercial dishwasher with 2.00 kW idle energy rate and 0.54 gal/rack water consumption or lower following ENERGY STAR efficiency requirements.

## **Savings Method**

Deemed

### Unit

Installed Dishwasher

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,634.0.

Hours Note: Dishwashers are assumed to operate 313 days per year. The average dishwasher is assumed to operate 18 hours per day, or 5,634 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dishwasher - Low Temperature Multi Tank Conveyor	16,131.0	2.8600	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dishwasher - Low Temperature Multi Tank Conveyor	20	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dishwasher - Low Temperature Multi Tank Conveyor	32.00%	35.00%	16.00%	17.00%

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dishwasher - Low Temperature Multi Tank Conveyor	93900.00	93900.00	0.23	0

Water/Sewer Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dishwasher - Low Temperature Multi Tank Conveyor	0.28	0.02	0.02	0.76

# **Dishwasher - Low Temperature Single Tank Conveyor**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Dishwasher Measure Sub Type: Low Temp, Single

tank

Program: C02a Design 2000plus

## **Measure Description**

Installation of a qualified ENERGY STAR® low temperature commercial dishwasher in a facility with electric hot water heating. Low temperature dishwashers use the hot water supplied by the kitchen's existing water heater and use a chemical sanitizing agentin the final rinse cycle and sometimes a drying agent.

# **Baseline Description**

The baseline efficiency case is a commercial dishwasher with 1.50 kW idle energy rate and 1.31 gal/rack water consumption.

### **Savings Principle**

The high efficiency case is a commercial dishwasher with 1.60 kW idle energy rate and 0.79 gal/rack water consumption or lower following ENERGY STAR efficiency requirements.

## **Savings Method**

Deemed

### Unit

Installed Dishwasher

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakWh / Hours$ 

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,634.0.

Hours Note: Dishwashers are assumed to operate 313 days per year. The average dishwasher is assumed to operate 18 hours per day, or 5,634 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dishwasher - Low Temperature Single Tank Conveyor	11,685.0	2.0700	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dishwasher - Low Temperature Single Tank Conveyor	20	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dishwasher - Low Temperature Single Tank Conveyor	32.00%	35.00%	16.00%	17.00%

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dishwasher - Low Temperature Single Tank Conveyor	65100.00	65100.00	0.23	0

Water/Sewer Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dishwasher - Low Temperature Single Tank Conveyor	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.02 / Gross kWh

Incentive: \$0.01 / Gross kWh

# **Dishwasher - Low Temperature Under Counter**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Dishwasher Measure Sub Type: Low Temp, Under

Counter

Program: C02a Design 2000plus

## **Measure Description**

Installation of a qualified ENERGY STAR® low temperature commercial dishwasher in a facility with electric hot water heating. Low temperature dishwashers use the hot water supplied by the kitchen's existing water heater and use a chemical sanitizing agentin the final rinse cycle and sometimes a drying agent.

# **Baseline Description**

The baseline efficiency case is a commercial dishwasher with 0.50 kW idle energy rate and 1.73 gal/rack water consumption.

## **Savings Principle**

The high efficiency case is a commercial dishwasher with 0.50 kW idle energy rate and 1.19 gal/rack water consumption or lower following ENERGY STAR efficiency requirements.

## **Savings Method**

Deemed

### Unit

Installed Dishwasher

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,634.0.

Hours Note: Dishwashers are assumed to operate 313 days per year. The average dishwasher is assumed to operate 18 hours per day, or 5,634 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dishwasher - Low Temperature Under Counter	2,178.0	0.3900	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dishwasher - Low Temperature Under Counter	10	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dishwasher - Low Temperature Under Counter	32.00%	35.00%	16.00%	17.00%

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dishwasher - Low Temperature Under Counter	12700.00	12700.00	0.23	0

Water/Sewer Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dishwasher - Low Temperature Under Counter	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.23 / Gross kWh

Incentive: \$0.15 / Gross kWh

# **Dual Enthalpy Economizer Controls**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Economizer

Program: C02a Design 2000plus

### **Measure Description**

The measure is to upgrade the outside-air dry-bulb economizer to a dual enthalpy economizer. The system will continuously monitor the enthalpy of both the outside air and return air. The system will control the system dampers adjust the outside quantity based on the two readings.

### **Baseline Description**

The baseline efficiency case for this measure assumes the relevant HVAC equipment is operating with a fixed dry-bulb economizer.

### **Savings Principle**

The high efficiency case is the installation of an outside air economizer utilizing two enthalpy sensors, one for outdoor air and one for return air.

## **Savings Method**

Deemed

### Unit

Total tons of controlled cooling capacity.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Dual Enthalpy Economizer Controls	289.0	0.2890	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Patel, Dinesh (2001). Energy Analysis: Dual Enthalpy Control. Prepared for NSTAR.

Electric kW Source: Patel, Dinesh (2001). Energy Analysis: Dual Enthalpy Control. Prepared for NSTAR.

# **Energy Impact Factors**

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Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dual Enthalpy Economizer Controls	10	1.00	1.00		1.05	1.00	1.00	0.34	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Dual Enthalpy Economizer Controls	26.40%	16.60%	34.90%	22.10%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 2, Energy Efficient HVAC and Process Cooling Equipment. Prepared for NE Power Service Co.

RRsp Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 2, Energy Efficient HVAC and Process Cooling Equipment. Prepared for NE Power Service Co.

RRwp Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 2, Energy Efficient HVAC and Process Cooling Equipment. Prepared for NE Power Service Co.

CFsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Dual Enthalpy Economizer Controls	0.00	0.00	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Dual Enthalpy Economizer Controls	0.28	0.02	0.02	0.76

## **ECM Fan Motor for HVAC**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Motors Measure Sub Type: ECM Motor

Program: C02a Design 2000plus

### **Measure Description**

This measure is offered through the Cool Choice program and promotes the installation of electronically commutated motors (ECMs) on fan powered terminal boxes, fan coils, and HVAC supply fans on small unitary equipment.

### **Baseline Description**

The baseline efficiency case for this measure assumes the VAV box fans are powered by a single speed fractional horsepower permanent split capacitor (PSC) induction motor.

### **Savings Principle**

The high efficiency case must have a motor installed on new, qualifying HVAC equipment.

### **Savings Method**

Calculated using site-specific inputs

### Unit

Installed ECM fan motor.

### **Savings Equation**

Gross kWh = DesignCFM × BoxSizeFactor × %Flow Annual × Hours

Gross Summer kW = DesignCFM × BoxSizeFactor × %Flow\_Summer × Hours

Gross Winter kW = DesignCFM × BoxSizeFactor × %Flow\_Winter × Hours

Where:

DesignCFM = Capacity of the VAV box in cubic feet perminute: site-specific.

BoxSizeFactor = Savings factor in Watts/CFM

%Flow\_Annual = Average % of design flow over all operating hours

%Flow\_Summer = Average % of design flow during summer peak period

%Flow Winter = Average % of design flow during winter peak period

Hours = Estimated annual operating hours for VAV box fans: site-specific.

DesignCFM = Capacity of the VAV box in cubic feet per minute: site-specific.

Hours = Estimated annual operating hours for VAV box fans: site-specific.

Hours: N/A.

Hours Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

Hours Note: The average cooling EFLHs are taken as 855 hours while the average heating EFLHs are taken as 1137 hours.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ECM Fan Motor for HVAC	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ECM Fan Motor for HVAC	20	1.00	1.00		1.00	1.00	1.00		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
ECM Fan Motor for HVAC	23.70%	27.20%	23.80%	25.30%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
ECM Fan Motor for HVAC	0.00	0.00	0.00	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ECM Fan Motor for HVAC	0.28	0.02	0.02	0.76

### **EMS**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: EMS
 Measure Sub Type: EMS

Program: C02a Design 2000plus

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
EMS	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
EMS	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
EMS	45.80%	20.90%	22.90%	10.40%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
EMS	Calc	Calc	0.04	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
EMS	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.81 / Gross kWh

Incentive: \$0.53 / Gross kWh

## **Food Service**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: FOOD Measure Sub Type: FOOD

Program: C02a Design 2000plus

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu Gas custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

nouis. N/A

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Food Service	Calc	Calc	0.00	Calc	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Food Service	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Food Service	0.00%	0.00%	50.00%	50.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Food Service	Calc	Calc	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Food Service	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.60 / Gross kWh

Incentive: \$0.39 / Gross kWh

## **Fuel Switch - DHW**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Fuel Switch - DHW Measure Sub Type: Fuel Switch -

DHW

Program: C02a Design 2000plus

## **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

### **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

### Unit

Installed custom energy-efficiency project.

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW sp custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Fuel Switch - DHW	Calc	Calc	0.00	Calc	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Fuel Switch - DHW	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Fuel Switch - DHW	0.00%	0.00%	50.00%	50.00%	

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Fuel Switch - DHW	Calc	Calc	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Fuel Switch - DHW	0.28	0.02	0.02	0.76

## **Fuel Switch - HVAC**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Fuel Switch - HVAC Measure Sub Type: Fuel Switch -

HVAC

Program: C02a Design 2000plus

## **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

### **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

### Unit

Installed custom energy-efficiency project.

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW sp custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Fuel Switch - HVAC	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Fuel Switch - HVAC	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Fuel Switch - HVAC	0.00%	0.00%	50.00%	50.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Fuel Switch - HVAC	Calc	Calc	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Fuel Switch - HVAC	0.28	0.02	0.02	0.76

# **Ground Source Heat Pump (Closed Loop)**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heat Pumps Measure Sub Type: Ground Source

Program: C02a Design 2000plus

### **Measure Description**

This measure applies to the installation of high-efficiency single package or split system air source, water source, ground source (closed loop) and groundwater source (open loop) heat pump systems for space conditioning applications.

### **Baseline Description**

Appendix A details the specific efficiency requirements by equipment type.

### **Savings Principle**

The high efficiency case assumes a high-efficiency air cooled, water source, ground water source, or ground source heat pump system that exceeds the energy efficiency requirements of the International Energy Conservation Code (IECC) 2015.

## **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed heat pump system for space cooling / heating.

### **Savings Equation**

Gross kWh = Tons  $\times$  (kBtu/hr per ton)  $\times$  [(1/SEER\_base - 1/SEER\_ee)  $\times$  Hours\_C + CR  $\times$  (1/HSPF\_base - 1/HSPF\_ee)  $\times$  Hours\_H] Gross kW = Tons  $\times$  (kBtu/hr per ton)  $\times$  (1/EER\_base - 1/EER\_ee)

### Where:

Tons = Rated cooling capacity of the installed equipment: site-specific.

12 kBtu/hr per ton = Conversion factor

SEER\_base = Seasonal Energy Efficiency Ratio of the baseline equipment: code

SEER\_ee = Seasonal energy efficiency ratio of the high-efficiency unit: site-specific.

Hours C = Equivalent full load cooling hours

HSPF base = Heating Seasonal Performance Factor for baseline equipment: code

HSPF ee = Heating Seasonal Performance Factor for new efficient equipment: site-specific.

Hours\_H = Equivalent full load heating hours

CR = Capacity Ratio converts rated coolingcapacity to heating capacity. For equipment with cooling capacity ≤ 5.4 tons, assume CR=1. For equipment > 5.4 tons, assume CR=1.15; Optimal Energy, Inc. (2008). Memo:Non-Electric enefits Analysis Update. Prepared for Dave Weber, NSTAR.

EER base = EnergyEfficiency Ratio of baseline equipment.

EER\_ee = Energy Efficiency Ratio of the new efficient equipment: site-specific. For equipment < 5.4 tons, assume the following conversion: EER≈SEER/1.1

# Hours: N/A.

Hours Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

Hours Note: If site-specific data is unavailable, the average cooling EFLHs are taken as 855 hours while the average heating EFLHs are taken as 1137 hours.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Ground Source Heat Pump (Closed Loop)	Calc	Calc	0.00	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Ground Source Heat Pump (Closed Loop)	25	1.00	1.00		1.05	1.00	1.00	0.40	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Ground Source Heat Pump (Closed Loop)	11.30%	10.80%	39.40%	38.50%

Measure Life Source: Ground Source Heat Pump eTRM Measure Review MA20C15-B-GSHP

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 2, Energy Efficient HVAC and Process Cooling Equipment. Prepared for NE Power Service Co.

RRsp Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 2, Energy Efficient HVAC and Process Cooling Equipment. Prepared for NE Power Service Co.

RRwp Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 2, Energy Efficient HVAC and Process Cooling Equipment. Prepared for NE Power Service Co.

CFsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

# Non-Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Ground Source Heat Pump (Closed Loop)	0.00	0.00	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Ground Source Heat Pump (Closed Loop)	0.28	0.02	0.02	0.76

# **Groundwater Source Heat Pump (Open Loop)**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heat Pumps Measure Sub Type: Groundwater

Source

Program: C02a Design 2000plus

## **Measure Description**

This measure applies to the installation of high-efficiency single package or split system air source, water source, ground source (closed loop) and groundwater source (open loop) heat pump systems for space conditioning applications.

### **Baseline Description**

Appendix A details the specific efficiency requirements by equipment type.

#### Savings Principle

The high efficiency case assumes a high-efficiency air cooled, water source, ground water source, or ground source heat pump system that exceeds the energy efficiency requirements of the International Energy Conservation Code (IECC) 2015.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed heat pump system for space cooling / heating.

### **Savings Equation**

 $Gross\ kWh = Tons \times (kBtu/hr\ per\ ton) \times [(1/SEER\_base - 1/SEER\_ee) \times Hours\_C + CR \times (1/HSPF\_base - 1/HSPF\_ee) \times Hours\_H]$ 

Gross kW = Tons  $\times$  (kBtu/hr per ton)  $\times$  (1/EER\_base - 1/EER\_ee)

### Where:

Tons = Rated cooling capacity of the installed equipment: site-specific.

12 kBtu/hr per ton = Conversion factor

SEER base = Seasonal Energy Efficiency Ratio of the baseline equipment: code

SEER\_ee = Seasonal energy efficiency ratio of the high-efficiency unit: site-specific.

Hours\_C = Equivalent full load cooling hours

HSPF\_base = Heating Seasonal Performance Factor for baseline equipment: code

HSPF\_ee = Heating Seasonal Performance Factor for new efficient equipment: site-specific.

Hours\_H = Equivalent full load heating hours

CR = Capacity Ratio converts rated coolingcapacity to heating capacity. For equipment with cooling capacity ≤ 5.4 tons, assume CR=1. For equipment > 5.4 tons, assume CR=1.15; Optimal Energy, Inc. (2008). Memo:Non-Electric enefits Analysis Update. Prepared for Dave Weber, NSTAR.

EER\_base = EnergyEfficiency Ratio of baseline equipment.

EER\_ee = Energy Efficiency Ratio of the new efficient equipment: site-specific. For equipment < 5.4 tons, assume the following conversion: EER≈SEER/1.1

Hours: N/A.

Hours Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

Hours Note: If site-specific data is unavailable, the average cooling EFLHs are taken as 855 hours while the average heating EFLHs are taken as 1137 hours.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Groundwater Source Heat Pump (Open Loop)	Calc	Calc	0.00	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Groundwater Source Heat Pump (Open Loop)	25	1.00	1.00		1.05	1.00	1.00	0.40	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Groundwater Source Heat Pump (Open Loop)	11.30%	10.80%	39.40%	38.50%

Measure Life Source: Ground Source Heat Pump eTRM Measure Review MA20C15-B-GSHP

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 2, Energy Efficient HVAC and Process Cooling Equipment. Prepared for NE Power Service Co.

RRsp Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 2, Energy Efficient HVAC and Process Cooling Equipment. Prepared for NE Power Service Co.

RRwp Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 2, Energy Efficient HVAC and Process Cooling Equipment. Prepared for NE Power Service Co.

CFsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Groundwater Source Heat Pump (Open Loop)	0.00	0.00	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Groundwater Source Heat Pump (Open Loop)	0.28	0.02	0.02	0.76

# **High Performance Contact Conveyor Toaster**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Food Service Measure Sub Type: Food Service

Program: C02a Design 2000plus

**Measure Description** 

The Installation of a high performance contact conveyor toaster.

**Baseline Description** 

The baseline is >3.75 W/bun from the 2022 CA eTRM.

**Savings Principle** 

The efficient equipment must be <= 3.75 W/bun.

**Savings Method** 

Deemed

Unit

Installed high performance contact conveyor toaster.

**Savings Equation** 

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
High Performance Contact Conveyor Toaster	2,340.0	0.3610	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: CA eTRM Electric kW Source: CA eTRM

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
High Performance Contact Conveyor Toaster	12	1.00	1.00		1.00	1.00	1.00	0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
High Performance Contact Conveyor Toaster	33.00%	0.00%	67.00%	0.00%

Measure Life Source: Guidehouse, MA Residential Baseline Study

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed 100% because savings are based on researched assumptions.

RRsp Note: Realization rate is assumed 100% because savings are based on researched assumptions.

RRwp Note: Realization rate is assumed 100% because savings are based on researched assumptions.

CFsp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

CFwp Note: Coincidence Factors are 0.9 for both summer and winter seasons to account for restaurants that close one day per week or may not serve lunch and dinner on weekdays.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
High Performance Contact Conveyor Toaster	0.00	0.00	0.01	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
High Performance Contact Conveyor Toaster	0.25	0.00	0.09	0.84

NTG Source: C&I Prescriptive and Custom NTG Omnibus Study (MA20X07-B-CIOMNINTG)

TRC: \$1.29 / Gross kWh

Incentive: \$0.26 / Gross kWh

# **Hot Food Holding Cabinet - 1/2**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Hot Food Cabinet Measure Sub Type: 1/2

Program: C02a Design 2000plus

### **Measure Description**

Installation of a qualified ENERGY STAR® hot food holding cabinet (HFHC).

### **Baseline Description**

The baseline efficiency idle energy rate for a HFHC is 400 W for all sizes.

### **Savings Principle**

A HFHC that incorporates better insulation, reducing heat loss, and may also offer additional energy saving devices such as magnetic door gaskets, auto-door closures, or dutch doors. 1/2 size idle energy rate is 172 W.

# **Savings Method**

Deemed

### Unit

Per hot food cabinet

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 4,695.0.

Hours Note: Hot food holding cabinets assumed to operate 313 days per year617 for 15 hours a day, or 4,695 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Hot Food Holding Cabinet - 1/2	1,095.0	0.2000	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Hot Food Holding Cabinet - 1/2	12	1.00	1.00		1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Hot Food Holding Cabinet - 1/2	32.00%	35.00%	16.00%	17.00%

Measure Life Source: ENERGY STAR® Commercial Kitchen Equipment Savings Calculator: HFHC Calcs.

<a href="http://www.energystar.gov/ia/business/bulk\_purchasing/bpsavings\_calc/commercial\_kitchen\_equipment\_calculator.xls">http://www.energystar.gov/ia/business/bulk\_purchasing/bpsavings\_calc/commercial\_kitchen\_equipment\_calculator.xls</a>

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Hot Food Holding Cabinet - 1/2	0.00	0.00	0.23	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Hot Food Holding Cabinet - 1/2	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.81 / Gross kWh

Incentive: \$0.59 / Gross kWh

# Hot Food Holding Cabinet - 3/4

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Hot Food Cabinet Measure Sub Type: 3/4

Program: C02a Design 2000plus

#### **Measure Description**

Installation of a qualified ENERGY STAR® hot food holding cabinet (HFHC).

### **Baseline Description**

The baseline efficiency idle energy rate for a HFHC is 400 W for all sizes.

#### **Savings Principle**

A HFHC that incorporates better insulation, reducing heat loss, and may also offer additional energy saving devices such as magnetic door gaskets, auto-door closures, or dutch doors. 3/4 size idle energy rate is 258 W.

# **Savings Method**

Deemed

### Unit

Per hot food cabinet

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 4,695.0.

Hours Note: Hot food holding cabinets assumed to operate 313 days per year617 for 15 hours a day, or 4,695 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Hot Food Holding Cabinet - 3/4	1,095.0	0.2000	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Hot Food Holding Cabinet - 3/4	12	1.00	1.00		1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Hot Food Holding Cabinet - 3/4	32.00%	35.00%	16.00%	17.00%	

 $\label{thm:measure Life Source: ENERGY STAR @ Commercial Kitchen Equipment Savings Calculator: HFHC Calcs.$ 

<a href="http://www.energystar.gov/ia/business/bulk\_purchasing/bpsavings\_calc/commercial\_kitchen\_equipment\_calculator.xls">http://www.energystar.gov/ia/business/bulk\_purchasing/bpsavings\_calc/commercial\_kitchen\_equipment\_calculator.xls</a>

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Hot Food Holding Cabinet - 3/4	0.00	0.00	0.23	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Hot Food Holding Cabinet - 3/4	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$1.13 / Gross kWh

Incentive: \$0.73 / Gross kWh

# **Hot Food Holding Cabinet - Full**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Hot Food Cabinet Measure Sub Type: Full

Program: C02a Design 2000plus

#### **Measure Description**

Installation of a qualified ENERGY STAR® hot food holding cabinet (HFHC).

### **Baseline Description**

The baseline efficiency idle energy rate for a HFHC is 400 W for all sizes.

#### **Savings Principle**

A HFHC that incorporates better insulation, reducing heat loss, and may also offer additional energy saving devices such as magnetic door gaskets, auto-door closures, or dutch doors. Full size idle energy rate is 294 W.

### **Savings Method**

Deemed

### Unit

Per hot food cabinet

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 4,695.0.

Hours Note: Hot food holding cabinets assumed to operate 313 days per year617 for 15 hours a day, or 4,695 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Hot Food Holding Cabinet - Full	2,737.0	0.5000	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Hot Food Holding Cabinet - Full	12	1.00	1.00		1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Hot Food Holding Cabinet - Full	32.00%	35.00%	16.00%	17.00%	

Measure Life Source: ENERGY STAR® Commercial Kitchen Equipment Savings Calculator: HFHC Calcs.

<a href="http://www.energystar.gov/ia/business/bulk\_purchasing/bpsavings\_calc/commercial\_kitchen\_equipment\_calculator.xls">http://www.energystar.gov/ia/business/bulk\_purchasing/bpsavings\_calc/commercial\_kitchen\_equipment\_calculator.xls</a>

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Hot Food Holding Cabinet - Full	0.00	0.00	0.23	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Hot Food Holding Cabinet - Full	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.53 / Gross kWh

Incentive: \$0.35 / Gross kWh

# Ice Making Head

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Ice Machine Measure Sub Type: Ice Making Head

Program: C02a Design 2000plus

#### **Measure Description**

Installation of a qualified ENERGY STAR® commercial ice machine.

### **Baseline Description**

The baseline efficiency case is a non-ENERGY STAR® commercial ice machine.

#### **Savings Principle**

The high efficiency case is a commercial ice machine meeting the ENERGY STAR® Specifications V3.0 Efficiency Requirements.

### **Savings Method**

Deemed

#### Unit

Per ice machine

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,634.0.

Hours Note: Ice making machines are assumed to operate 365 days per year. The average ice making machine is assumed to operate 18 hours per day, or 5,634 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Ice Making Head	1,117.0	0.2800	0.00	0.00	0.00	0.00	0.00

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Ice Making Head	8	1.00	1.00		1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Ice Making Head	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <a href="http://www.energystar.gov/buildings/sites/default/uploads/files/commercial\_kitchen\_equipment\_calculator.xlsx">http://www.energystar.gov/buildings/sites/default/uploads/files/commercial\_kitchen\_equipment\_calculator.xlsx</a> >

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Ice Making Head	3322.00	3322.00	0.23	0

Water/Sewer Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Ice Making Head	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.38 / Gross kWh

Incentive: \$0.25 / Gross kWh

# Ice Remote (Cont.)

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Ice Machine Measure Sub Type: Ice Remote/Split

Program: C02a Design 2000plus

#### **Measure Description**

Installation of a qualified ENERGY STAR® commercial ice machine.

### **Baseline Description**

The baseline efficiency case is a non-ENERGY STAR® commercial ice machine.

#### **Savings Principle**

The high efficiency case is a commercial ice machine meeting the ENERGY STAR® Specifications V3.0 Efficiency Requirements.

### **Savings Method**

Deemed

#### Unit

Per ice machine

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,634.0.

Hours Note: Ice making machines are assumed to operate 365 days per year. The average ice making machine is assumed to operate 18 hours per day, or 5,634 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Ice Remote (Cont.)	3,641.0	0.2800	0.00	0.00	0.00	0.00	0.00

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Ice Remote (Cont.)	8	1.00	1.00		1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Ice Remote (Cont.)	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <a href="http://www.energystar.gov/buildings/sites/default/uploads/files/commercial\_kitchen\_equipment\_calculator.xlsx">http://www.energystar.gov/buildings/sites/default/uploads/files/commercial\_kitchen\_equipment\_calculator.xlsx</a> >

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Ice Remote (Cont.)	0.00	0.00	0.23	0

Water/Sewer Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Ice Remote (Cont.)	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.10 / Gross kWh

Incentive: \$0.06 / Gross kWh

### Ice Self Contained

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Food Service Measure Type: Ice Machine Measure Sub Type: Ice Self Contained

Program: C02a Design 2000plus

#### **Measure Description**

Installation of a qualified ENERGY STAR® commercial ice machine.

### **Baseline Description**

The baseline efficiency case is a non-ENERGY STAR® commercial ice machine.

#### **Savings Principle**

The high efficiency case is a commercial ice machine meeting the ENERGY STAR® Specifications V3.0 Efficiency Requirements.

### **Savings Method**

Deemed

#### Unit

Per ice machine

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5,634.0.

Hours Note: Ice making machines are assumed to operate 365 days per year. The average ice making machine is assumed to operate 18 hours per day, or 5,634 hours per year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Ice Self Contained	805.0	0.2800	0.00	0.00	0.00	0.00	0.00

Electric kW Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Ice Self Contained	8	1.00	1.00		1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Ice Self Contained	32.00%	35.00%	16.00%	17.00%

Measure Life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <a href="http://www.energystar.gov/buildings/sites/default/uploads/files/commercial\_kitchen\_equipment\_calculator.xlsx">http://www.energystar.gov/buildings/sites/default/uploads/files/commercial\_kitchen\_equipment\_calculator.xlsx</a> >

ISR Note: In-service rates are set to 100% based on the assumption that all purchased units are installed.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rates are 100% since savings estimates are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Ice Self Contained	3526.00	3526.00	0.23	0

Water/Sewer Source: Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Ice Self Contained	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.43 / Gross kWh

Incentive: \$0.28 / Gross kWh

#### **LEDs**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: LEDS
 Measure Sub Type: LEDS

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LEDs	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LEDs	multi	1.00	1.00		0.95	0.94	0.75		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LEDs	40.70%	26.00%	20.30%	13.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

 $RRsp\ Source:\ RI-19-CE-Cust Elec\ and\ RI-20-CE-Cust Elec\ PY19-Impact\ Evaluation\ of\ PY2018\ and\ PY2019\ Custom\ Electric$ 

Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LEDs	Calc	Calc	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LEDs	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.53 / Gross kWh

Incentive: \$0.35 / Gross kWh

# **Lighting Controls**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: LGHT CNTRLS Measure Sub Type: LGHT CNTRLS

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Lighting Controls	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Lighting Controls	9	1.00	1.00		0.95	0.94	0.75		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Lighting Controls	40.70%	26.00%	20.30%	13.00%

Measure Life Source: Dan Mellinger's Lighting Control Measure Life Memo

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Lighting Controls	Calc	Calc	0.09	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Lighting Controls	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.53 / Gross kWh

Incentive: \$0.35 / Gross kWh

# **Lighting Systems**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: LGHT SYSTEMS Measure Sub Type: LGHT SYSTEMS

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Lighting Systems	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Lighting Systems	multi	1.00	1.00		0.95	0.94	0.75		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Lighting Systems	40.70%	26.00%	20.30%	13.00%

Measure Life Source: RI C&I Lighting Market and AML Update Study

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Lighting Systems	Calc	Calc	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Lighting Systems	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.53 / Gross kWh

Incentive: \$0.35 / Gross kWh

# **Low Pressure Drop Filter**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Compressed Air Measure Type: Low Pressure Drop Measure Sub Type: Low Pressure

Filters Drop Filter

Program: C02a Design 2000plus

# **Measure Description**

Filters remove solids and aerosols from compressed air systems. Low pressure drop filters have longer lives and lower pressure drops than traditional coalescing filters resulting in higher efficiencies.

### **Baseline Description**

The baseline efficiency case is a standard coalescing filter with initial drop of between 1 and 2 pounds per sq inch (psi) with an end of life drop of 10 psi.

### **Savings Principle**

The high efficiency case is a low pressure drop filter with initial drop not exceeding 1 psi when new and 3 psi at element change. Filters must be deep-bed, "mist eliminator" style and installed on a single operating compressor rated 15 – 75 HP.

### **Savings Method**

Calculated using site-specific inputs

### Unit

Installed filter.

### **Savings Equation**

Gross kWh = Qty × HP\_compressor × (kW per HP) × %SAVE × Hours

Gross  $kW = Qty \times HP\_compressor \times (kW per HP) \times %SAVE$ 

Where:

Qty = Number of filters installed: site-specific

HP\_compressor = Average compressor load: site-specific

kW per HP = Conversion factor

%SAVE = Percent change in pressure drop: site-specific

Hours = Annual operating hours of the lower pressure drop filter: site-specific

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low Pressure Drop Filter	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low Pressure Drop Filter	15	1.00	1.00		1.00	1.00	1.00	0.80	0.54

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low Pressure Drop Filter	24.50%	25.80%	24.50%	25.10%

Measure Life Note: Based on NSTAR estimates of typical replacement schedule.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

RRsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

RRwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low Pressure Drop Filter	0.00	0.00	0.04	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low Pressure Drop Filter	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.43 / Gross kWh
Incentive: \$0.28 / Gross kWh

#### Motor

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: MOTOR Measure Sub Type: MOTOR

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Motor	Calc	Calc	Calc	0.00	0.00	Calc	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Motor	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Motor	23.70%	27.20%	23.80%	25.30%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Motor	Calc	Calc	0.02	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Motor	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.34 / Gross kWh

Incentive: \$0.22 / Gross kWh

### Other

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: OTHER
 Measure Sub Type: Other

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Other	Calc	Calc	Calc	0.00	0.00	Calc	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Other	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Other	42.60%	24.00%	21.30%	12.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Other	Calc	Calc	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Other	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.60 / Gross kWh

Incentive: \$0.39 / Gross kWh

# Packaged AC to 30 tons

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: PTAC Measure Sub Type: AC to 5.4 tons

Program: C02a Design 2000plus

#### **Measure Description**

This measure applies to the installation of high-efficiency single package or split system air source, water source, ground source (closed loop) and groundwater source (open loop) heat pump systems for space conditioning applications.

### **Baseline Description**

Appendix A details the specific efficiency requirements by equipment type.

#### **Savings Principle**

The high efficiency case assumes the HVAC equipment exceeds the requirements of the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed unitary AC system for space cooling.

### **Savings Equation**

Gross kWh = Tons × (kBtu/hr per ton) × (1/SEER base - 1/SEER ee) × Hours C

Gross kW = Tons × (kBtu/hr per ton) × (1/EER\_base - 1/EER\_ee)

#### Where:

Tons = Rated cooling capacity of the installed equipment: site-specific.

12 kBtu/hr per ton = Conversion factor

SEER\_base = Seasonal Energy Efficiency Ratio of the baseline equipment: code

SEER\_ee = Seasonal energy efficiency ratio of the high-efficiency unit: site-specific.

Hours C = Equivalent full load cooling hours

EER\_ee = Energy Efficiency Ratio of the new efficient equipment: site-specific. For equipment < 5.4 tons, assume the following conversion: EER≈SEER/1.1

EER\_base = Energy Efficiency Ratio of baseline equipment: code. Since IECC 2012 does not provide EER requirements for equipment < 5.4 tons, assume the following conversion: EER ≈ SEER/1.1

#### Hours: N/A.

Hours Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

Hours Note: If site-specific data is unavailable, the average cooling EFLHs are taken as 855 hours while the average heating EFLHs are taken as 1137 hours.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Packaged AC to 30 tons	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Packaged AC to 30 tons	20	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Packaged AC to 30 tons	11.30%	10.80%	39.40%	38.50%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

RRsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

RRwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Packaged AC to 30 tons	0.00	0.00	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Packaged AC to 30 tons	0.45	0.00	0.00	0.55

NTG Source: MA C&I HVAC & Water Heater NTG & Market Effects Measurement

# **Packaged Terminal Air Conditioner**

 Sector: C&I
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: PTAC
 Measure Sub Type: PTAC

Program: C02a Design 2000plus

#### **Measure Description**

This measure applies to the installation of high-efficiency single package or split system air source, water source, ground source (closed loop) and groundwater source (open loop) heat pump systems for space conditioning applications.

### **Baseline Description**

Appendix A details the specific efficiency requirements by equipment type.

#### **Savings Principle**

The high efficiency case assumes the HVAC equipment exceeds the requirements of the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed unitary AC system for space cooling.

### **Savings Equation**

Gross kWh = Tons × (kBtu/hr per ton) × (1/SEER base - 1/SEER ee) × Hours C

Gross kW = Tons × (kBtu/hr per ton) × (1/EER\_base - 1/EER\_ee)

#### Where:

Tons = Rated cooling capacity of the installed equipment: site-specific.

12 kBtu/hr per ton = Conversion factor

SEER\_base = Seasonal Energy Efficiency Ratio of the baseline equipment: code

SEER\_ee = Seasonal energy efficiency ratio of the high-efficiency unit: site-specific.

Hours C = Equivalent full load cooling hours

EER\_ee = Energy Efficiency Ratio of the new efficient equipment: site-specific. For equipment < 5.4 tons, assume the following conversion: EER≈SEER/1.1

EER\_base = Energy Efficiency Ratio of baseline equipment: code. Since IECC 2012 does not provide EER requirements for equipment < 5.4 tons, assume the following conversion: EER ≈ SEER/1.1

#### Hours: N/A.

Hours Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

Hours Note: If site-specific data is unavailable, the average cooling EFLHs are taken as 855 hours while the average heating EFLHs are taken as 1137 hours.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Packaged Terminal Air Conditioner	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Packaged Terminal Air Conditioner	20	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Packaged Terminal Air Conditioner	11.30%	10.80%	39.40%	38.50%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

RRsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

RRwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Packaged Terminal Air Conditioner	0.00	0.00	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Packaged Terminal Air Conditioner	0.45	0.00	0.00	0.55

NTG Source: MA C&I HVAC & Water Heater NTG & Market Effects Measurement

# **Packaged Terminal Heat Pumps (PTHP)**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heat Pumps Measure Sub Type: Heat Pump,

**Packaged Terminal** 

Program: C02a Design 2000plus

**Measure Description** 

Installation of a high efficiency PTHP from a code level PTHP.

**Baseline Description** 

The baseline is a code level PTHP.

**Savings Principle** 

The high efficiency case is a high efficiency PTHP.

Savings Method

Deemed

Unit

Per PTHP

**Savings Equation** 

Gross kWh = Qty × (kW\_base - kW\_ee) × Hours

Gross kW = Qty × (kW\_base - kW\_ee)

Where:

Qty = Total number of units.

kW\_base = Deemed average demand per baseline unit.

kW ee = Deemed average demand per high-efficiency unit.

Hours = Deemed average annual operating hours.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Packaged Terminal Heat Pumps (PTHP)	1.0	0.0000	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Based on energy modeling of PNNL prototype buildings of small hotel, large hotel, and multifamily midrise.

Electric kW Note: The peak demand occurs in the winter at low ambient temps when supplemental electrical resistance heat is operational. As a result, there is no max kW demand reduction going from PTAC to high efficiency PTHP (existing buildings) or code level PTHP to high

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Packaged Terminal Heat Pumps (PTHP)	8	1.00	1.00		1.00	1.00	1.00	0.01	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Packaged Terminal Heat Pumps (PTHP)	19.10%	16.80%	36.30%	27.80%

Measure Life Source: 'ComEd Effective Useful Life Research Report', May 2018

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization Rate is assumed 100%. RRwp Note: Realization Rate is assumed 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Packaged Terminal Heat Pumps (PTHP)	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Packaged Terminal Heat Pumps (PTHP)	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$3.08 / Gross kWh

Incentive: \$1.73 / Gross kWh

# **Performance Lighting**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: LGHT-PERF Measure Sub Type: LGHT-PERF

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Performance Lighting	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Performance Lighting	multi	1.00	1.00		0.95	0.94	0.75		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Performance Lighting	40.70%	26.00%	20.30%	13.00%

Measure Life Source: RI C&I Lighting Market and AML Update Study

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Performance Lighting	Calc	Calc	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Performance Lighting	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.53 / Gross kWh

Incentive: \$0.35 / Gross kWh

# **Prescriptive Lighting**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Prescriptive Measure Sub Type: Prescriptive

Program: C02a Design 2000plus

#### **Measure Description**

The Installation of efficient lighting discounted at the prescriptive level.

### **Baseline Description**

The baseline case is a mix of fluorescent and halogen fixtures for LEDs and low efficiency fluorescents for high efficiency fluorescents.

#### **Savings Principle**

The high efficiency case is high efficiency LED. Please refer to Table 6 in Appendix A for wattage details.

### **Savings Method**

Algorithm with site-specific inputs

#### Unit

Installed high-efficiency lighting project.

#### **Savings Equation**

Gross kWh = SUM[QTY\_i × Watts\_i × (Hours\_base\_i - Hours\_ee\_i)] / (Watts per kW)

Gross kW = SUM(QTY\_i × Watts\_i) / (Watts per kW)

Where:

QTY\_i = Quantity in controlled fixtures in location i

Watts\_i = Connected wattage of controlled fixtures in location i

Hours\_base\_i = Total annual hours that the connected lighting in location i operated without controls (for retrofit installations) or would have operated with code-compliance controls (for new construction installations).

Hours\_ee\_i = Total annual hours that the connected lighting in location i operates with the lighting controls implemented.

1,000 Watts per kW = Conversion factor

deltaMMBtu\_Gas/kWh = Gross natural gas MMBtu reduction per gross kWh saved.

deltaMMBtu\_Oil/kWh = Gross heating oil MMBtu reduction per gross kWh saved.

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Prescriptive Lighting	Table 6	Table 6	0.00	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

Gas Heat MMBtu Note: NEI per kWh

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Prescriptive Lighting	multi	1.00	1.00		21.00	21.00	21.00	21.00	21.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Prescriptive Lighting	#VALUE!	#VALUE!	#VALUE!	#VALUE!

Measure Life Source: RI C&I Lighting Market and AML Update Study

Measure Life Note: Massachusetts Common Assumption SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Prescriptive Lighting	0.00	0.00	0.03	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Prescriptive Lighting	21.00	21.00	21.00	21.00

TRC: \$0.34 / Gross kWh

Incentive: \$0.22 / Gross kWh

### **Process**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: PROCESS Measure Sub Type: PROCESS

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Process	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Process	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Process	45.50%	21.10%	22.80%	10.60%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Process	Calc	Calc	0.01	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Process	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.52 / Gross kWh

Incentive: \$0.34 / Gross kWh

# **Process Cooling**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: PROC-COOLING Measure Sub Type: PROC-COOLING

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Process Cooling	Calc	Calc	0.00	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Process Cooling	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Process Cooling	45.50%	21.10%	22.80%	10.60%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Process Cooling	Calc	Calc	0.01	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Process Cooling	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.50 / Gross kWh

Incentive: \$0.32 / Gross kWh

# **Refrigerated Air Dryer**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Compressed Air Measure Type: Refrigerated Air Measure Sub Type: Refrigerated Air

Dryers Dryer

Program: C02a Design 2000plus

### **Measure Description**

The installation of cycling or variable frequency drive (VFD)-equipped refrigerated compressed air dryer. An efficient refrigerated dryer cycles on and off or uses a variable speed drive as required by the demand for compressed air instead of running continuously. Only properly sized refrigerated air dryers used in a single-compressor system are eligible.

## **Baseline Description**

The baseline efficiency case is a non-cycling refrigerated air dryer.

## **Savings Principle**

The high efficiency case is a cycling refrigerated dryer or a refrigerated dryer equipped with a VFD.

### Savings Method

Calculated using site-specific inputs

#### Unit

kW saved per CFM of installed air dryer capacity.

#### **Savings Equation**

Gross kWh = CFM\_dryer × deltakW/CFM × Hours

Gross kW = CFM\_dryer × deltakW/CFM

Where:

CFM\_dryer = Full flow rated capacity of the refrigerated air dryer in cubic feet per minute (CFM), typically obtained from equipment's Compressed Air Gas Institute Datasheet: site-specific

deltakW/CFM = Refrigerated air dryer kW reduction per dryer full flow rated CFM

Hours = Annual operating hours of the refrigerated air dryer: site-specific

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis; RR adjusts for evaluation results.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Refrigerated Air Dryer	Calc	0.0056	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Algorithm Input kwh/CFM based on NSTAR metering analysis and supported by multiple 3rd part impact evaluations.

Electric kW Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

Electric kW Note: kW/(rated CFM)

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Refrigerated Air Dryer	15	1.00	1.00		1.56	1.00	1.00	1.05	0.83

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Refrigerated Air Dryer	24.50%	25.80%	24.50%	25.10%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

RRsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

RRwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFsp Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

CFwp Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Refrigerated Air Dryer	0.00	0.00	0.04	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Refrigerated Air Dryer	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

# Split System AC to 5.4 tons

 Sector: C&I
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: AC
 Measure Sub Type: Split

Program: C02a Design 2000plus

### **Measure Description**

This measure applies to the installation of high-efficiency single package or split system air source, water source, ground source (closed loop) and groundwater source (open loop) heat pump systems for space conditioning applications.

### **Baseline Description**

Appendix A details the specific efficiency requirements by equipment type.

#### **Savings Principle**

The high efficiency case assumes the HVAC equipment exceeds the requirements of the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed unitary AC system for space cooling.

### **Savings Equation**

Gross kWh = Tons × (kBtu/hr per ton) × (1/SEER base - 1/SEER ee) × Hours C

Gross kW = Tons × (kBtu/hr per ton) × (1/EER\_base - 1/EER\_ee)

#### Where:

Tons = Rated cooling capacity of the installed equipment: site-specific.

12 kBtu/hr per ton = Conversion factor

SEER\_base = Seasonal Energy Efficiency Ratio of the baseline equipment: code

SEER\_ee = Seasonal energy efficiency ratio of the high-efficiency unit: site-specific.

Hours C = Equivalent full load cooling hours

EER\_ee = Energy Efficiency Ratio of the new efficient equipment: site-specific. For equipment < 5.4 tons, assume the following conversion: EER≈SEER/1.1

EER\_base = Energy Efficiency Ratio of baseline equipment: code. Since IECC 2012 does not provide EER requirements for equipment < 5.4 tons, assume the following conversion: EER ≈ SEER/1.1

#### Hours: N/A.

Hours Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

Hours Note: If site-specific data is unavailable, the average cooling EFLHs are taken as 855 hours while the average heating EFLHs are taken as 1137 hours.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu	
Split System AC to 5.4 tons	Calc	Calc	0.00	0.00	0.00	0.00	0.00	

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Split System AC to 5.4 tons	20	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Split System AC to 5.4 tons	11.30%	10.80%	39.40%	38.50%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

RRsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

RRwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Split System AC to 5.4 tons	0.00	0.00	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Split System AC to 5.4 tons	0.47	0.00	0.00	0.54

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

### **Transformers**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: TRNS
 Measure Sub Type: TRNS

Program: C02a Design 2000plus

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Transformers	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Transformers	multi	1.00	1.00		0.81	0.71	0.86		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Transformers	0.00%	0.00%	50.00%	50.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric

Installations

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Transformers	Calc	Calc	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Transformers	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.62 / Gross kWh

Incentive: \$0.40 / Gross kWh

# Unitary AC to 5.4 tons

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Unitary AC Measure Sub Type: AC to 5.4 tons

Program: C02a Design 2000plus

#### **Measure Description**

This measure applies to the installation of high-efficiency single package or split system air source, water source, ground source (closed loop) and groundwater source (open loop) heat pump systems for space conditioning applications.

### **Baseline Description**

Appendix A details the specific efficiency requirements by equipment type.

#### **Savings Principle**

The high efficiency case assumes the HVAC equipment exceeds the requirements of the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed unitary AC system for space cooling.

### **Savings Equation**

Gross kWh = Tons × (kBtu/hr per ton) × (1/SEER\_base - 1/SEER\_ee) × Hours\_C

Gross kW = Tons × (kBtu/hr per ton) × (1/EER\_base - 1/EER\_ee)

#### Where:

Tons = Rated cooling capacity of the installed equipment: site-specific.

12 kBtu/hr per ton = Conversion factor

SEER\_base = Seasonal Energy Efficiency Ratio of the baseline equipment: code

SEER ee = Seasonal energy efficiency ratio of the high-efficiency unit: site-specific.

Hours C = Equivalent full load cooling hours

EER\_ee = Energy Efficiency Ratio of the new efficient equipment: site-specific. For equipment < 5.4 tons, assume the following conversion: EER≈SEER/1.1

EER\_base = Energy Efficiency Ratio of baseline equipment: code. Since IECC 2012 does not provide EER requirements for equipment < 5.4 tons, assume the following conversion: EER ≈ SEER/1.1

#### Hours: N/A.

Hours Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

Hours Note: If site-specific data is unavailable, the average cooling EFLHs are taken as 855 hours while the average heating EFLHs are taken as 1137 hours.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Unitary AC to 5.4 tons	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Unitary AC to 5.4 tons	12	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Unitary AC to 5.4 tons	8.60%	4.60%	52.70%	34.10%

Measure Life Source: MA19C02-B-EUL - C&I Measure Life Report

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

RRsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

RRwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Unitary AC to 5.4 tons	0.00	0.00	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Unitary AC to 5.4 tons	0.47	0.00	0.00	0.53

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

# **Vending Miser - Glass Front Refrigerated Coolers**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Vending Miser Measure Type: Vending Miser Measure Sub Type: Vending Miser

Program: C02a Design 2000plus

#### **Measure Description**

Standard efficiency glass front refrigerated cooler with a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

### **Baseline Description**

The baseline efficiency case is a standard efficiency glass front refrigerated cooler without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

#### **Savings Principle**

The high efficiency case is a standard efficiency glass front refrigerated cooler without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

### **Savings Method**

Deemed

#### Unit

Installed vending miser.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: It is assumed that the connected equipment operates 24 hours per day, 7 days per week for a total annual operating hours of 8,760.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Vending Miser - Glass Front Refrigerated Coolers	1,208.0	0.1380	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Electric kW Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Vending Miser - Glass Front Refrigerated Coolers	5	1.00	1.00		1.00	1.00	1.00	0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Vending Miser - Glass Front Refrigerated Coolers	23.00%	27.00%	23.00%	27.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRsp Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRwp Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

CFsp Source: PY2019 C&I Free Ridership/Spillover study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Vending Miser - Glass Front Refrigerated Coolers	0.00	0.00	0.00	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Vending Miser - Glass Front Refrigerated Coolers	0.18	0.00	0.05	0.87

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.12 / Gross kWh

Incentive: \$0.09 / Gross kWh

# **Vending Miser - Non-Refrigerated Snack Vending Machines UPSTR**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Vending Miser Measure Type: Vending Miser Measure Sub Type: Vending Miser

Program: C02a Design 2000plus

### **Measure Description**

Standard efficiency non-refrigerated snack vending machine with a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

### **Baseline Description**

The baseline efficiency case is a standard efficiency nonrefrigerated snack vending machine without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

#### **Savings Principle**

The high efficiency case is a standard efficiency nonrefrigerated snack vending machine without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

### **Savings Method**

Deemed

#### Unit

Installed vending miser.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Vending Miser - Non- Refrigerated Snack Vending Machines UPSTR	343.0	0.0390	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Electric kW Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Vending Miser - Non-Refrigerated Snack Vending Machines UPSTR	5	1.00	1.00		1.00	1.00	1.00	0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Vending Miser - Non-Refrigerated Snack Vending Machines UPSTR	23.00%	27.00%	23.00%	27.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRsp Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRwp Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

CFsp Source: PY2019 C&I Free Ridership/Spillover study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Vending Miser - Non-Refrigerated Snack Vending Machines UPSTR	0.00	0.00	0.00	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Vending Miser - Non-Refrigerated Snack Vending Machines UPSTR	0.18	0.00	0.05	0.87

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.41 / Gross kWh

Incentive: \$0.32 / Gross kWh

# **Vending Miser - Refrigerated Beverage Vending Machines UPSTR**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Vending Miser Measure Type: Vending Miser Measure Sub Type: Vending Miser

Program: C02a Design 2000plus

### **Measure Description**

Standard efficiency refrigerated beverage vending machine with a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

### **Baseline Description**

The baseline efficiency case is a standard efficiency refrigerated beverage vending machine without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

#### Savings Principle

The high efficiency case is a standard efficiency refrigerated beverage vending machine with a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

### **Savings Method**

Deemed

#### Unit

Installed vending miser.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: It is assumed that the connected equipment operates 24 hours per day, 7 days per week for a total annual operating hours of 8,760.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Vending Miser - Refrigerated Beverage Vending Machines UPSTR	1,612.0	0.1840	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Electric kW Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Vending Miser - Refrigerated Beverage Vending Machines UPSTR	5	1.00	1.00		1.00	1.00	1.00	0.90	0.90

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Vending Miser - Refrigerated Beverage Vending Machines UPSTR	23.00%	27.00%	23.00%	27.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRsp Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRwp Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

CFsp Source: PY2019 C&I Free Ridership/Spillover study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Vending Miser - Refrigerated Beverage Vending Machines UPSTR	0.00	0.00	0.00	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Vending Miser - Refrigerated Beverage Vending Machines UPSTR	0.18	0.00	0.05	0.87

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.09 / Gross kWh

Incentive: \$0.07 / Gross kWh

# VSD Compressor (15<=HP<=75)

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Compressed Air Measure Type: Compressor Measure Sub Type: Variable Speed

**Drive Compressor** 

Program: C02a Design 2000plus

### **Measure Description**

The installation of oil flooded, rotary screw compressors with Variable Speed Drive capacity control schemes to improve compression efficiencies at partial loads, including a properly sized air receiver.

### **Baseline Description**

The baseline efficiency case is a typical load / unload compressor.

### **Savings Principle**

The high efficiency case is an oil-flooded, rotary screw compressor with Variable Speed Drive capacity control with a properly sized air receiver.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

kW saved per horsepower (hp) of installed air compressor capacity.

### **Savings Equation**

Gross kWh = HP\_compressor × deltakW/HP × Hours

Gross kW = HP\_compressor × deltakW/HP

Where:

HP\_compressor = Nominal rated horsepower of high efficiency air compressor: site-specific

Hours = Annual operating hours of the air compressor: site-specific

deltakW/HP = Air compressor kW reduction per HP

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis; RR adjusts for evaluation results.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
VSD Compressor (15<=HP<=75)	Calc	0.1900	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Algorithm Input kwh/horsepower based on NSTAR metering analysis and supported by multiple 3rd part impact evaluations.

Electric kW Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

Electric kW Note: kW/HP

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSD Compressor (15<=HP<=75)	15	1.00	1.00		1.41	1.00	1.00	1.05	0.83

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
VSD Compressor (15<=HP<=75)	24.50%	25.80%	24.50%	25.10%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

RRsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

RRwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFsp Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

CFwp Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
VSD Compressor (15<=HP<=75)	0.00	0.00	0.04	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
VSD Compressor (15<=HP<=75)	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

### **VSD-HVAC**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: VSD
 Measure Sub Type: HVAC

Program: C02a Design 2000plus

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
VSD-HVAC	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSD-HVAC	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
VSD-HVAC	23.70%	27.20%	23.80%	25.30%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
VSD-HVAC	Calc	Calc	0.02	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
VSD-HVAC	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.34 / Gross kWh

Incentive: \$0.22 / Gross kWh

### **VSD-NON HVAC**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: VSD Measure Sub Type: Non-HVAC

Program: C02a Design 2000plus

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
VSD-NON HVAC	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSD-NON HVAC	multi	1.00	1.00		0.83	0.67	0.85		

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
VSD-NON HVAC	23.70%	27.20%	23.80%	25.30%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

## **Non-Energy Impact Factors**

Measure	asure Water: Gallons		Annual \$	One-time \$
VSD-NON HVAC	Calc	Calc	0.02	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
VSD-NON HVAC	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.34 / Gross kWh

Incentive: \$0.22 / Gross kWh

## **Water Source Heat Pump**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heat Pumps Measure Sub Type: Ground Source

Program: C02a Design 2000plus

#### **Measure Description**

This measure applies to the installation of high-efficiency single package or split system air source, water source, ground source (closed loop) and groundwater source (open loop) heat pump systems for space conditioning applications.

### **Baseline Description**

Appendix A details the specific efficiency requirements by equipment type.

#### **Savings Principle**

The high efficiency case assumes a high-efficiency air cooled, water source, ground water source, or ground source heat pump system that exceeds the energy efficiency requirements of the International Energy Conservation Code (IECC) 2015.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed heat pump system for space cooling / heating.

### **Savings Equation**

Gross kWh = Tons  $\times$  (kBtu/hr per ton)  $\times$  [(1/SEER\_base - 1/SEER\_ee)  $\times$  Hours\_C + CR  $\times$  (1/HSPF\_base - 1/HSPF\_ee)  $\times$  Hours\_H] Gross kW = Tons  $\times$  (kBtu/hr per ton)  $\times$  (1/EER\_base - 1/EER\_ee)

#### Where:

Tons = Rated cooling capacity of the installed equipment: site-specific.

12 kBtu/hr per ton = Conversion factor

SEER\_base = Seasonal Energy Efficiency Ratio of the baseline equipment: code

SEER\_ee = Seasonal energy efficiency ratio of the high-efficiency unit: site-specific.

Hours C = Equivalent full load cooling hours

HSPF base = Heating Seasonal Performance Factor for baseline equipment: code

HSPF ee = Heating Seasonal Performance Factor for new efficient equipment: site-specific.

Hours\_H = Equivalent full load heating hours

CR = Capacity Ratio converts rated coolingcapacity to heating capacity. For equipment with cooling capacity ≤ 5.4 tons, assume CR=1. For equipment > 5.4 tons, assume CR=1.15; Optimal Energy, Inc. (2008). Memo:Non-Electric enefits Analysis Update. Prepared for Dave Weber, NSTAR.

EER base = EnergyEfficiency Ratio of baseline equipment.

EER\_ee = Energy Efficiency Ratio of the new efficient equipment: site-specific. For equipment < 5.4 tons, assume the following conversion: EER≈SEER/1.1

# Hours: N/A.

Hours Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

Hours Note: If site-specific data is unavailable, the average cooling EFLHs are taken as 855 hours while the average heating EFLHs are taken as 1137 hours.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Water Source Heat Pump	Calc	Calc	0.00	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Water Source Heat Pump	12	1.00	1.00		1.05	1.00	1.00	0.40	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Water Source Heat Pump	11.30%	10.80%	39.40%	38.50%

Measure Life Source: DNV GL (2018). Expected Useful Life (EUL) Estimation for Air-Conditioning Equipment from Current Age Distribution Memo.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 2, Energy Efficient HVAC and Process Cooling Equipment. Prepared for NE Power Service Co.

RRsp Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 2, Energy Efficient HVAC and Process Cooling Equipment. Prepared for NE Power Service Co.

RRwp Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 2, Energy Efficient HVAC and Process Cooling Equipment. Prepared for NE Power Service Co.

CFsp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

CFwp Source: KEMA (2011). C&I Unitary HVAC Load Shape Project Final Report. Prepared for the Regional Evaluation, Measurement and Verification Forum.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Water Source Heat Pump	0.00	0.00	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Water Source Heat Pump	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

### Zero Loss Condensate Drain

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Compressed Air Measure Type: Zero Loss Condensate Measure Sub Type: Zero Loss

Drains Condensate Drain

Program: C02a Design 2000plus

## **Measure Description**

Drains remove water from a compressed air system. Zero loss condensate drains remove water from a compressed air system without venting any air, resulting in less air demand and consequently greater efficiency.

### **Baseline Description**

The baseline efficiency case is the installation of a standard condensate drain on a compressor system.

### **Savings Principle**

The high efficiency case is the installation of a zero loss condensate drain on a single operating compressor rated <= 75 HP.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed drain.

### **Savings Equation**

Gross kWh = CFM\_pipe × deltaCFM/CFM\_pipe × deltakW/CFM × Hours

Gross kW = CFM pipe × deltaCFM/CFM pipe × deltakW/CFM

Where:

CFM\_pipe = CFM capacity of piping: site-specific

0.049 deltaCFM/CFM\_pipe = Average CFM saved per CFM of piping capacity

0.24386 deltakW/CFM = Average demand savings per CFM; Based on regional analysis assuming a typical timed drain settings discharge scenario.

Hours = Annual operating hours of the zero loss condensate drain: site-specific

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Zero Loss Condensate Drain	Calc	Calc	0.00	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Zero Loss Condensate Drain	15	1.00	1.00	•	1.00	1.00	1.00	0.80	0.54

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Zero Loss Condensate Drain	24.50%	25.80%	24.50%	25.10%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

RRsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

RRwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Zero Loss Condensate Drain	0.00	0.00	0.04	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Zero Loss Condensate Drain	0.28	0.02	0.02	0.76

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Building Operator Certification**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Whole Building Measure Type: BOC Training Measure Sub Type: Certification

Program: C03a Energy Initiative

### **Measure Description**

The Building Operator Certification (BOC) class improves operators' ability to optimize / minimize gas and electricity use in buildings.

## **Baseline Description**

The base case is a building operator without specific training on efficient use of gas and electricity in buildings.

### **Savings Principle**

The high efficiency case is a building operator attending a class on improving the efficiency of gas and electricity use in buildings.

### **Savings Method**

Deemed

#### Unit

kWh/SF/BOC completion

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Building Operator Certification	0.2	0.0000	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Navigant Consulting (2015). Comprehensive Review of Non-Residential Training and Education Programs, with a Focus on Building Operator Certification. Prepared for the Massachusetts PAs and EEAC

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Building Operator Certification	5	1.00	1.00		1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
<b>Building Operator Certification</b>	34.80%	34.80%	13.00%	17.40%	

Measure Life Source: Navigant Consulting (2015). Comprehensive Review of Non-Residential Training and Education Programs, with a Focus on Building Operator Certification. Prepared for the Massachusetts PAs and EEAC

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Building Operator Certification	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Building Operator Certification	0.00	0.00	0.00	1.00

# **Building Operator Certification + Capital Improvements**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Whole Building Measure Type: BOC Training Measure Sub Type: Certification +

capital improvements

Program: C03a Energy Initiative

### **Measure Description**

The Building Operator Certification (BOC) class improves operators' ability to optimize / minimize gas and electricity use in buildings.

### **Baseline Description**

The base case is a building operator without specific training on efficient use of gas and electricity in buildings.

#### Savings Principle

The high efficiency case is a building operator attending a class on improving the efficiency of gas and electricity use in buildings, as well as capital investments in EE projects.

### **Savings Method**

Deemed

#### Unit

kWh/SF/BOC completion

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Building Operator Certification + Capital Improvements	0.4	0.0000	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: Navigant Consulting (2015). Comprehensive Review of Non-Residential Training and Education Programs, with a Focus on Building Operator Certification. Prepared for the Massachusetts PAs and EEAC

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Building Operator Certification + Capital Improvements	5	1.00	1.00		1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Building Operator Certification + Capital Improvements	34.80%	34.80%	13.00%	17.40%

Measure Life Source: Navigant Consulting (2015). Comprehensive Review of Non-Residential Training and Education Programs, with a Focus on Building Operator Certification. Prepared for the Massachusetts PAs and EEAC

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Building Operator Certification + Capital Improvements	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Building Operator Certification + Capital Improvements	0.00	0.00	0.00	1.00

# **Comprehensive Retrofit (CR)**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Whole Building Measure Sub Type: Whole Building

Program: C03a Energy Initiative

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Comprehensive Retrofit (CR)	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Comprehensive Retrofit (CR)	multi	1.00	1.00		0.47	0.49	0.25	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Comprehensive Retrofit (CR)	0.00%	0.00%	50.00%	50.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI C&I Impact Evaluation of 2013-2015 Custom CDA
RRsp Source: RI C&I Impact Evaluation of 2013-2015 Custom CDA
RRwp Source: RI C&I Impact Evaluation of 2013-2015 Custom CDA

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Comprehensive Retrofit (CR)	0.00	0.00	0.06	0	

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Comprehensive Retrofit (CR)	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

### **Custom CHP**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: CHP
 Measure Sub Type: CHP

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

## **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom CHP	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom CHP	multi	1.00	1.00		1.00	1.00	1.00	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Custom CHP	31.00%	36.00%	15.00%	18.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Custom CHP	0.00	0.00	-0.01	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom CHP	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Custom Compressed Air**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Compressed Air Measure Sub Type: Compressed Air

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

Defined per project.

## **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom Compressed Air	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom Compressed Air	multi	1.00	1.00		0.83	0.67	0.85	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Custom Compressed Air	32.00%	34.70%	16.00%	17.30%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation
RRsp Source: PY2020 Custom Electric Impact Evaluation
RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Custom Compressed Air	0.00	0.00	0.06	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom Compressed Air	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.10 / Gross kWh

Incentive: \$0.08 / Gross kWh

### **Custom HVAC**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: HVAC
 Measure Sub Type: HVAC

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

### Unit

Installed custom energy-efficiency project.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu Gas custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom HVAC	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom HVAC	multi	1.00	1.00		0.83	0.67	0.85	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Custom HVAC	32.40%	34.30%	16.20%	17.20%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Custom HVAC	0.00	0.00	0.02	0	

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom HVAC	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.90 / Gross kWh
Incentive: \$0.50 / Gross kWh

# **Custom Lighting**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Lighting Measure Sub Type: Lighting

**Program:** C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom Lighting	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom Lighting	multi	1.00	1.00		0.95	0.94	0.75	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Custom Lighting	30.30%	17.40%	34.30%	18.10%

Measure Life Source: RI C&I Lighting Market and AML Update Study

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Custom Lighting	0.00	0.00	0.06	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom Lighting	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

### **Custom Motor**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Motor
 Measure Sub Type: Motor

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

# **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom Motor	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom Motor	multi	1.00	1.00		0.83	0.67	0.85	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Custom Motor	23.70%	27.20%	23.80%	25.30%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Custom Motor	0.00	0.00	0.02	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom Motor	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.42 / Gross kWh

Incentive: \$0.30 / Gross kWh

### **Custom Other**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Other
 Measure Sub Type: Other

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

# **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom Other	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom Other	multi	1.00	1.00		0.83	0.67	0.85	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Custom Other	35.20%	31.40%	17.60%	15.70%	

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation
RRsp Source: PY2020 Custom Electric Impact Evaluation
RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Custom Other	0.00	0.00	0.06	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom Other	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$1.04 / Gross kWh

Incentive: \$0.20 / Gross kWh

#### **Custom Process**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Process Measure Sub Type: Process

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom Process	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom Process	multi	1.00	1.00		0.81	0.71	0.86	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Custom Process	32.80%	33.90%	16.40%	16.90%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Custom Process	0.00	0.00	0.06	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom Process	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.34 / Gross kWh
Incentive: \$0.21 / Gross kWh

# **Custom Refrigeration**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Refrigeration Measure Sub Type: Refrigeration

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

# **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

# **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom Refrigeration	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom Refrigeration	multi	1.00	1.00		0.81	0.71	0.86	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Custom Refrigeration	22.60%	27.30%	23.00%	26.80%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Custom Refrigeration	0.00	0.00	0.05	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom Refrigeration	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.78 / Gross kWh

Incentive: \$0.44 / Gross kWh

# **Custom: SEM**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: SEM
 Measure Sub Type: SEM

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom: SEM	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom: SEM	3	1.00	1.00		1.00	1.00	1.00	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Custom: SEM	32.40%	34.30%	16.20%	17.10%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Custom: SEM	Calc	Calc	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom: SEM	0.00	0.00	0.00	1.00

# **Energy Management System**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Controls Measure Sub Type: Energy

Management System

Program: C03a Energy Initiative

### **Measure Description**

The measure is the installation of a new building energy management system (EMS) or the expansion of an existing energy management system for control of non-lighting electric and gas end-uses in an existing building on existing equipment.

### **Baseline Description**

The baseline case is the existing equipment and systems without the implemented controls.

#### Savings Principle

The high efficiency case is the installation of a new EMS or the expansion of an existing EMS to control additional non-lighting electric and/or gas equipment. The EMS must be installed in an existing building on existing equipment.

#### **Savings Method**

Calculated using site-specific inputs

### Unit

Upgrade to existing energy management system.

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Energy Management System	Calc	Calc	Calc	0.00	0.00	Calc	0.00

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Energy Management System	10	1.00	1.00		0.81	0.71	0.86	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Energy Management System	26.40%	16.60%	34.90%	22.10%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Energy Management System	0.00	0.00	0.02	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Energy Management System	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.54 / Gross kWh

Incentive: \$0.30 / Gross kWh

### **Food Service**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Food Service Measure Sub Type: Food Service

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Food Service	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Food Service	multi	1.00	1.00		0.83	0.67	0.85	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Food Service	0.00%	0.00%	50.00%	50.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Food Service	0.00	0.00	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Food Service	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$1.04 / Gross kWh
Incentive: \$0.35 / Gross kWh

### **Fuel Switch - DHW**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Fuel Switch
 Measure Sub Type: DHW

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Fuel Switch - DHW	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Fuel Switch - DHW	multi	1.00	1.00		0.83	0.67	0.85	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Fuel Switch - DHW	0.00%	0.00%	50.00%	50.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Fuel Switch - DHW	0.00	0.00	0	0	

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Fuel Switch - DHW	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

### **Fuel Switch - HVAC**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Fuel Switch
 Measure Sub Type: HVAC

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

# **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Fuel Switch - HVAC	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Fuel Switch - HVAC	multi	1.00	1.00		0.83	0.67	0.85	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Fuel Switch - HVAC	0.00%	0.00%	50.00%	50.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Fuel Switch - HVAC	0.00	0.00	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Fuel Switch - HVAC	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Glass Front Refrigerated Coolers**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Refrigeration Measure Type: Controls Measure Sub Type: Vending Miser

Program: C03a Energy Initiative

#### **Measure Description**

Controls can significantly reduce the energy consumption of vending machine lighting and refrigeration systems. Qualifying controls must power down these systems during periods of inactivity but, in the case of refrigerated machines, must always maintaina cool product that meets customer expectations. This measure applies to refrigerated beverage vending machines, non-refrigerated snack vending machines, and glass front refrigerated coolers. This measure should not be applied to ENERGY STAR® qualified vending machines, as they already have built-in controls.

### **Baseline Description**

The baseline efficiency case is a standard efficiency refrigerated beverage vending machine, non-refrigerated snack vending machine, or glass front refrigerated cooler without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

#### **Savings Principle**

The high efficiency case is a standard efficiency refrigerated beverage vending machine, non-refrigerated snack vending machine, or glass front refrigerated cooler with a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

#### Savings Method

Deemed

#### Unit

Installed vending miser.

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: It is assumed that the connected equipment operates 24 hours per day, 7 days per week for a total annual operating hours of 8,760.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Glass Front Refrigerated Coolers	1,208.0	0.1380	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Electric kW Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Glass Front Refrigerated Coolers	5	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Glass Front Refrigerated Coolers	26.40%	16.60%	34.90%	22.10%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

CFwp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Glass Front Refrigerated Coolers	0.00	0.00	0.11	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Glass Front Refrigerated Coolers	0.15	0.00	0.00	0.86

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Hotel Occupancy Sensor**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Occupancy

Sensor

Program: C03a Energy Initiative

### **Measure Description**

The measure is to the installation of hotel occupancy sensors (HOS) to control packaged terminal AC units (PTACs) with electric heat, heat pump units and/or fan coil units in hotels that operate all 12 months of the year.

### **Baseline Description**

The baseline efficiency case assumes the equipment has no occupancy based controls.

### **Savings Principle**

The high efficiency case is the installation of controls that include (a) occupancy sensors, (b) window/door switches for rooms that have operable window or patio doors, and (c) set back to 65 degrees Fahrenheit in the heating mode and set forward to 78 Fin the cooling mode when occupancy detector is in the unoccupied mode. Sensors controlled by a front desk system are not eligible.

### **Savings Method**

Deemed

#### Unit

Installed hotel occupancy sensor.

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Hotel Occupancy Sensor	438.0	0.0900	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: National Grid and NSTAR (2010). Energy Analysis: Hotel Guest Occupancy Sensors.

Electric kW Source: National Grid and NSTAR (2010). Energy Analysis: Hotel Guest Occupancy Sensors.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Hotel Occupancy Sensor	10	1.00	1.00		1.00	1.00	1.00	0.30	0.70

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Hotel Occupancy Sensor	26.40%	16.60%	34.90%	22.10%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Note: Coincidence factors are custom calculated based on project-specific detail.

CFwp Note: Coincidence factors are custom calculated based on project-specific detail.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Hotel Occupancy Sensor	0.00	0.00	0.11	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Hotel Occupancy Sensor	0.15	0.00	0.00	0.86

NTG Source: PY2019 C&I Free Ridership/Spillover study

### LED

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Upstream Measure Sub Type: LED Screw in

Program: C03a Energy Initiative

# **Measure Description**

The installation of efficient lighting discounted at the distribution level.

### **Baseline Description**

The baseline case is a mix of fluorescent and halogen fixtures for LEDs and low efficiency fluorescents for high efficiency fluorescents.

### **Savings Principle**

The high efficiency case is high efficiency LED. Please refer to Table 6 in Appendix A for wattage details.

# **Savings Method**

Deemed

#### Unit

Installed high-efficiency lighting project.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

Hours Note: The annual hours of operation are application specific and can be seen in Table 6: Upstream Lighting.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LED	Table 6	Table 6	0.00	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

Gas Heat MMBtu Note: NEI per kWh

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED	2	0.76	1.00		0.50	0.58	0.46	0.57	0.58

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LED	30.30%	17.40%	34.30%	18.10%

Measure Life Source: RI C&I Lighting Market and AML Update Study

Measure Life Note: Massachusetts Common Assumption

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

RRsp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

RRwp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

CFsp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

CFwp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LED	0.00	0.00	0.03	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LED	0.27	0.00	0.00	0.73

NTG Source: C&I upstream lighting updated based on 8/1 MA NTG concensus group email

TRC: \$0.83 / Gross kWh
Incentive: \$0.34 / Gross kWh

## **LED Exterior**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Upstream Measure Sub Type: LED Exterior

Program: C03a Energy Initiative

### **Measure Description**

The installation of efficient lighting discounted at the distribution level.

### **Baseline Description**

The baseline case is a mix of fluorescent and halogen fixtures for LEDs and low efficiency fluorescents for high efficiency fluorescents.

### **Savings Principle**

The high efficiency case is high efficiency LED. Please refer to Table 6 in Appendix A for wattage details.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency lighting project.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

Hours Note: The annual hours of operation are application specific and can be seen in Table 6: Upstream Lighting.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LED Exterior	Table 6	Table 6	0.00	0.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Exterior	5	0.76	1.00		0.95	0.95	0.95	0.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LED Exterior	30.30%	17.40%	34.30%	18.10%

Measure Life Source: RI C&I Lighting Market and AML Update Study

Measure Life Note: Massachusetts Common Assumption SPF Note: Savings persistence is assumed to be 100%.

RRe Source: P81 Process Evaluation of C&I Upstream Lighting Initiative [new ISRs]

RRsp Source: P81 Process Evaluation of C&I Upstream Lighting Initiative [new ISRs]

RRwp Source: P81 Process Evaluation of C&I Upstream Lighting Initiative [new ISRs]

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LED Exterior	0.00	0.00	0.03	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LED Exterior	0.27	0.00	0.00	0.73

NTG Source: C&I upstream lighting updated based on 8/1 MA NTG concensus group email

TRC: \$0.29 / Gross kWh
Incentive: \$0.10 / Gross kWh

# **LED High/Low Bay**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Upstream Measure Sub Type: LED High/Low

Bay

Program: C03a Energy Initiative

# **Measure Description**

The installation of efficient lighting discounted at the distribution level.

### **Baseline Description**

The baseline case is a mix of fluorescent and halogen fixtures for LEDs and low efficiency fluorescents for high efficiency fluorescents.

### **Savings Principle**

The high efficiency case is high efficiency LED. Please refer to Table 6 in Appendix A for wattage details.

# **Savings Method**

Deemed

#### Unit

Installed high-efficiency lighting project.

## **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

Hours Note: The annual hours of operation are application specific and can be seen in Table 6: Upstream Lighting.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu			Propane MMBtu
LED High/Low Bay	Table 6	Table 6	0.00	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED High/Low Bay	7	0.76	1.00	•	0.93	1.05	0.90	0.66	0.68

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LED High/Low Bay	30.30%	17.40%	34.30%	18.10%

Measure Life Source: RI C&I Lighting Market and AML Update Study

Measure Life Note: Massachusetts Common Assumption

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: P81 Process Evaluation of C&I Upstream Lighting Initiative [new ISRs]

RRsp Source: P81 Process Evaluation of C&I Upstream Lighting Initiative [new ISRs]

RRwp Source: P81 Process Evaluation of C&I Upstream Lighting Initiative [new ISRs]

CFsp Note: Not include in most recent evaluation; assumed same as stairwell fixtures.

CFwp Note: Not include in most recent evaluation; assumed same as stairwell fixtures.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LED High/Low Bay	0.00	0.00	0.03	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LED High/Low Bay	0.27	0.00	0.00	0.73

NTG Source: C&I upstream lighting updated based on 8/1 MA NTG concensus group email

TRC: \$0.43 / Gross kWh

Incentive: \$0.15 / Gross kWh

## **LED Stairwell**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Upstream Measure Sub Type: LED stairwell

Program: C03a Energy Initiative

#### **Measure Description**

The installation of efficient lighting discounted at the distribution level.

### **Baseline Description**

The baseline case is a mix of fluorescent and halogen fixtures for LEDs and low efficiency fluorescents for high efficiency fluorescents.

### **Savings Principle**

The high efficiency case is high efficiency LED. Please refer to Table 6 in Appendix A for wattage details.

# **Savings Method**

Deemed

#### Unit

Installed high-efficiency lighting project.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

Hours Note: The annual hours of operation are application specific and can be seen in Table 6: Upstream Lighting.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LED Stairwell	Table 6	Table 6	0.00	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

Gas Heat MMBtu Note: NEI per kWh

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Stairwell	7	0.76	1.00		0.86	0.86	0.86	0.66	0.68

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
LED Stairwell	30.30%	17.40%	34.30%	18.10%	

Measure Life Source: RI C&I Lighting Market and AML Update Study

Measure Life Note: Massachusetts Common Assumption

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

RRsp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

RRwp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

CFsp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

CFwp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LED Stairwell	0.00	0.00	0.03	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LED Stairwell	0.27	0.00	0.00	0.73

NTG Source: C&I upstream lighting updated based on 8/1 MA NTG concensus group email

TRC: \$0.66 / Gross kWh
Incentive: \$0.33 / Gross kWh

#### **LEDs**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: LEDS
 Measure Sub Type: LEDS

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

# **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LEDs	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LEDs	6	1.00	1.00		0.95	0.94	0.75	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LEDs	38.40%	28.20%	19.30%	14.10%

Measure Life Source: RI C&I Lighting Market and AML Update Study

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LEDs	0.00	0.00	0.06	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LEDs	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.83 / Gross kWh

Incentive: \$0.34 / Gross kWh

# **Lighting Controls**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Lighting Controls Measure Sub Type: Lighting Controls

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

# **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Lighting Controls	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Lighting Controls	9	1.00	1.00		0.95	0.94	0.75	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Lighting Controls	38.40%	28.20%	19.30%	14.10%

Measure Life Source: Dan Mellinger's Lighting Control Measure Life Memo

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Lighting Controls	0.00	0.00	0.10	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Lighting Controls	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.83 / Gross kWh
Incentive: \$0.55 / Gross kWh

## **Linear LED**

 Sector: C&I
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Lighting
 Measure Type: Upstream
 Measure Sub Type: LED Linear

Program: C03a Energy Initiative

#### **Measure Description**

The installation of efficient lighting discounted at the distribution level.

### **Baseline Description**

The baseline case is a mix of fluorescent and halogen fixtures for LEDs and low efficiency fluorescents for high efficiency fluorescents.

### **Savings Principle**

The high efficiency case is high efficiency LED. Please refer to Table 6 in Appendix A for wattage details.

# **Savings Method**

Deemed

#### Unit

Installed high-efficiency lighting project.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

Hours Note: The annual hours of operation are application specific and can be seen in Table 6: Upstream Lighting.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Linear LED	Table 6	Table 6	0.00	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

Gas Heat MMBtu Note: NEI per kWh

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Linear LED	6	0.76	1.00		0.98	1.10	0.95	0.80	0.59

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Linear LED	30.30%	17.40%	34.30%	18.10%	

Measure Life Source: RI C&I Lighting Market and AML Update Study

Measure Life Note: Massachusetts Common Assumption

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

RRsp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

RRwp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

CFsp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

CFwp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Linear LED	0.00	0.00	0.03	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Linear LED	0.37	0.00	0.00	0.63

NTG Source: C&I upstream lighting updated based on 8/1 MA NTG concensus group email

TRC: \$0.40 / Gross kWh
Incentive: \$0.08 / Gross kWh

# **Low Pressure Drop Filter**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Compressed Air Measure Type: Filter Measure Sub Type: Low pressure

drop filter

Program: C03a Energy Initiative

# **Measure Description**

Filters remove solids and aerosols from compressed air systems. Low pressure drop filters have longer lives and lower pressure drops than traditional coalescing filters resulting in higher efficiencies.

### **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is a low pressure drop filter with initial drop not exceeding 1 psi when new and 3 psi at element change. Filters must be deep-bed, "mist eliminator" style and installed on a single operating compressor rated 15 - 75 HP.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed filter.

### **Savings Equation**

Gross kWh = Qty × HP\_compressor × (kW per HP) × %SAVE × Hours

Gross  $kW = Qty \times HP\_compressor \times (kW per HP) \times %SAVE$ 

Where:

Qty = Number of filters installed: site-specific

HP\_compressor = Average compressor load: site-specific

kW per HP = Conversion factor

%SAVE = Percent change in pressure drop: site-specific

Hours = Annual operating hours of the lower pressure drop filter: site-specific

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low Pressure Drop Filter	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Algorithm Input kwh/horsepower based on NSTAR metering analysis and supported by multiple 3rd part impact evaluations.

Electric kW Note: Algorithm Input kwh/horsepower based on NSTAR metering analysis and supported by multiple 3rd part impact evaluations.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low Pressure Drop Filter	13	1.00	1.00		1.00	1.00	1.00	0.80	0.54

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Low Pressure Drop Filter	34.20%	28.90%	18.40%	18.40%	

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

RRsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

RRwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low Pressure Drop Filter	0.00	0.00	0.06	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low Pressure Drop Filter	0.15	0.00	0.00	0.86

NTG Source: PY2019 C&I Free Ridership/Spillover study

# Non-Refrigerated Snack Vending Machine

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Refrigeration Measure Type: Controls Measure Sub Type: Vending Miser

Program: C03a Energy Initiative

#### **Measure Description**

Controls can significantly reduce the energy consumption of vending machine lighting and refrigeration systems. Qualifying controls must power down these systems during periods of inactivity but, in the case of refrigerated machines, must always maintaina cool product that meets customer expectations. This measure applies to refrigerated beverage vending machines, non-refrigerated snack vending machines, and glass front refrigerated coolers. This measure should not be applied to ENERGY STAR® qualified vending machines, as they already have built-in controls.

### **Baseline Description**

The baseline efficiency case is a standard efficiency refrigerated beverage vending machine, non-refrigerated snack vending machine, or glass front refrigerated cooler without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

#### **Savings Principle**

The high efficiency case is a standard efficiency refrigerated beverage vending machine, non-refrigerated snack vending machine, or glass front refrigerated cooler with a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

### **Savings Method**

Deemed

### Unit

Installed vending miser.

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: It is assumed that the connected equipment operates 24 hours per day, 7 days per week for a total annual operating hours of 8,760.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Non-Refrigerated Snack Vending Machine	343.0	0.0390	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Electric kW Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Non-Refrigerated Snack Vending Machine	5	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Non-Refrigerated Snack Vending Machine	26.40%	16.60%	34.90%	22.10%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

CFwp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Non-Refrigerated Snack Vending Machine	0.00	0.00	0.11	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Non-Refrigerated Snack Vending Machine	0.15	0.00	0.00	0.86

NTG Source: PY2019 C&I Free Ridership/Spillover study

### **0&M**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: O & M Measure Sub Type: O & M

Program: C03a Energy Initiative

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

## **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
0&M	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
O&M	multi	1.00	1.00		0.83	0.67	0.85	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
0&M	0.00%	0.00%	50.00%	50.00%

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
0&M	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
O&M	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.34 / Gross kWh
Incentive: \$0.17 / Gross kWh

# **Packaged Terminal Heat Pumps (PTHP)**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heat Pumps Measure Sub Type: Heat Pump,

**Packaged Terminal** 

Program: C03a Energy Initiative

**Measure Description** 

Installation of a high efficiency PTHP to replace an existing PTAC.

**Baseline Description** 

The baseline is an existing PTAC.

**Savings Principle** 

The high efficiency case is a high efficiency PTHP.

Savings Method

Deemed

Unit

Per PTHP

**Savings Equation** 

Gross kWh = Qty × deltakW × Hours

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

DeltakW = Deemed average kW reduction per unit.

Hours = Deemed average annual operating hours.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Packaged Terminal Heat Pumps (PTHP)	1.0	0.0000	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Based on energy modeling of PNNL prototype buildings of small hotel, large hotel, and multifamily midrise

Electric kW Note: The peak demand occurs in the winter at low ambient temps when supplemental electrical resistance heat is operational. As a result, there is no max kW demand reduction going from PTAC to high efficiency PTHP (existing buildings) or code level PTHP to high

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Packaged Terminal Heat Pumps (PTHP)	8	1.00	1.00		1.00	1.00	1.00	0.06	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Packaged Terminal Heat Pumps (PTHP)	31.60%	33.40%	19.80%	15.20%

Measure Life Source: 'ComEd Effective Useful Life Research Report', May 2018

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization Rate is assumed 100%. RRwp Note: Realization Rate is assumed 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Packaged Terminal Heat Pumps (PTHP)	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Packaged Terminal Heat Pumps (PTHP)	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

TRC: \$0.39 / Gross kWh

Incentive: \$0.15 / Gross kWh

# **Prescriptive Lighting**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Lighting Measure Type: Prescriptive Measure Sub Type: Prescriptive

Program: C03a Energy Initiative

#### **Measure Description**

The Installation of efficient lighting discounted at the prescriptive level.

### **Baseline Description**

The baseline case is a mix of fluorescent and halogen fixtures for LEDs and low efficiency fluorescents for high efficiency fluorescents.

#### **Savings Principle**

The high efficiency case is high efficiency LED. Please refer to Table 6 in Appendix A for wattage details.

### **Savings Method**

Algorithm with site-specific inputs

#### Unit

Installed high-efficiency lighting project.

#### **Savings Equation**

Gross kWh = SUM[QTY\_i × Watts\_i × (Hours\_base\_i - Hours\_ee\_i)] / (Watts per kW)

Gross kW = SUM(QTY\_i × Watts\_i) / (Watts per kW)

Where:

QTY\_i = Quantity in controlled fixtures in location i

Watts\_i = Connected wattage of controlled fixtures in location i

Hours\_base\_i = Total annual hours that the connected lighting in location i operated without controls (for retrofit installations) or would have operated with code-compliance controls (for new construction installations).

Hours\_ee\_i = Total annual hours that the connected lighting in location i operates with the lighting controls implemented.

1,000 Watts per kW = Conversion factor

deltaMMBtu\_Gas/kWh = Gross natural gas MMBtu reduction per gross kWh saved.

deltaMMBtu\_Oil/kWh = Gross heating oil MMBtu reduction per gross kWh saved.

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Prescriptive Lighting	Table 6	Table 6	0.00	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

Gas Heat MMBtu Note: NEI per kWh

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Prescriptive Lighting	multi	1.00	1.00		20.00	20.00	20.00	0.49	0.99

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Prescriptive Lighting	30.30%	17.40%	34.30%	18.10%

Measure Life Source: RI C&I Lighting Market and AML Update Study

Measure Life Note: Massachusetts Common Assumption

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of 2011 Rhode Island Prescriptive Retrofit Lighting Installations. Prepared by KEMA. 10/2013

RRsp Source: Impact Evaluation of 2011 Rhode Island Prescriptive Retrofit Lighting Installations. Prepared by KEMA. 10/2013

RRwp Source: Impact Evaluation of 2011 Rhode Island Prescriptive Retrofit Lighting Installations. Prepared by KEMA. 10/2013

CFsp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

CFwp Source: Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Prescriptive Lighting	0.00	0.00	0.03	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Prescriptive Lighting	0.15	0.10	0.10	1.05

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Process Cooling**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Process Cooling Measure Sub Type: Process Cooling

Program: C03a Energy Initiative

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Process Cooling	Calc	Calc	0.00	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Process Cooling	multi	1.00	1.00		0.83	0.67	0.85	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Process Cooling	32.80%	33.90%	16.40%	16.90%

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Process Cooling	0.00	0.00	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Process Cooling	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.34 / Gross kWh
Incentive: \$0.30 / Gross kWh

# **Refrigerated Beverage Vending Machine**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Refrigeration Measure Type: Controls Measure Sub Type: Vending Miser

Program: C03a Energy Initiative

#### **Measure Description**

Controls can significantly reduce the energy consumption of vending machine lighting and refrigeration systems. Qualifying controls must power down these systems during periods of inactivity but, in the case of refrigerated machines, must always maintaina cool product that meets customer expectations. This measure applies to refrigerated beverage vending machines, non-refrigerated snack vending machines, and glass front refrigerated coolers. This measure should not be applied to ENERGY STAR® qualified vending machines, as they already have built-in controls.

### **Baseline Description**

The baseline efficiency case is a standard efficiency refrigerated beverage vending machine, non-refrigerated snack vending machine, or glass front refrigerated cooler without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

#### **Savings Principle**

The high efficiency case is a standard efficiency refrigerated beverage vending machine, non-refrigerated snack vending machine, or glass front refrigerated cooler with a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

### **Savings Method**

Deemed

### Unit

Installed vending miser.

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: It is assumed that the connected equipment operates 24 hours per day, 7 days per week for a total annual operating hours of 8,760.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Refrigerated Beverage Vending Machine	1,612.0	0.1840	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Electric kW Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Refrigerated Beverage Vending Machine	5	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Refrigerated Beverage Vending Machine	26.40%	16.60%	34.90%	22.10%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

CFwp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

# **Non-Energy Impact Factors**

Measure	Water: Gallons Sewer: Gallons		Annual \$	One-time \$	
Refrigerated Beverage Vending Machine	0.00	0.00	0.11	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Refrigerated Beverage Vending Machine	0.15	0.00	0.00	0.86

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Street Lighting**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Street Lights Measure Sub Type: Street lighting

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

## **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Street Lighting	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Street Lighting	5	1.00	1.00		0.95	0.94	0.75	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Street Lighting	15.00%	52.00%	7.00%	26.00%

Measure Life Source: RI C&I Lighting Market and AML Update Study

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Street Lighting	0.00	0.00	0.06	0	

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Street Lighting	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.83 / Gross kWh

Incentive: \$0.24 / Gross kWh

# **Street Lighting with Controls**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Street Lights Measure Sub Type: Street lighting

w/controls

Program: C03a Energy Initiative

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Completed custom project

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Street Lighting with Controls	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Street Lighting with Controls	6	1.00	1.00		0.95	0.94	0.75	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Street Lighting with Controls	15.00%	52.00%	7.00%	26.00%

Measure Life Source: RI C&I Lighting Market and AML Update Study

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Street Lighting with Controls	0.00	0.00	0.10	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Street Lighting with Controls	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.83 / Gross kWh
Incentive: \$0.29 / Gross kWh

### **Transformers**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Tranformers Measure Sub Type: Tranformers

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

## **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Transformers	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Transformers	multi	1.00	1.00		0.81	0.71	0.86	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Transformers	0.00%	0.00%	50.00%	50.00%	

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Transformers	0.00	0.00	0	0	

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Transformers	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$1.04 / Gross kWh

Incentive: \$0.35 / Gross kWh

# **Verified Savings**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Verified savings Measure Sub Type: Verified savings

Program: C03a Energy Initiative

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

## **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Verified Savings	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Verified Savings	multi	1.00	1.00		0.81	0.71	0.86	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Verified Savings	0.00%	0.00%	50.00%	50.00%

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRsp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

RRwp Source: RI-19-CE-CustElec and RI-20-CE-CustElecPY19 - Impact Evaluation of PY2018 and PY2019 Custom Electric Installations

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Verified Savings	0.00	0.00	0	0	

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Verified Savings	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

# VSD Compressor up to 75 HP

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Compressed Air Measure Type: Compressor Measure Sub Type: VSD compressor

up to 75 HP

Program: C03a Energy Initiative

### **Measure Description**

The installation of oil flooded, rotary screw compressors with Variable Speed Drive capacity control schemes to improve compression efficiencies at partial loads, including a properly sized air receiver.

### **Baseline Description**

Defined per project.

#### **Savings Principle**

The high efficiency case is an oil-flooded, rotary screw compressor with Variable Speed Drive capacity control with a properly sized air receiver.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

kW saved per horsepower (hp) of installed air compressor capacity.

# **Savings Equation**

Gross kWh = HP\_compressor × deltakW/HP × Hours

Gross kW = HP\_compressor × deltakW/HP

Where:

HP\_compressor = Nominal rated horsepower of high efficiency air compressor: site-specific

Hours = Annual operating hours of the air compressor: site-specific

deltakW/HP = Air compressor kW reduction per HP

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis; RR adjusts for evaluation results.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
VSD Compressor up to 75 HP	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Algorithm Input kwh/horsepower based on NSTAR metering analysis and supported by multiple 3rd part impact evaluations.

Electric kW Note: Algorithm Input kwh/horsepower based on NSTAR metering analysis and supported by multiple 3rd part impact evaluations.

# **Energy Impact Factors**

October 2022

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSD Compressor up to 75 HP	13	1.00	1.00		1.41	1.00	1.00	1.05	0.83

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
VSD Compressor up to 75 HP	25.50%	25.50%	24.60%	24.30%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

RRsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

RRwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFsp Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

CFwp Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
VSD Compressor up to 75 HP	0.00	0.00	0.06	0

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
VSD Compressor up to 75 HP	0.15	0.00	0.00	0.86

NTG Source: PY2019 C&I Free Ridership/Spillover study

## **VSD-HVAC**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Custom
 Measure Type: VSD
 Measure Sub Type: HVAC

Program: C03a Energy Initiative

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
VSD-HVAC	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSD-HVAC	multi	1.00	1.00		0.83	0.67	0.85	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
VSD-HVAC	23.70%	27.20%	23.80%	25.30%	

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
VSD-HVAC	0.00	0.00	0.02	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
VSD-HVAC	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.42 / Gross kWh Incentive: \$0.35 / Gross kWh

## **VSD-NON HVAC**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: VSD Measure Sub Type: Non-HVAC

Program: C03a Energy Initiative

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

Defined per project.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

# **Savings Method**

Custom

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
VSD-NON HVAC	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSD-NON HVAC	multi	1.00	1.00		0.83	0.67	0.85	Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
VSD-NON HVAC	23.70%	27.20%	23.80%	25.30%

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Electric Impact Evaluation

RRsp Source: PY2020 Custom Electric Impact Evaluation

RRwp Source: PY2020 Custom Electric Impact Evaluation

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on

project-specific information.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
VSD-NON HVAC	0.00	0.00	0.02	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
VSD-NON HVAC	0.36	0.01	0.01	0.65

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.42 / Gross kWh

Incentive: \$0.35 / Gross kWh

## **Zero Loss Drain**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Compressed Air Measure Type: Drain Measure Sub Type: Zero Loss Drain

Program: C03a Energy Initiative

### **Measure Description**

Drains remove water from a compressed air system. Zero loss condensate drains remove water from a compressed air system without venting any air, resulting in less air demand and consequently greater efficiency.

### **Baseline Description**

Defined per project.

#### **Savings Principle**

The high efficiency case is the installation of a zero loss condensate drain on a single operating compressor rated <= 75 HP.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed drain.

#### **Savings Equation**

Gross kWh = CFM\_pipe × deltaCFM/CFM\_pipe × deltakW/CFM × Hours

Gross kW = CFM\_pipe × deltaCFM/CFM\_pipe × deltakW/CFM

Where:

CFM\_pipe = CFM capacity of piping: site-specific

0.049 deltaCFM/CFM\_pipe = Average CFM saved per CFM of piping capacity

0.24386 deltakW/CFM = Average demand savings per CFM; Based on regional analysis assuming a typical timed drain settings discharge scenario.

Hours = Annual operating hours of the zero loss condensate drain: site-specific

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Zero Loss Drain	Calc	Calc	0.00	0.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Zero Loss Drain	13	1.00	1.00		1.00	1.00	1.00	0.80	0.54

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Zero Loss Drain	34.20%	28.90%	18.40%	18.40%	

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

RRsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

RRwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFsp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

CFwp Source: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid. Results analyzed in RLW Analytics (2006). Sample Design and Impact Evaluation.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Zero Loss Drain	0.00	0.00	0.06	0	

Annual \$ Source: Tetra Tech (2012). Final Report – Commercial and Industrial Non-Energy Impacts Study. Prepared for the MA Program Administrators.

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Zero Loss Drain	0.15	0.00	0.00	0.86

NTG Source: PY2019 C&I Free Ridership/Spillover study

### **CUSTOM LIGHTING**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Lighting Measure Sub Type: Lighting

Program: C03b Small Customers under 200kW

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
CUSTOM LIGHTING	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CUSTOM LIGHTING	13	1.00	1.00		1.05	1.18	1.03	0.46	0.50

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
CUSTOM LIGHTING	30.30%	17.40%	34.30%	18.10%

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I RRsp Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I RRwp Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I CFsp Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I CFwp Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
CUSTOM LIGHTING	0.00	0.00	0	0

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CUSTOM LIGHTING	0.12	0.00	0.00	0.88

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.86 / kWh
Incentive: \$0.60 / kWh

#### **CUSTOM REFRIGERATION**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Custom Measure Type: Refrigeration Measure Sub Type: Refrigeration

Program: C03b Small Customers under 200kW

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

### Unit

Installed custom energy-efficiency project.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
CUSTOM REFRIGERATION	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CUSTOM REFRIGERATION	13	1.00	1.00		1.05	1.49	0.69	1.49	0.69

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
CUSTOM REFRIGERATION	39.30%	27.40%	19.60%	13.70%

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRsp Source: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

RRwp Source: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

CFsp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

CFwp Note: For all custom projects, gross summer and winter peak coincidence factors are custom-calculated based on project-specific information.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
CUSTOM REFRIGERATION	0.00	0.00	0	0	

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CUSTOM REFRIGERATION	0.29	0.00	0.00	0.71

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$1.72 / kWh

Incentive: \$1.20 / kWh

### **Door Heater Control**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Refrigeration Measure Type: Controls Measure Sub Type: Door Heater

Control

Program: C03b Small Customers under 200kW

# **Measure Description**

The Installation of controls to reduce the run time of door and frame heaters for freezers and walk-in or reach-in coolers. The reduced heating also results in a reduced cooling load.

# **Baseline Description**

The baseline efficiency case is a cooler or freezer door heater that operates 8,760 hours per year without any controls.

#### Savings Principle

The high efficiency case is a cooler or freezer door heater connected to a heater control system, which controls the door heaters by calculating the dew point of the store, and controlling the anti-sweat heater based on specific algorithms for freezer and cooler doors.

# **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed door heater controls on existing cooler/freezer.

### **Savings Equation**

Gross kWh = kW\_DoorHeater × %OFF × Hours

Gross kW = kW\_DoorHeater × %OFF

Where:

kW\_DoorHeater = Total demand of the door heater, calculated as Volts \* Amps / 1000: site-specific

%OFF = Door heater Off time: 46% for freezer door heaters or 74% for cooler door heaters

Hours = Door heater annual run hours before controls

Hours: N/A.

Hours Note: Pre-retrofit hours are 8,760 hours per year. After controls are installed, the door heaters in freezers are on for an average 4,730.4 hours/year (46% off time) and the door heaters for coolers are on for an average 2,277.6 hours/year (74% off time) basedon National Resource Management field experience.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Door Heater Control	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Algorithm Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorithm Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Door Heater Control	10	1.00	1.00		1.05	1.00	1.00	0.44	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Door Heater Control	39.30%	27.40%	19.60%	13.70%	

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRsp Note: Realization rate is assumed 100% because savings are based on researched assumptions.

RRwp Note: Realization rate is assumed 100% because savings are based on researched assumptions.

CFsp Source: Cadmus, "Commercial Refrigeration Load shape Project Final Report", Northeast Energy Efficiency Partnership, Regional Evaluation, Measurement, and Verification Forum, Lexington, MA, 2015 (table 39)

CFwp Source: HEC, Inc. (1995). Analysis of Door Master Walk-In Cooler Anti-Sweat Door Heater Controls Installed at 10 Sites in MA. Prepared for NEPSCo; Table 9.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Door Heater Control	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Door Heater Control	0.29	0.00	0.00	0.71

# **ECM Evaporator Fan Motors (Walk-in Coolers/Freezers)**

 Sector: C&I
 Fuel: Electric
 Program Type: Custom

 Measure Category: Refrigeration
 Measure Type: Motors
 Measure Sub Type: ECM

Program: C03b Small Customers under 200kW

### **Measure Description**

Installation of electronically commutated motors (ECMs) in multi-deck and freestanding coolers and freezers, typically on the retail floor of convenience stores, liquor stores, and grocery stores.

# **Baseline Description**

The baseline efficiency case is the existing case motor.

### **Savings Principle**

The high efficiency case is the replacement of the existing case motor with an ECM.

# **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed electronically commutated motor for evaporator fans in existing cooler/freezer.

### **Savings Equation**

Gross kWh = kW\_Fan × LRF × Hours × (1 + RefrigEff × (Btu/hr per kW) / (Btu/hr per ton))

Gross kW = Gross kWh / Hours

Where:

kW\_Fan = Power demand of evaporator fan calculated from equipment nameplate data and estimated 0.55 power factor/adjustment

LRF = Load reduction factor for motor replacement

Hours = Annual fan operating hours: site-specific

1.6 RefrigEff = Efficiency of typical refrigeration system (kW/ton); Estimate based on NRM field experience.

3413 Btu/hr per kW = Conversion factor

12,000 Btu/hrper ton = Conversion factor

Hours: N/A.

Hours Note: The annual operating hours are assumed to be 8,760 \* (1-%OFF), where %OFF = 0 if the facility does not have evaporator fan controls or %OFF > 0 if the facility has evaporator fan controls.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ECM Evaporator Fan Motors (Walk-in Coolers/Freezers)	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Algorithm Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorithm Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ECM Evaporator Fan Motors (Walk-in Coolers/Freezers)	15	1.00	0.00		1.05	1.00	1.00	0.87	0.51

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
ECM Evaporator Fan Motors (Walk- in Coolers/Freezers)	23.70%	27.20%	23.80%	25.30%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRsp Source: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

RRwp Source: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

CFsp Source: RLW Analytics (2007). Impact Evaluation Analysis of the 2005 Custom SBS Program. Prepared for National Grid. Derivation based on site specific results from the study adjusted for current on peak hours.

CFwp Source: RLW Analytics (2007). Impact Evaluation Analysis of the 2005 Custom SBS Program. Prepared for National Grid. Derivation based on site specific results from the study adjusted for current on peak hours.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
ECM Evaporator Fan Motors (Walk-in Coolers/Freezers)	0.00	0.00	0.02	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ECM Evaporator Fan Motors (Walk-in Coolers/Freezers)	0.29	0.00	0.00	0.71

# **Fan Control**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Refrigeration Measure Type: Controls Measure Sub Type: Fan Control

Program: C03b Small Customers under 200kW

### **Measure Description**

Installation of controls to modulate the evaporator fans based on temperature control. Energy savings include: fan energy savings from reduced fan operating hours, refrigeration energy savings from reduced waste heat, and compressor energy savings resulting from the electronic temperature control.

# **Baseline Description**

The baseline efficiency case assumes evaporator fans that run 8760 annual hours with no temperature control.

### **Savings Principle**

The high efficiency case is the use of an energy management system to control evaporator fan operation based on temperature.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed controls on evaporator fans in existing cooler/freezer.

### **Savings Equation**

Gross kWh = kW\_Fan  $\times$  %OFF  $\times$  (Hours per year)  $\times$  (1 + RefrigEff  $\times$  (Btu/hr per kW) / (Btu/hr per ton)) + [kW\_cp  $\times$  Hours\_cp + kW\_fan  $\times$  (Hours per year)  $\times$  (1-%OFF)]  $\times$  %SAVE

Gross kW = Gross kWh / Hours

Where:

kW\_Fan = Power demand of evaporator fan calculatedfrom equipment nameplate data and estimated 0.55 power factor/adjustment

%OFF\_heater = Door heater Off time: 46% for freezer door heaters or 74% for cooler door heaters

8760 Hours per year = Conversion factor

1.6 RefrigEff = Efficiency of typical refrigeration system (kW/ton); Estimate based on NRM field experience.

3,413 Btu/hr per kW = Conversion factor

12 kBtu/hr per ton = Conversion factor

kW\_cp = Total power demand of compressor motor and condenser fan calculated from equipment nameplate data and estimated 0.85 power factor

Hours cp = Equivalent annual full load hours of compressor operation; Estimate based on NRM field experience.

%OFF\_evap = Percent of annual hours that the evaporator is turned off; Estimate based on NRM field experience.

%SAVE = Reduced run-time of compressor and evaporator due to electronic controls; Estimate based on NRM field experience.

Hours: 4,072.0.

Hours Note: The average annual operating hours are 4072 hours/year, based on National Resource Management field experience.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Fan Control	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Calculation assumptions based off of NRM field experience and data.

Electric kW Note: Calculation assumptions based off of NRM field experience and data.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Fan Control	10	1.00	1.00		1.05	1.00	1.00	0.23	0.84

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Fan Control	39.30%	27.40%	19.60%	13.70%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRsp Source: HEC, Inc. (1996). Analysis of Savings from Walkiin Cooler Air Economizers and Evaporator Fan Controls. Prepared for NEPSco.

RRwp Source: HEC, Inc. (1996). Analysis of Savings from Walkiin Cooler Air Economizers and Evaporator Fan Controls. Prepared for NEPSco.

CFsp Source: HEC, Inc. (1995). Analysis of Door Master Walk-In Cooler Anti-Sweat Door Heater Controls Installed at 10 Sites in MA. Prepared for NEPSCo; Table 9.

CFwp Source: HEC, Inc. (1995). Analysis of Door Master Walk-In Cooler Anti-Sweat Door Heater Controls Installed at 10 Sites in MA. Prepared for NEPSCo; Table 9.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Fan Control	0.00	0.00	0.00	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Fan Control	0.29	0.00	0.00	0.71

# **Faucet Aerator**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: C03b Small Customers under 200kW

# **Measure Description**

The installation of a high efficiency water heating measures, such as faucet aerators, showerheads, spray valves, and salon nozzles.

# **Baseline Description**

Standard efficiency DHW fixture.

# **Savings Principle**

High efficiency / low flow DHW fixture.

# **Savings Method**

Deemed

# Unit

Installed salon aerator

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Faucet Aerator	387.4	0.0700	0.00	0.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Faucet Aerator	5	1.00	1.00	•	1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Faucet Aerator	41.50%	31.40%	15.20%	11.90%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

CFwp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Faucet Aerator	5460.00	5460.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Faucet Aerator	0.29	0.00	0.00	0.71

### Freezer Door Heater Controls

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Refrigeration Measure Type: Controls Measure Sub Type: Door Heater

Control

Program: C03b Small Customers under 200kW

# **Measure Description**

The Installation of controls to reduce the run time of door and frame heaters for freezers and walk-in or reach-in coolers. The reduced heating also results in a reduced cooling load.

# **Baseline Description**

The baseline efficiency case is a cooler or freezer door heater that operates 8,760 hours per year without any controls.

#### Savings Principle

The high efficiency case is a cooler or freezer door heater connected to a heater control system, which controls the door heaters by calculating the dew point of the store, and controlling the anti-sweat heater based on specific algorithms for freezer and cooler doors.

# **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed door heater controls on existing cooler/freezer.

### **Savings Equation**

Gross kWh = kW\_DoorHeater × %OFF × Hours

Gross kW = kW\_DoorHeater × %OFF

Where:

kW\_DoorHeater = Total demand of the door heater, calculated as Volts \* Amps / 1000: site-specific

%OFF = Door heater Off time: 46% for freezer door heaters or 74% for cooler door heaters

Hours = Door heater annual run hours before controls

Hours: N/A.

Hours Note: Pre-retrofit hours are 8,760 hours per year. After controls are installed, the door heaters in freezers are on for an average 4,730.4 hours/year (46% off time) and the door heaters for coolers are on for an average 2,277.6 hours/year (74% off time) basedon National Resource Management field experience.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Freezer Door Heater Controls	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Algorithm Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorithm Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Freezer Door Heater Controls	10	1.00	1.00		1.05	1.00	1.00	0.44	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Freezer Door Heater Controls	39.30%	27.40%	19.60%	13.70%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRsp Note: Realization rate is assumed 100% because savings are based on researched assumptions.

RRwp Note: Realization rate is assumed 100% because savings are based on researched assumptions.

CFsp Source: Cadmus, "Commercial Refrigeration Load shape Project Final Report", Northeast Energy Efficiency Partnership, Regional Evaluation, Measurement, and Verification Forum, Lexington, MA, 2015 (table 39)

CFwp Source: HEC, Inc. (1995). Analysis of Door Master Walk-In Cooler Anti-Sweat Door Heater Controls Installed at 10 Sites in MA. Prepared for NEPSCo; Table 9.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Freezer Door Heater Controls	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Freezer Door Heater Controls	0.29	0.00	0.00	0.71

# **LED Exit Signs**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Signage Measure Sub Type: Exit Sign LED

Program: C03b Small Customers under 200kW

# **Measure Description**

The installation of an LED exit sign.

# **Baseline Description**

For retrofit installations, the baseline efficiency case is project-specific and is determined using actual fixture types and counts from the existing space. For lost opportunity installations, the baseline case is based on comparable code-compliant installations and standard practices.

# **Savings Principle**

The high efficiency case is the installation of LED exit signs.

# **Savings Method**

Calculated using site-specific inputs

### Unit

Installed high-efficiency lighting project.

### **Savings Equation**

Gross kWh = [SUM(QTY\_base\_i × Watts\_base\_i) - SUM(QTY\_ee\_j × Watts\_ee\_j)] / (Watts per kW) × Hours

Gross kW = [SUM(QTY\_base\_i × Watts\_base\_i) - SUM(QTY\_ee\_j × Watts\_ee\_j)] / (Watts per kW)

Where:

QTY\_base\_i = Quantity of baseline fixtures in location i

Watts\_base\_i = Connected wattage of baseline fixtures in location i

QTY\_ee\_j = Quantity of efficient fixtures in location j

Watts\_ee\_j = Connected wattage of efficient fixtures in location j

1,000 Watts per kW = Conversion factor

Hours = Lighting annual hours of operation: site-specific.

deltaMMBtu Gas/kWh = Gross natural gas MMBtu reduction per gross kWh saved.

deltaMMBtu\_Oil/kWh = Gross heating oil MMBtu reduction per gross kWh saved.

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LED Exit Signs	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Exit Signs	6	1.00	1.00		1.03	0.98	0.98	0.62	0.44

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LED Exit Signs	30.30%	17.40%	34.30%	18.10%

Measure Life Source: RI C&I Lighting Market and AML Update Study

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Summit Blue Consulting (2008). Large Commercial and Industrial Retrofit Program Impact Evaluation 2007. Prepared for National Grid.

RRsp Source: Summit Blue Consulting (2008). Large Commercial and Industrial Retrofit Program Impact Evaluation 2007. Prepared for National Grid.

RRwp Source: Summit Blue Consulting (2008). Large Commercial and Industrial Retrofit Program Impact Evaluation 2007. Prepared for National Grid.

CFsp Note: Coincidence Factors are assumed to be 1.0 since exit signs are on 8,760 hours a year.

CFwp Note: Coincidence Factors are assumed to be 1.0 since exit signs are on 8,760 hours a year.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LED Exit Signs	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LED Exit Signs	0.12	0.00	0.00	0.88

# **LED EXTERIOR - HW**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Exterior Measure Sub Type: LED Fixture

Program: C03b Small Customers under 200kW

# **Measure Description**

The installation of hardwired ENERGY STAR® LED outdoor fixtures with pin-based bulbs. Savings for this measure are attributable to high efficiency outdoor lighting fixtures and are treated similarly to indoor fixtures.

# **Baseline Description**

Lighting baseline mix.

# **Savings Principle**

The high efficiency case is the installation of LED lighting fixtures.

# **Savings Method**

Calculated using deemed inputs

### Unit

**Installed LED fixtures** 

# **Savings Equation**

Gross kWh = Qty × deltakW × Hours

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

DeltakW = Deemed average kW reduction per unit.

Hours = Deemed average annual operating hours.

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
LED EXTERIOR - HW	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: DNV GL (2015) RI Small Business EE Program Prescriptive Lighting Study

Oil MMBtu Source: DNV GL (2015) RI Small Business EE Program Prescriptive Lighting Study

Propane MMBtu Source: DNV GL (2015) RI Small Business EE Program Prescriptive Lighting Study

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED EXTERIOR - HW	5	1.00	1.00		1.05	1.18	1.03	0.46	0.50

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
LED EXTERIOR - HW	30.30%	17.40%	34.30%	18.10%

Measure Life Source: RI C&I Lighting Market and AML Update Study

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I
RRsp Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I
RRwp Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I
CFsp Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I
CFwp Source: DNV GL (2015) RI Small Business EE Program Prescriptive Lighting Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
LED EXTERIOR - HW	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
LED EXTERIOR - HW	0.12	0.00	0.00	0.88

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.86 / kWh

Incentive: \$0.60 / kWh

# **Lighting Systems**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Interior Measure Sub Type: Efficient Lighting

Program: C03b Small Customers under 200kW

### **Measure Description**

This measure promotes the installation of efficient lighting including, but not limited to, efficient fluorescent lamps, ballasts, and fixtures, solid state lighting, and efficient high intensity discharge (HID) lamps, ballasts, and fixtures.

### **Baseline Description**

For retrofit installations, the baseline efficiency case is project-specific and is determined using actual fixture types and counts from the existing space. Existing fixture wattages are provided in the Table 4 of Appendix A. For lost opportunity installations, the baseline case is based on comparable code-compliant installations and standard practices.

### **Savings Principle**

For both new construction and retrofit installations, the high efficiency case is project-specific and is

determined using actual fixture counts for the project and wattages found in Tables 3 and 5 in Appendix A.

# **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed high-efficiency lighting project.

### **Savings Equation**

Gross kWh = [SUM(QTY\_base\_i × Watts\_base\_i) - SUM(QTY\_ee\_j × Watts\_ee\_j)] / (Watts per kW) × Hours

Gross kW = [SUM(QTY\_base\_i × Watts\_base\_i) - SUM(QTY\_ee\_j × Watts\_ee\_j)] / (Watts per kW)

Where:

QTY\_base\_i = Quantity of baseline fixtures in location i

Watts\_base\_i = Connected wattage of baseline fixtures in location i

QTY ee j = Quantity of efficient fixtures in location j

Watts\_ee\_j = Connected wattage of efficient fixtures in location j

1,000 Watts per kW = Conversion factor

Hours = Lighting annual hours of operation: site-specific.

deltaMMBtu\_Gas/kWh = Gross natural gas MMBtu reduction per gross kWh saved.

deltaMMBtu\_Oil/kWh = Gross heating oil MMBtu reduction per gross kWh saved.

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Lighting Systems	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Lighting Systems	6	1.00	1.00		1.05	1.18	1.03	0.46	0.50

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Lighting Systems	30.30%	17.40%	34.30%	18.10%

Measure Life Source: Nexus Market Research and RLW Analytics (2004). Impact Evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I RRsp Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I RRwp Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I CFsp Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I CFwp Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Lighting Systems	0.00	0.00	0	0	

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Lighting Systems	0.12	0.00	0.00	0.88

# Low-Flow Showerhead

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: C03b Small Customers under 200kW

# **Measure Description**

Installation of a low flow showerhead with a flow rate of 1.5 GPM or less in a commercial setting with service water heated by electricity.

# **Baseline Description**

The baseline efficiency case is a 2.5 GPM showerhead.

# **Savings Principle**

The high efficiency case is a 1.5 GPM showerhead.

# **Savings Method**

Deemed

### Unit

Installed low-flow showerhead

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow Showerhead	1,185.0	0.2000	0.00	0.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow Showerhead	10	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Flow Showerhead	41.50%	31.40%	15.20%	11.90%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

CFwp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low-Flow Showerhead	7300.00	7300.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead	0.29	0.00	0.00	0.71

# **Novelty Cooler Shutoff**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Refrigeration Measure Type: Controls Measure Sub Type: Novelty Cooler

Control

Program: C03b Small Customers under 200kW

# **Measure Description**

Installation of controls to shut off a facility's novelty coolers for non-perishable goods based on pre-programmed store hours. Energy savings occur as coolers cycle off during facility unoccupied hours.

# **Baseline Description**

The baseline efficiency case is the novelty coolers operating 8,760 hours per year.

#### Savings Principle

The high efficiency case is the novelty coolers operating fewer than 8,760 hours per year since they are controlled to cycle each night based on pre-programmed facility unoccupied hours.

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Installed controls on existing cooler/freezer.

### **Savings Equation**

Gross kWh = kW nc × DC nc × HoursOff

Gross kW = 0

Where:

kW nc = Power demand of novelty cooler calculated from equipment nameplate data and estimated 0.85 power factor.

DC\_nc = Weighted average annual duty cycle; Estimate based on NRM field experience.

HoursOff = Potential hours off every night per year, estimated as one less than the number of hours the store is closed per day: site-specific.

Hours: N/A.

Hours Note: Energy and demand savings are based on the reduced operation hours of the cooler equipment. Hours reduced per day are estimated on a case-by-case basis, and are typically calculated as one less than the number of hours per day that the facility is closed; the baseline assumes equipment operated 24/7/365.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Novelty Cooler Shutoff	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Algorithm Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorithm Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Novelty Cooler Shutoff	10	1.00	1.00		1.05	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Novelty Cooler Shutoff	39.30%	27.40%	19.60%	13.70%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

CFwp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Novelty Cooler Shutoff	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Novelty Cooler Shutoff	0.29	0.00	0.00	0.71

# **OCCUPANCY SENSORS**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Controls Measure Sub Type: Occupancy

Sensor

Program: C03b Small Customers under 200kW

# **Measure Description**

This measure promotes the installation of lighting controls in both lost-opportunity and retrofit applications. Promoted technologies include occupancy sensors and daylight dimming controls.

# **Baseline Description**

The baseline efficiency case assumes no controls (retrofit) or code-compliant controls (new construction).

### **Savings Principle**

The high efficiency case involves lighting fixtures connected to controls that reduce the pre-retrofit or baseline hours of operation.

### **Savings Method**

Calculated using site-specific inputs

### Unit

Installed lighting controls project.

### **Savings Equation**

Gross kWh = SUM[QTY\_i × Watts\_i × (Hours\_base\_i - Hours\_ee\_i)] / (Watts per kW)

Gross kW = SUM(QTY\_i × Watts\_i) / (Watts per kW)

Where:

QTY\_i = Quantity in controlled fixtures in location i

Watts\_i = Connected wattage of controlled fixtures in location i

Hours\_base\_i = Total annual hours that the connected lighting in location i operated without controls (for retrofit installations) or would have operated with code-compliance controls (for new construction installations).

Hours\_ee\_i = Total annual hours that the connected lighting in location i operates with the lighting controls implemented.

1,000 Watts per kW = Conversion factor

deltaMMBtu\_Gas/kWh = Gross natural gas MMBtu reduction per gross kWh saved.

deltaMMBtu\_Oil/kWh = Gross heating oil MMBtu reduction per gross kWh saved.

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
OCCUPANCY SENSORS	Calc	Calc	0.00031 / kWh	0.00	0.00	0.00060 / kWh	0.00

Gas Heat MMBtu Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I

Oil MMBtu Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
OCCUPANCY SENSORS	9	1.00	1.00		1.00	0.94	0.94	0.35	0.28

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
OCCUPANCY SENSORS	30.30%	17.40%	34.30%	18.10%

Measure Life Source: Dan Mellinger's Lighting Control Measure Life Memo

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations RRsp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations RRwp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations CFsp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations CFwp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
OCCUPANCY SENSORS	0.00	0.00	0.08	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
OCCUPANCY SENSORS	0.12	0.00	0.00	0.88

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.86 / kWh

Incentive: \$0.60 / kWh

# **PHOTOCELLS**

Fuel: Electric Sector: C&I Program Type: Custom

Measure Type: Controls Measure Sub Type: Photocells Measure Category: Lighting

Program: C03b Small Customers under 200kW

**Measure Description** 

Installing a photocell to control lighting.

**Baseline Description** 

Lighting that runs 24/7.

**Savings Principle** 

Installed photocell controls lighting.

**Savings Method** 

Calculated using site-specific inputs

Installed lighting controls project.

**Savings Equation** 

Gross kWh = SUM[QTY\_i × Watts\_i × (Hours\_base\_i - Hours\_ee\_i)] / (Watts per kW)

Gross kW = SUM(QTY\_i × Watts\_i) / (Watts per kW)

Where:

QTY\_i = Quantity in controlled fixtures in location i

Watts i = Connected wattage of controlled fixtures in location i

Hours base i = Total annual hours that the connected lighting in location i operated without controls (for retrofit installations) or would have operated with code-compliance controls (for new construction installations).

Hours ee i = Total annual hours that the connected lighting in location i operates with the lighting controls implemented.

1,000 Watts per kW = Conversion factor

deltaMMBtu Gas/kWh = Gross natural gas MMBtu reduction per gross kWh saved.

deltaMMBtu Oil/kWh = Gross heating oil MMBtu reduction per gross kWh saved.

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
PHOTOCELLS	Calc	Calc	0.00031 / kWh	0.00	0.00	0.00060 / kWh	0.00

Gas Heat MMBtu Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I

Oil MMBtu Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
PHOTOCELLS	9	1.00	1.00		1.00	0.94	0.94	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
PHOTOCELLS	30.30%	17.40%	34.30%	18.10%

Measure Life Source: Dan Mellinger's Lighting Control Measure Life Memo

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations RRsp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations RRwp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations CFsp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations

CFwp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
PHOTOCELLS	0.00	0.00	0.08	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
PHOTOCELLS	0.12	0.00	0.00	0.88

# **Pre-Rinse Spray Valve**

Sector: C&I Fuel: Electric Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow Spray

Valve

Program: C03b Small Customers under 200kW

# **Measure Description**

Retrofitting existing standard spray nozzles in locations where service water is supplied by an electric hot water heater with new low flow pre-rinse spray nozzles with an average flow rate of 1.6 GPM.

# **Baseline Description**

Standard spray valve.

# **Savings Principle**

The high efficiency case is a low flow pre-rinse spray valve with an average flow rate of 1.6 GPM.

# **Savings Method**

Deemed

### Unit

Installed pre-rinse spray valve.

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pre-Rinse Spray Valve	2,598.0	0.6786	0.00	0.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pre-Rinse Spray Valve	8	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pre-Rinse Spray Valve	41.50%	31.40%	15.20%	11.90%

Measure Life Source: DNV GL (2014)Impact Evaluation of Massachusetts Prescriptive Gas Pre-Rinse Spray Valve Measure

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

CFwp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pre-Rinse Spray Valve	6410.00	6410.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pre-Rinse Spray Valve	0.29	0.00	0.00	0.71

# PROGRAMMABLE THERMOSTATS

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: C03b Small Customers under 200kW

# **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

# **Baseline Description**

The baseline efficiency case is an HVAC system providing space heating or cooling without a programmable thermostat.

### **Savings Principle**

The high efficiency case is an HVAC system that has a programmable thermostat or wi-fi programmable thermostat installed.

# **Savings Method**

Deemed

# Unit

Installed thermostat

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
PROGRAMMABLE THERMOSTATS	Calc	Calc	0.00	0.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
PROGRAMMABLE THERMOSTATS	8	1.00	1.00		1.05	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
PROGRAMMABLE THERMOSTATS	39.30%	27.40%	19.60%	13.70%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

CFwp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
PROGRAMMABLE THERMOSTATS	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
PROGRAMMABLE THERMOSTATS	0.29	0.00	0.00	0.71

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.66 / kWh
Incentive: \$0.46 / kWh

# **Refrigerated Case LED**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Refrigeration Measure Type: Refrigeration Lighting Measure Sub Type: Refrigerator Case

LED

Program: C03b Small Customers under 200kW

# **Measure Description**

Installation of LED lighting in freezer and/or cooler cases. The LED lighting consumes less energy, and results in less waste heat which reduces the cooling/freezing load.

# **Baseline Description**

The baseline efficiency case is the existing lighting fixtures in the cooler or freezer cases.

#### Savings Principle

The high efficiency case is the installation of LED lighting fixtures on the cooler or freezer cases, replacing the existing lighting fixtures.

### **Savings Method**

Calculated using site-specific inputs

### Unit

Completed lighting project.

### **Savings Equation**

Gross kWh =  $[SUM(QTY\_base \times Watts\_base \times Hours\_base) - SUM(QTY\_ee \times kW\_ee \times Hours\_ee)] \times (1 + EffRefrig \times (Btu/hr per kW) / (Btu/hr per ton))$ 

Gross kW = Gross kWh / Hours ee

Where:

QTY\_base = Quantity of baseline lighting fixtures in cooler/freezer case

Watts base = Connected wattage of baseline lighting fixtures in cooler/freezer case

Hours\_base = Annual operating hours of baseline lighting fixtures in cooler/freezer case

QTY\_ee = Quantity of efficient lighting fixtures in cooler/freezer case

Watts\_ee =Connected wattage of efficient lighting fixtures in cooler/freezer case

Hours\_ee = Annual operating hours of efficient lighting fixtures in cooler/freezer case

1.9 RefrigEff = Efficiency of typical refrigeration system (kW/ton); Estimate based on NRM field experience.

3413 Btu/hr per kW = Conversion factor

12,000 Btu/hr per ton = Conversion factor

Hours\_ee = Annual operating hours of efficient lighting fixtures in cooler/freezer case

Hours: 8,760.0.

Hours Note: The average annual operating hours are 8760 hours/year.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Refrigerated Case LED	Calc	Calc	0.00	0.00	0.00	0.00	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Refrigerated Case LED	6	1.00	1.00		1.05	1.07	1.15	0.99	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Refrigerated Case LED	30.30%	17.40%	34.30%	18.10%

Measure Life Source: RI C&I Lighting Market and AML Update Study

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: Impact Evaluation of 2017 Small Business Electric Installations (MA19C03-E-SBIMPCT) (P90)

RRsp Source: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

RRwp Source: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

CFsp Note: Coincidence factors set to 1.00 since gross kW is the average kW reduction during operation.

CFwp Note: Coincidence factors set to 1.00 since gross kW is the average kW reduction during operation.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Refrigerated Case LED	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Refrigerated Case LED	0.29	0.00	0.00	0.71

# **TIMECLOCKS**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Lighting Measure Type: Controls Measure Sub Type: Timeclocks

Program: C03b Small Customers under 200kW

**Measure Description** 

Installing a timeclock to control lighting.

**Baseline Description** 

Lighting that runs unnecessarily.

**Savings Principle** 

Installed timeclock controls lighting.

**Savings Method** 

Calculated using site-specific inputs

Unit

Installed lighting controls project.

**Savings Equation** 

Gross kWh = SUM[QTY\_i × Watts\_i × (Hours\_base\_i - Hours\_ee\_i)] / (Watts per kW)

Gross kW = SUM(QTY\_i × Watts\_i) / (Watts per kW)

Where:

QTY\_i = Quantity in controlled fixtures in location i

Watts i = Connected wattage of controlled fixtures in location i

Hours\_base\_i = Total annual hours that the connected lighting in location i operated without controls (for retrofit installations) or would have operated with code-compliance controls (for new construction installations).

Hours ee i = Total annual hours that the connected lighting in location i operates with the lighting controls implemented.

1,000 Watts per kW = Conversion factor

deltaMMBtu Gas/kWh = Gross natural gas MMBtu reduction per gross kWh saved.

deltaMMBtu\_Oil/kWh = Gross heating oil MMBtu reduction per gross kWh saved.

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
TIMECLOCKS	Calc	Calc	0.00031 / kWh	0.00	0.00	0.00060 / kWh	0.00

Gas Heat MMBtu Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I

Oil MMBtu Source: Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
TIMECLOCKS	9	1.00	1.00		1.00	0.94	0.94	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
TIMECLOCKS	30.30%	17.40%	34.30%	18.10%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations RRsp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations RRwp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations CFsp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations

CFwp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Prescriptive Lighting Installations

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
TIMECLOCKS	0.00	0.00	0.08	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per kWh

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
TIMECLOCKS	0.12	0.00	0.00	0.88

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.74 / kWh
Incentive: \$0.52 / kWh

# **VENDING MACHINES**

Fuel: Electric Sector: C&I Program Type: Prescriptive

Measure Category: Refrigeration Measure Type: Controls Measure Sub Type: Vending Miser

Program: C03b Small Customers under 200kW

### **Measure Description**

Controls significantly reduce the energy consumption of vending machines lighting and refrigeration systems by powering down these systems during periods of inactivity. This measure does not apply to ENERGY STAR® qualified vending machines, as they already have built-in controls.

# **Baseline Description**

The baseline efficiency case is a standard efficiency vending machine, or glass front refrigerated cooler without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

# **Savings Principle**

The high efficiency case is a standard efficiency vending machine, or glass front refrigerated cooler with a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

# **Savings Method**

Deemed

# Unit

Installed vending miser.

# **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: 8,760.0.

Hours Note: It is assumed that the connected equipment operates 24 hours per day, 7 days per week for a total annual operating hours of 8,760.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
VENDING MACHINES	1,612.0	0.1840	0.00	0.00	0.00	0.00	0.00

Electric kWh Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Electric kW Source: USA Technologies Energy Management Product Sheets (2006). Accessed on 09/01/2009.

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VENDING MACHINES	5	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
VENDING MACHINES	39.30%	27.40%	19.60%	13.70%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

CFwp Note: Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
VENDING MACHINES	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
VENDING MACHINES	0.29	0.00	0.00	0.71

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.41 / kWh

Incentive: \$0.29 / kWh

# **Peak Shaving DR**

Sector: C&I Fuel: Electric Program Type: Custom

Measure Category: Whole Building Measure Type: Demand Response Measure Sub Type: Whole Building

**Program:** Commercial ConnectedSolutions

# **Measure Description**

This is a peak shaving program offering where during National Grid called events C&I customers will curtail as much load as possible and receive an incentive for shifting loads to off peak times.

# **Baseline Description**

No action taken for these customers

# **Savings Principle**

Peak Demand savings are achieved by customers shifting load from peak times to off peak times.

# **Savings Method**

Custom

# Unit

Per demand response event

## **Savings Equation**

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Peak Shaving DR	0	0	0.00	0.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Peak Shaving DR	1	1.00	1.00			0.80		1.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Peak Shaving DR	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

RRsp Source: Cross-State C&I Active Demand Reduction Initiative Summer 2019 Evaluation Report

RRsp Note: National Grid is using the MA National Grid specific prospective RR.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Peak Shaving DR	0.00	0.00	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Peak Shaving DR	0.00	0.00	0.00	1.00

TRC: \$40.00 / Summer Net kW Savings

Incentive: \$40.00 / Summer Net kW Savings

### **Solar Inverters**

 Sector: C&I
 Fuel: Electric
 Program Type: Prescriptive

 Measure Category: Controls
 Measure Type: Demand Response
 Measure Sub Type: Controls

**Program:** Commercial ConnectedSolutions

#### **Measure Description**

This is a solar inverter program where during called events the solar inverter is to inject or absorb reactive power depending on local voltage and generation conditions.

#### **Baseline Description**

No action taken for these customers

#### **Savings Principle**

Peak Demand savings are achieved by customers shifting load from peak times to off peak times.

#### **Savings Method**

Deemed

#### Unit

Installation of solar inverter

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross  $kW = Qty \times deltakW$ 

Where:

Qty = Total number of units.

Delta kWh = Deemed average annual kWh reduction per unit.

Delta kW = Deemed average kW reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Solar Inverters	17,857.0	1.9600	0.00	0.00	0.00	0.00	0.00

Electric kWh Note: Based on RI 2022 EE plan value. Electric kW Note: Based on RI 2022 EE plan value.

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Solar Inverters	1	1.00	1.00					1.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Solar Inverters	30.50%	36.10%	15.20%	18.30%

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Solar Inverters	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Solar Inverters	0.00	0.00	0.00	1.00

### Air Sealing

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Building Shell
 Measure Type: Air Sealing
 Measure Sub Type: Air Sealing/Infiltration

Program: C&I Multifamily

#### **Measure Description**

Thermal shell air leaks are sealed through strategic use and location of air-tight materials.

#### **Baseline Description**

The baseline efficiency case is the existing building before the air sealing measure is implemented. The baseline building is characterized by the existing CFM50 measurement (CFM50PRE) for single family homes, or the existing air changes per hour (ACHPRE).

#### **Savings Principle**

The high efficiency case is the existing building after the air sealing measure is implemented. The high efficiency building is characterized by the new CFM50 measurement for single family homes (CFM50POST), or the new air changes per hour (ACHPOST) for multi-family facilities, which is measured after the air sealing measure is implemented.

#### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed air sealing project.

#### **Savings Equation**

Gross MMBtu Gas = (CFM50\_pre - CFM50\_post) / LBL  $\times$  HDD  $\times$  (Hours per Day)  $\times$  (Minutes per Hour)  $\times$  (Btu/ft3-°F)  $\times$  CorrectionFactor / SeasonalEff / (Btu per MMBtu)

### Where:

CFM50\_pre = CFM50 measurement before air sealing

CFM50\_post = CFM50 measurement after air sealing (cu.ft./min)

LBL = LBL factor - This factor is determined as the product of the N-factor and a Height Correction Factor according to BPI Protocol

4644 HDD = Heating degree days (deg. F-day); This value is an average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data. http://www.ncdc.noaa.gov

24 Hours per Day = Conversion factor

60 Minutes per Hour = Conversion factor

0.018 Btu/ft3-°F = Heat capacity of 1 cubic foot of air at 70 °F

1 CorrectionFactor = Correction factor determined by auditor (e.g. for seasonal homes): Default

0.7 SeasonalEff = Heating system seasonal efficiency factor determined by auditor for homes heated with natural gas: Default

1,000,000 Btuper MMBtu = Conversion factor

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

Hours Note: Heating hours are characterized by the heating degree days for the facility, 4644.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Air Sealing	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Sealing	20	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Air Sealing	0.00%	0.00%	0.00%	0.00%

Measure Life Source: 'ComEd Effective Useful Life Research Report', May 2018

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Energy realization rate is 100% because deemed savings are based on evaluation results.

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Air Sealing	0.00	0.00	19.35	135.83	

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

Annual \$ Note: NEI per participant / treated unit

One-time \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Air Sealing	0.33	0.01	0.00	0.68

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: MF Bundled costs (see Participant listing)

#### Custom

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Custom Measure Sub Type: Custom

Program: C&I Multifamily

### **Measure Description**

Vendors install a variety of measures at multifamily facilities. Measures include custom non-lighting C&I multifamily measures.

#### **Baseline Description**

For retrofit projects, the baseline efficiency case is the same as the existing, or pre-retrofit, case for the

#### **Savings Principle**

The high efficiency scenario is specific to the facility and may include one or more energy efficiency

#### **Savings Method**

Calc

#### Unit

Completed custom project

#### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

Hours Note: The annual hours of operation are site specific and will be determined on a case by case basis.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom	Calc	Calc	Calc	Calc	0.00	Calc	Calc

Gas Heat MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom	multi	1.00	1.00	0.99	0.99			Cust om	Custo m

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Custom	0.00%	0.00%	0.00%	0.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Custom	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom	0.00	0.00	0.00	1.00

TRC: MF Bundled costs (see Participant listing)

### **Demand Circulator**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Demand

Circulator

Program: C&I Multifamily

**Measure Description** 

Installation of a demand controller on a re-circulation loop.

**Baseline Description** 

Full time operation of re-circ pump.

**Savings Principle** 

The re-circulation pump is controlled by a demand signal or timer to reduce operating hours when no hot water usage occurs.

**Savings Method** 

Calc

Unit

Installed recirculation controller

**Savings Equation** 

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Demand Circulator	0	0	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Demand Circulator	15	1.00	1.00	1.00	1.00				_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Demand Circulator	0.00%	0.00%	0.00%	0.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Demand Circulator	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Demand Circulator	0.00	0.00	0.00	1.00

TRC: MF Bundled costs (see Participant listing)

# **Duct Sealing**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Ducting Measure Sub Type: Duct Sealing

Program: C&I Multifamily

#### **Measure Description**

Ducts are sealed by reconnecting disconnected duct joints and sealing gaps or seams with mastic and fiber-mesh tape as appropriate.

#### **Baseline Description**

The baseline efficiency case is the existing facility or equipment prior to the implementation of duct sealing.

#### **Savings Principle**

The baseline efficiency case is the existing facility or equipment after the implementation of duct sealing.

#### **Savings Method**

Calc

#### Unit

Installation of duct sealing

#### **Savings Equation**

MMBtu = Annualheatingconsumption x %SAVE x (1/1000000)

Where

Annual Heating Consumption = The total annual heating consumption for the facility (Btu)

%SAVE = Average reduction in energy consumption.

1/1,000,000 = Conversion from Btu to MMBtu

Savings Factors for Multifamily Duct Sealing

Measure Type %SAVE158

Savings Factors for Multifamily Duct Sealing

Surface Area < 50 SQFT 7%

Surface Area > 50 SQFT and < 200 SQFT 3%

Surface Area > 200 SQFT 1%

Hours: N/A.

### **Measure Gross Savings per Unit**

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Duct Sealing	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Calculated by RISE Engineering according to algorithms found in The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for Massachusetts Program Administrators.

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Duct Sealing	20	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Duct Sealing	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Duct Sealing	0.00	0.00	0.23	0

Annual \$ Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation. Prepared for Massachusetts Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Duct Sealing	0.33	0.01	0.00	0.68

NTG Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

TRC: MF Bundled costs (see Participant listing)

#### **Faucet Aerator**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: C&I Multifamily

#### **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a commercial setting with service water heated by natural gas.

#### **Baseline Description**

The baseline efficiency case is a 2.2 GPM faucet.

#### **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less aerator installed.

#### **Savings Method**

Deemed

#### Unit

Installed faucet aerator.

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Faucet Aerator	0	0	0.00	0.20	0.00	0.00	0.00

Gas DHW MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Faucet Aerator	7	0.90	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Faucet Aerator	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Federal Energy Management Program (2010). Energy Cost Calculator for Faucets and Showerheads. Accessed on 10/12/2011.

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Faucet Aerator	359.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Faucet Aerator	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: MF Bundled costs (see Participant listing)

# Low Flow Showerhead with Thermo Control (Ladybug Gas DHW)

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: C&I Multifamily

**Measure Description** 

A showerhead with a control that limits flow once water is heated.

**Baseline Description** 

The baseline case is a showerhead with a flow of 2.5 gallons per minute, or for the case of the adapter, a low flow showerhead with flow of 1.5 gpm or less.

**Savings Principle** 

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

**Savings Method** 

Deemed

Unit

Installed low-flow showerhead

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low Flow Showerhead with Thermo Control (Ladybug Gas DHW)	0	0	0.00	0.34	0.00	0.00	0.00

Gas DHW MMBtu Source: National Grid (2014). Review of ShowerStart evolve.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low Flow Showerhead with Thermo Control (Ladybug Gas DHW)	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low Flow Showerhead with Thermo Control (Ladybug Gas DHW)	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

Measure Life Note: Massachusetts Common Assumption

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low Flow Showerhead with Thermo Control (Ladybug Gas DHW)	558.00	0.00	0	0

Water/Sewer Source: National Grid (2014). Review of ShowerStart evolve.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low Flow Showerhead with Thermo Control (Ladybug Gas DHW)	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: MF Bundled costs (see Participant listing)

# Low Flow Showerhead with Thermo Control (Roadrunner Gas DHW)

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: C&I Multifamily

# **Measure Description**

A showerhead with a control that limits flow once water is heated.

#### **Baseline Description**

The baseline case is a showerhead with a flow of 2.5 gallons per minute, or for the case of the adapter, a low flow showerhead with flow of 1.5 gpm or less.

#### **Savings Principle**

The high efficiency is a low-flow showerhead with a control that limits flow once the water is heated.

#### **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	0	0	0.00	1.60	0.00	0.00	0.00

Gas DHW MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	15	0.90	1.00	1.00	1.00				

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

Measure Life Note: Massachusetts Common Assumption

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: National Grid assumption based on regional PA working groups.

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	2254.00	0.00	0.58	0

Water/Sewer Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low Flow Showerhead with Thermo Control (Roadrunner Gas DHW)	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: MF Bundled costs (see Participant listing)

### Low-Flow Showerhead

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: C&I Multifamily

#### **Measure Description**

Installation of a low flow showerhead with a flow rate of 1.5 GPM or less in a commercial setting with service water heated by natural gas.

### **Baseline Description**

The baseline efficiency case is a 2.5 GPM showerhead.

#### **Savings Principle**

The high efficiency case is a 1.5 GPM showerhead.

#### **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow Showerhead	0	0	0.00	1.30	0.00	0.00	0.00

Gas DHW MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow Showerhead	15	0.90	1.00	1.00					_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Flow Showerhead	0.00%	0.00%	0.00%	0.00%

Measure Life Source: MA Comprehensive TRM Review MA19R17-B-TRM DRAFT

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Low-Flow Showerhead	1786.00	0.00	0.58	0	

Water/Sewer Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

TRC: MF Bundled costs (see Participant listing)

#### MF Shell Insulation

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Building Shell
 Measure Type: Insulation
 Measure Sub Type: Shell

Program: C&I Multifamily

Insulation upgrades are applied in existing multifamily facilities.

#### **Baseline Description**

Measure Description

The baseline efficiency case is characterized by the total R-value of the existing attic, basement or sidewall (Rexisit). This is calculated as the R-value of the existing insulation, estimated by the program contractor, plus the R-value of the ceiling, floor, or wall (for all projects: RCEILING = 3.36; RFLOOR = 6.16; RWALL = 6.65).

#### **Savings Principle**

The high efficiency case is characterized by the total R-value of the attic after the installation of additional attic, basement or sidewall insulation. This is calculated as the sum of the existing R-value (RBASE) plus the R-value of the added insulation(RADD).

### **Savings Method**

Calculated using site-specific inputs

#### Unit

Completed insulation project.

#### **Savings Equation**

MMBTUannual = (((1/Rexist)-(1/Rnew)) x HDD x 24 x Area) / (1,000,000) X Nheat

kWhannual = MMBtuannaul x 293.1

kW = kWhannual x kW/kWh heating

Where:

Rexist = Existing effective R-value (R-ExistingInsulation + R-Assembly), ft2-°F/Btuh

Rnew = New total effective R-value (R-ProposedMeasure + R-ExistingInsulation + R-Assembly), ft2-°F/Btuh

Area = Square footage of insulated area

nheat = Efficiency of the heating system (AFUE or COP)

293.1 = Conversion constant (1MMBtu = 293.1 kWh)

24 = Conversion for hours per day

HDD = Heating Degree Days; dependent on location, see table below

1,000,000 = Conversion from Btu to MMBtu

kW/kWh heating = Average annual kW reduction per kWh reduction: 0.00050 kW/kWh

Hours: 4,644.0.

Hours Source: NOAA Weather data: An average BASE 60 Annual Heating Degree Day value for weather stations in Rhode Island and southeastern Massachusetts based on NOAA 30-year data.

Hours Note: Heating hours are characterized by the heating degree days for the facility, 4644.

#### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
MF Shell Insulation	Calc	Calc	Calc	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
MF Shell Insulation	25	1.00	1.00	1.00	1.00			0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
MF Shell Insulation	7.00%	4.00%	47.00%	42.00%

Measure Life Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
MF Shell Insulation	0.00	0.00	47.31	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
MF Shell Insulation	0.33	0.01	0.00	0.68

NTG Source: RI-20-RX-EWMFImpact - Impact Evaluation of EnergyWise Multifamily Program

TRC: MF Bundled costs (see Participant listing)

# **Participant**

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: Participant
 Measure Type: Participant
 Measure Sub Type: C&I MF

**Program:** C&I Multifamily **Measure Description** 

This row identifies a participant for tracking and cost purposes.

**Baseline Description** 

**Savings Principle** 

**Savings Method** 

Unit

Per participant

**Savings Equation** 

N/A

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Participant	0	0	0.00	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Participant	1	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Participant	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Participant	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Participant	0.00	0.00	0.00	1.00

TRC: \$415.00 / participant

Incentive: \$378.00 / participant

# **Pipe Wrap (Water Heating)**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Insulation Measure Sub Type: Pipe Insulation

Program: C&I Multifamily

**Measure Description** 

Installation of DHW pipe wraps.

**Baseline Description** 

The baseline efficiency case is the existing hot water equipment.

**Savings Principle** 

The high efficiency case includes pipe wrap.

**Savings Method** 

Deemed

Unit

Installation of a DHW pipe wrap

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# **Measure Gross Savings per Unit**

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Wrap (Water Heating)	0	0	0.00	0.15	0.00	0.00	0.00

Gas DHW MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Gas DHW MMBtu Note: 3 feet per piece

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pipe Wrap (Water Heating)	15	0.90	1.00	1.00	1.00				_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pipe Wrap (Water Heating)	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pipe Wrap (Water Heating)	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pipe Wrap (Water Heating)	0.08	0.01	0.00	0.93

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: MF Bundled costs (see Participant listing)

# **Programmable Thermostat**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: C&I Multifamily

#### **Measure Description**

Installation of a programmable thermostat which gives the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

#### **Baseline Description**

For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating without a programmable thermostat. For the installation of a wi-fi programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating with a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system that has a programmable thermostat or wi-fi programmable thermostat installed.

#### Savings Method

Deemed

#### Unit

Installation of programmable thermostat

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat	29.0	0.0461	1.50	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Gas Heat MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat	13	0.95	1.00	1.00	1.00		•	0.35	0.00

Measure	Energy %		Summer Peak Energy %	Summer Off-Peak Energy %	
Programmable Thermostat	7.00%	4.00%	47.00%	42.00%	

Measure Life Source: Guidehouse (2021). Comprehensive TRM Review.

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat	0.00	0.00	14.35	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat	0.48	0.01	0.00	0.53

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: MF Bundled costs (see Participant listing)

# Wi-Fi Programmable Thermostat (Controls Gas Heat Only)

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: C&I Multifamily

#### **Measure Description**

A communicating thermostat which allows remote set point adjustment and control via remote application. System requires an outdoor air temperature algorithm in the control logic to operate heating and cooling systems Primary Energy Impact: Natural Gas.

### **Baseline Description**

For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating without a programmable thermostat. For the installation of a wi-fi programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to provide space heating with a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system that has a programmable thermostat or wi-fi programmable thermostat installed.

#### **Savings Method**

Deemed

#### Unit

Installation of WiFi programmable thermostat

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Wi-Fi Programmable Thermostat (Controls Gas Heat Only)	31.0	0.0493	2.30	0.00	0.00	0.00	0.00

Electric kWh Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Electric kW Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

Gas Heat MMBtu Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Wi-Fi Programmable Thermostat (Controls Gas Heat Only)	15	0.95	1.00	1.00	1.00			0.35	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Wi-Fi Programmable Thermostat (Controls Gas Heat Only)	7.00%	4.00%	47.00%	42.00%	

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Navigant Consulting (2018). Baseline Loadshape Study
CFwp Source: Navigant Consulting (2018). Baseline Loadshape Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Wi-Fi Programmable Thermostat (Controls Gas Heat Only)	0.00	0.00	14.35	0

Annual \$ Source: NMR Group and DNV GL (2018). TXC 29 Market-Rate Rental Property NEI Study (Phase 1). Prepared for the MA Program Administrators.

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Wi-Fi Programmable Thermostat (Controls Gas Heat Only)	0.48	0.01	0.00	0.53

NTG Source: RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

TRC: MF Bundled costs (see Participant listing)

### **Boiler Reset Control**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Boiler Control

Program: C&I Small Business Direct Install

#### **Measure Description**

Boiler reset controls are devices that automatically control boiler water temperature based on outdoor temperature using a software program.

### **Baseline Description**

Fixed boiler water temperature.

#### **Savings Principle**

The high efficiency case is a boiler with reset controls.

#### **Savings Method**

Deemed

#### Unit

Installed boiler reset control

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler Reset Control	0	0.0000	35.50	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler Reset Control	15	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Boiler Reset Control	0.00%	0.00%	0.00%	0.00%

Measure Life Source: ACEEE (2006). Emerging Technologies Report: Advanced Boiler Controls. Prepared for ACEEE.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Boiler Reset Control	0.00	0.00	0	0	

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler Reset Control	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$7.14 / Gross therm

Incentive: \$5.00 / Gross therm

#### **DEMAND CIRCULATOR**

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: Water Heating
 Measure Type: Controls
 Measure Sub Type: Recirc

Program: C&I Small Business Direct Install

#### **Measure Description**

Installation of a demand controller on a re-circulation loop.

#### **Baseline Description**

Full time operation of re-circ pump.

#### **Savings Principle**

The re-circulation pump is controlled by a demand signal or timer to reduce operating hours when no hot water usage occurs.

#### **Savings Method**

Deemed

#### Unit

Installed recirculation controller

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
DEMAND CIRCULATOR	96.0	0.1600	195.00	19.50	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
DEMAND CIRCULATOR	15	1.00	1.00	1.00				0.58	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
DEMAND CIRCULATOR	42.00%	31.00%	15.00%	12.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Source: P72 Prescriptive C&I Loadshapes of Savings
CFwp Source: P72 Prescriptive C&I Loadshapes of Savings

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
DEMAND CIRCULATOR	0.00	0.00	0.08	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
DEMAND CIRCULATOR	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.29 / Gross therm

Incentive: \$3.00 / Gross therm

#### **Faucet Aerator**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: C&I Small Business Direct Install

#### **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a commercial setting with service water heated by natural gas.

#### **Baseline Description**

The baseline efficiency case is a 2.2 GPM faucet.

#### **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less aerator installed.

#### **Savings Method**

Deemed

#### Unit

Installed faucet aerator.

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: 130.0.

Hours Source: Federal Energy Management Program (2010). Energy Cost Calculator for Faucets and Showerheads. Accessed on 10/12/2011.

Hours Note: The calculator used to determine the deemed savings uses a default operation of 30 minuts/day, 260 days/year. Not applicable for Multifamily applications.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Faucet Aerator	0	0.0000	0.00	1.70	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Faucet Aerator	5	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Faucet Aerator	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: Federal Energy Management Program (2010). Energy Cost Calculator for Faucets and Showerheads. Accessed on 10/12/2011.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Faucet Aerator	5460.00	5460.00	0.08	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Faucet Aerator	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.29 / Gross therm

Incentive: \$3.00 / Gross therm

# **High-Pressure Steam Trap HVAC**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Steam Traps Measure Sub Type: Steam Trap

**Program:** C&I Small Business Direct Install

#### **Measure Description**

The repair or replacement of malfunctioning steam traps in systems with an operating pressure greater than 15 psig.

#### **Baseline Description**

The baseline efficiency case is a failed steam trap.

#### **Savings Principle**

The high efficiency case is a repaired or replaced steam trap.

#### **Savings Method**

Deemed

#### Unit

Repaired or replaced steam trap.

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# **Measure Gross Savings per Unit**

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
High-Pressure Steam Trap HVAC	0	0.0000	35.60	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: ERS Two-Tier Steam Trap Savings Study; April 26, 2018

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
High-Pressure Steam Trap HVAC	6	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
High-Pressure Steam Trap HVAC	0.00%	0.00%	0.00%	0.00%

 $Measure\ Life\ Source:\ DNV\ GL\ MA\ 2013,2017\ Prescriptive\ Gas\ Impact\ Evaluation:\ Steam\ Trap\ Evaulation\ Phase\ 1\ \&\ 2$ 

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
High-Pressure Steam Trap HVAC	0.00	0.00	0	0	

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
High-Pressure Steam Trap HVAC	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

# INS\_DUCT\_SF

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Insulation
 Measure Sub Type: Duct

**Program:** C&I Small Business Direct Install

**Measure Description** 

The installation of duct insulation and air sealing.

**Baseline Description** 

Un-insulated ductwork with air leaks

**Savings Principle** 

Insulating and air sealing ductwork reduces heat loss / gain, thereby saving energy.

**Savings Method** 

Deemed

Unit

SF of installed insulation

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# **Measure Gross Savings per Unit**

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
INS_DUCT_SF	Calc	Calc	0.13	0.00	0.00	0.00	0.00

Gas Heat MMBtu Note: National Grid Staff Estimate (2010) MA SBS-DI Duct Sealing and Insulation Scenario and Deemed Savings.

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
INS_DUCT_SF	20	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
INS_DUCT_SF	0.00%	0.00%	0.00%	0.00%

Measure Life Note: National Grid Staff Estimate (2010) MA SBS-DI Duct Sealing and Insulation Scenario and Deemed Savings.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

#### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
INS_DUCT_SF	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
INS_DUCT_SF	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$12.86 / Gross therm
Incentive: \$9.00 / Gross therm

# **Insulation Pipe Diameter 1.5in H2O**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Insulation

Insulation

Program: C&I Small Business Direct Install

**Measure Description** 

Install insulation on hot water piping located in non-conditioned spaces.

**Baseline Description** 

Existing uninsulated pipe.

**Savings Principle** 

The high efficiency condition is hot water piping in unconditional space with insulation installed.

**Savings Method** 

Deemed

Unit

Installed LF of pipe insulation

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Insulation Pipe Diameter 1.5in H2O	0	0.0000	0.21	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Insulation Pipe Diameter 1.5in H2O	15	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Insulation Pipe Diameter 1.5in H2O	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Insulation Pipe Diameter 1.5in H2O	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Insulation Pipe Diameter 1.5in H2O	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.29 / Gross therm

Incentive: \$3.00 / Gross therm

# **Insulation Pipe Diameter 1.5in Steam**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Insulation

Insulation

Program: C&I Small Business Direct Install

## **Measure Description**

Install insulation on steam piping located in non-conditioned spaces.

### **Baseline Description**

Existing uninsulated pipe.

### **Savings Principle**

The high efficiency condition is steam piping in unconditional space with insulation installed.

### **Savings Method**

Deemed

### Unit

Installed LF of pipe insulation

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Insulation Pipe Diameter 1.5in Steam	0	0.0000	0.21	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Insulation Pipe Diameter 1.5in Steam	15	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Insulation Pipe Diameter 1.5in Steam	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Insulation Pipe Diameter 1.5in Steam	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Insulation Pipe Diameter 1.5in Steam	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.29 / Gross therm

Incentive: \$3.00 / Gross therm

# **Insulation Pipe Diameter 2in H2O**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Insulation

Insulation

Program: C&I Small Business Direct Install

**Measure Description** 

Install insulation on hot water piping located in non-conditioned spaces.

**Baseline Description** 

Existing uninsulated pipe.

**Savings Principle** 

The high efficiency condition is hot water piping in unconditional space with insulation installed.

**Savings Method** 

Deemed

Unit

Installed LF of pipe insulation

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Insulation Pipe Diameter 2in H2O	0	0.0000	0.36	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Insulation Pipe Diameter 2in H2O	15	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Insulation Pipe Diameter 2in H2O	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Insulation Pipe Diameter 2in H2O	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Insulation Pipe Diameter 2in H2O	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.29 / Gross therm

Incentive: \$3.00 / Gross therm

# **Insulation Pipe Diameter 2in Steam**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Insulation

Insulation

Program: C&I Small Business Direct Install

**Measure Description** 

Install insulation on steam piping located in non-conditioned spaces.

**Baseline Description** 

Existing uninsulated pipe.

**Savings Principle** 

The high efficiency condition is steam piping in unconditional space with insulation installed.

**Savings Method** 

Deemed

Unit

Installed LF of pipe insulation

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Insulation Pipe Diameter 2in Steam	0	0.0000	0.37	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Insulation Pipe Diameter 2in Steam	15	1.00	1.00	1.00					_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Insulation Pipe Diameter 2in Steam	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Insulation Pipe Diameter 2in Steam	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Insulation Pipe Diameter 2in Steam	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.29 / Gross therm

Incentive: \$3.00 / Gross therm

## Low-Flow Showerhead

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: C&I Small Business Direct Install

### **Measure Description**

Installation of a low flow showerhead with a flow rate of 1.5 GPM or less in a commercial setting with service water heated by natural gas.

## **Baseline Description**

The baseline efficiency case is a 2.5 GPM showerhead.

#### **Savings Principle**

The high efficiency case is a 1.5 GPM showerhead.

### **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: 121.6.

Hours Source: Federal Energy Management Program (2010). Energy Cost Calculator for Faucets and Showerheads. Accessed on 10/12/2011.

Hours Note: The calculator used to determine the deemed savings uses a default operation of 20 minutes/day, 365 days/year. Not applicable for Multifamily applications.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow Showerhead	0	0.0000	0.00	5.20	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow Showerhead	10	1.00	1.00	1.00					_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Low-Flow Showerhead	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low-Flow Showerhead	7300.00	7300.00	0.08	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$3.57 / Gross therm

Incentive: \$2.50 / Gross therm

## **Low-Pressure Steam Trap HVAC**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Steam Traps Measure Sub Type: Steam Trap

**Program:** C&I Small Business Direct Install

### **Measure Description**

The repair or replacement of malfunctioning steam traps in systems with an operating pressure less than or equal to 15 psig.

### **Baseline Description**

The baseline efficiency case is a failed steam trap.

### **Savings Principle**

The high efficiency case is a repaired or replaced steam trap.

### **Savings Method**

Deemed

#### Unit

Repaired or replaced steam trap.

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## **Measure Gross Savings per Unit**

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Pressure Steam Trap HVAC	0	0.0000	8.40	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: ERS Two-Tier Steam Trap Savings Study; April 26, 2018

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Pressure Steam Trap HVAC	6	1.00	1.00	1.00					_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Pressure Steam Trap HVAC	0.00%	0.00%	0.00%	0.00%

Measure Life Source: DNV GL MA 2013,2017 Prescriptive Gas Impact Evaluation: Steam Trap Evaulation Phase 1 & 2

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low-Pressure Steam Trap HVAC	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Pressure Steam Trap HVAC	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Pre-Rinse Spray Valve**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow Spray

Valve

Program: C&I Small Business Direct Install

## **Measure Description**

Retrofitting existing standard spray nozzles in locations where service water is supplied by natural gas fired hot water heater with new low flow pre-rinse spray nozzles with an average flow rate of 1.6 GPM.

### **Baseline Description**

The baseline efficiency case is a standard efficiency spray valve.

### **Savings Principle**

The high efficiency case is a low flow pre-rinse spray valve with an average flow rate of 1.6 GPM.

### **Savings Method**

Deemed

#### Unit

Installed pre-rinse spray valve.

#### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pre-Rinse Spray Valve	0	0.0000	0.00	11.40	0.00	0.00	0.00

Gas DHW MMBtu Source: DNV GL (2014)Impact Evaluation of Massachusetts Prescriptive Gas Pre-Rinse Spray Valve Measure

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pre-Rinse Spray Valve	8	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pre-Rinse Spray Valve	0.00%	0.00%	0.00%	0.00%

Measure Life Source: DNV GL (2014)Impact Evaluation of Massachusetts Prescriptive Gas Pre-Rinse Spray Valve Measure

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Pre-Rinse Spray Valve	6410.00	6410.00	0.08	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pre-Rinse Spray Valve	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$3.57 / Gross therm
Incentive: \$2.50 / Gross therm

## **Programmable Thermostat**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: C&I Small Business Direct Install

#### **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

### **Baseline Description**

The baseline efficiency case is an HVAC system using natural gas to provide space heating without a programmable thermostat.

### **Savings Principle**

The high efficiency case is an HVAC system using natural gas to provide space heating with a programmable thermostat installed.

#### **Savings Method**

Deemed

#### Unit

Installed programmable thermostat

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat	0	0.0000	3.20	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: DNV-GL, MA45 Prescriptive Programmable Thermostats, March 2017

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat	15	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat	0.00	0.00	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$5.71 / Gross therm

Incentive: \$4.00 / Gross therm

## Salon Nozzle

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow Spray

Valve

Program: C&I Small Business Direct Install

**Measure Description** 

The installation of a high efficiency salon nozzle.

**Baseline Description** 

Standard salon nozzle.

**Savings Principle** 

An efficient salon nozzle.

Savings Method

Deemed

Unit

Installed salon nozzle

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Salon Nozzle	0	0.0000	0.00	20.40	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Salon Nozzle	5	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Salon Nozzle	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Salon Nozzle	28639.00	28639.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Salon Nozzle	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.86 / Gross therm

Incentive: \$2.00 / Gross therm

# WiFi Tstat - Cooling and Heating

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Controls
 Measure Sub Type: WiFi T-stat

Program: C&I Small Business Direct Install

### **Measure Description**

A communicating thermostat which allows remote set point adjustment and control via remote application. System requires an outdoor air temperature algorithm in the control logic to operate heating and cooling systems.

### **Baseline Description**

The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system that has a Wi-Fi thermostat installed.

### **Savings Method**

Deemed

### Unit

Installation of WiFi programmable thermostat

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Tstat - Cooling and Heating	0	0.0000	6.60	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Tstat - Cooling and Heating	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %			Summer Off-Peak Energy %
WiFi Tstat - Cooling and Heating	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WiFi Tstat - Cooling and Heating	0.00	0.00	0.59	0.00

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Tstat - Cooling and Heating	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.00 / Gross therm
Incentive: \$2.80 / Gross therm

# WiFi Tstat - Heating Only

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Controls
 Measure Sub Type: WiFi T-stat

Program: C&I Small Business Direct Install

### **Measure Description**

A communicating thermostat which allows remote set point adjustment and control via remote application. System requires an outdoor air temperature algorithm in the control logic to operate heating and cooling systems Primary Energy Impact: Natural Gas.

## **Baseline Description**

The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.

### **Savings Principle**

The high efficiency case is an HVAC system that has a Wi-Fi thermostat installed.

### **Savings Method**

Deemed

#### Unit

Installation of WiFi programmable thermostat

#### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Tstat - Heating Only	0	0.0000	6.60	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Tstat - Heating Only	15	1.00	1.00	1.00		1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WiFi Tstat - Heating Only	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
WiFi Tstat - Heating Only	0.00	0.00	0.59	0.00	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Tstat - Heating Only	0.11	0.02	0.00	0.90

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.00 / Gross therm
Incentive: \$2.80 / Gross therm

### **BOILER RESET 1 STAGE**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Boiler Control

Program: Large C&I Retrofit

#### **Measure Description**

Boiler reset controls are devices that improve the efficiency of an existing boiler system by modulating the hot water temperature set point. Reset controls automatically control boiler water temperature based on outdoor temperature using a software program; load controls sense the thermal demand of the heating system and resets the water temperature based on the demand.

### **Baseline Description**

The baseline efficiency case is a boiler without reset or load controls.

### **Savings Principle**

The efficient case is a boiler with reset or load controls, which reset the supply water temperature based on outdoor temperatures and/or building load.

### **Savings Method**

Deemed

### Unit

Installation of boiler reset control on existing boiler

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
BOILER RESET 1 STAGE	0	0.0000	35.50	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
BOILER RESET 1 STAGE	15	1.00	1.00	1.00		•		•	

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
BOILER RESET 1 STAGE	0.00%	0.00%	0.00%	0.00%

Measure Life Source: ACEEE (2006). Emerging Technologies Report: Advanced Boiler Controls. Prepared for ACEEE.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
BOILER RESET 1 STAGE	0.00	0.00	0.59	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
BOILER RESET 1 STAGE	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Boiler Reset Control (Multi-Stage)**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Boiler Control

Program: Large C&I Retrofit

#### **Measure Description**

Boiler reset controls are devices that automatically control boiler water temperature based on outdoor temperature using a software program.

## **Baseline Description**

The baseline efficiency case is a boiler without reset controls.

#### **Savings Principle**

The high efficiency case is a boiler with reset controls.

### **Savings Method**

Deemed

#### Unit

Boiler reset control installed on existing boiler.

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler Reset Control (Multi-Stage)	0	0.0000	35.50	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Environmental Protection Agency (2011). Savings Calculator for ENERGY STAR Qualified Commercial Kitchen Equipment: Steam Cooker Calcs.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler Reset Control (Multi-Stage)	15	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Boiler Reset Control (Multi-Stage)	0.00%	0.00%	0.00%	0.00%

Measure Life Source: ACEEE (2006). Emerging Technologies Report: Advanced Boiler Controls. Prepared for ACEEE.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Boiler Reset Control (Multi-Stage)	0.00	0.00	0.59	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler Reset Control (Multi-Stage)	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Boiler, Condensing Blend**

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Boiler
 Measure Sub Type: Blend

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler, Condensing Blend	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Condensing Blend	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Boiler, Condensing Blend	0.00%	0.00%	0.00%	0.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Boiler, Condensing Blend	Calc	Calc	0.05	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler, Condensing Blend	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Boiler, Condensing Heating**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Boiler Measure Sub Type: Heating

Program: Large C&I Retrofit

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler, Condensing Heating	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Condensing Heating	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Boiler, Condensing Heating	0.00%	0.00%	0.00%	0.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Boiler, Condensing Heating	Calc	Calc	-0.07	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler, Condensing Heating	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Boiler, Condensing Year-Round**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Boiler Measure Sub Type: Year-round

Program: Large C&I Retrofit

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

### **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler, Condensing Year-Round	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Condensing Year-Round	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Boiler, Condensing Year-Round	0.00%	0.00%	0.00%	0.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Boiler, Condensing Year-Round	Calc	Calc	0.35	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler, Condensing Year-Round	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Boiler, Non-Condensing Blend**

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Boiler
 Measure Sub Type: Blend

Program: Large C&I Retrofit

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler, Non-Condensing Blend	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Non-Condensing Blend	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Boiler, Non-Condensing Blend	0.00%	0.00%	0.00%	0.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Boiler, Non-Condensing Blend	Calc	Calc	-0.05	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler, Non-Condensing Blend	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Boiler, Non-Condensing Heating**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Boiler Measure Sub Type: Heating

Program: Large C&I Retrofit

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler, Non-Condensing Heating	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Non-Condensing Heating	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Boiler, Non-Condensing Heating	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Boiler, Non-Condensing Heating	Calc	Calc	-0.07	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler, Non-Condensing Heating	0.07	0.00	0.16	1.09

# **Boiler, Non-Condensing Year-Round**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Boiler Measure Sub Type: Year-round

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler, Non-Condensing Year- Round	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Non-Condensing Year-Round	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Boiler, Non-Condensing Year-Round	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Boiler, Non-Condensing Year-Round	Calc	Calc	0.35	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler, Non-Condensing Year-Round	0.07	0.00	0.16	1.09

# **Building Operator Certification**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Whole Building Measure Type: BOC Training Measure Sub Type: Certification

Program: Large C&I Retrofit

## **Measure Description**

The Building Operator Certification (BOC) class improves operators' ability to optimize / minimize gas and electricity use in buildings.

### **Baseline Description**

The base case is a building operator without specific training on efficient use of gas and electricity in buildings.

### **Savings Principle**

The high efficiency case is a building operator attending a class on improving the efficiency of gas and electricity use in buildings.

### **Savings Method**

Deemed

#### Unit

MMBTU/SF/BOC completion

#### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Building Operator Certification	0	0.0000	0.00	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Navigant Consulting (2015). Comprehensive Review of Non-Residential Training and Education Programs, with a Focus on Building Operator Certification. Prepared for the Massachusetts PAs and EEAC

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Building Operator Certification	5	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
<b>Building Operator Certification</b>	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Navigant Consulting (2015). Comprehensive Review of Non-Residential Training and Education Programs, with a Focus on Building Operator Certification. Prepared for the Massachusetts PAs and EEAC

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Building Operator Certification	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Building Operator Certification	0.07	0.00	0.16	1.09

# **Building Operator Certification + Capital Improvements**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Whole Building Measure Type: BOC Training Measure Sub Type: Certification +

capital improvements

Program: Large C&I Retrofit

### **Measure Description**

The Building Operator Certification (BOC) class improves operators' ability to optimize / minimize gas and electricity use in buildings.

### **Baseline Description**

The base case is a building operator without specific training on efficient use of gas and electricity in buildings.

#### Savings Principle

The high efficiency case is a building operator attending a class on improving the efficiency of gas and electricity use in buildings, as well as capital investments in EE projects.

#### **Savings Method**

Deemed

#### Unit

MMBTU/SF/BOC completion

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Building Operator Certification + Capital Improvements	0	0.0000	0.00	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: Navigant Consulting (2015). Comprehensive Review of Non-Residential Training and Education Programs, with a Focus on Building Operator Certification. Prepared for the Massachusetts PAs and EEAC

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Building Operator Certification + Capital Improvements	5	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Building Operator Certification + Capital Improvements	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Navigant Consulting (2015). Comprehensive Review of Non-Residential Training and Education Programs, with a Focus on Building Operator Certification. Prepared for the Massachusetts PAs and EEAC

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Building Operator Certification + Capital Improvements	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Building Operator Certification + Capital Improvements	0.07	0.00	0.16	1.09

# **Building Shell**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Whole Building Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Building Shell	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Building Shell	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Building Shell	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Building Shell	Calc	Calc	0.32	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Building Shell	0.07	0.00	0.16	1.09

## **Comprehensive Design - CD**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Whole Building Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Comprehensive Design - CD	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Comprehensive Design - CD	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Comprehensive Design - CD	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Comprehensive Design - CD	Calc	Calc	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Comprehensive Design - CD	0.07	0.00	0.16	1.09

## **Comprehensive Design - CDA**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Whole Building Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Comprehensive Design - CDA	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Comprehensive Design - CDA	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Comprehensive Design - CDA	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Comprehensive Design - CDA	Calc	Calc	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Comprehensive Design - CDA	0.07	0.00	0.16	1.09

# **Comprehensive Retrofit**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Whole Building Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Comprehensive Retrofit	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Comprehensive Retrofit	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Comprehensive Retrofit	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Comprehensive Retrofit	Calc	Calc	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Comprehensive Retrofit	0.07	0.00	0.16	1.09

### **Custom Other**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Whole Building Measure Sub Type: Whole Building

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom Other	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom Other	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Custom Other	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Custom Other	Calc	Calc	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom Other	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$5.00 / Gross therm
Incentive: \$2.50 / Gross therm

## **Custom: SEM**

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Custom
 Measure Type: SEM
 Measure Sub Type: SEM

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Custom: SEM	Calc	Calc	Calc	0.00	0.00	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom: SEM	3	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Custom: SEM	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Custom: SEM	Calc	Calc	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Custom: SEM	0.00	0.00	0.00	1.00

### **Domestic Hot Water**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: DHW Measure Sub Type: Year-round

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Domestic Hot Water	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Domestic Hot Water	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Domestic Hot Water	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Domestic Hot Water	Calc	Calc	0.35	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Domestic Hot Water	0.07	0.00	0.16	1.09

# **Energy Management System (Building)**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: HVAC Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

### **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Energy Management System (Building)	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Energy Management System (Building)	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Energy Management System (Building)	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Water: Gallons Sewer: Gallons		One-time \$
Energy Management System (Building)	Calc	Calc	0.04	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Energy Management System (Building)	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$6.00 / Gross therm

Incentive: \$3.00 / Gross therm

### **ERV - Fixed Plate UPSTR**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Upstream Measure Sub Type: Energy Recovery

Ventilator

Program: Large C&I Retrofit

#### Measure Description

Installation of a gas fired heated air system with ERV ≥60% total effectiveness.

#### **Baseline Description**

The baseline is a gas fired heating system without ERV.

#### **Savings Principle**

The high efficiency case is a gas fired heated air system with ERV ≥60% total effectiveness.

#### **Savings Method**

Calc

#### Unit

Installed gas fired heating system with ERV.

#### **Savings Equation**

Unit Peak kWh Savings =((4.5\*CFM\*deltah\_cooling)\*(1/EER\*ERV\_E)/1000 - (CFM\*PD/6356/Eff\_Motor/Eff\_fan\*0.746\*2)\*CF

Unit Dth Savings per Year =  $(4.5*CFM*deltah\_heating)/\eta*((HDD65*24)/(T_indoor-T_design))*(Hours/24))/1,000,000*ERV_E*0.75$ 

Where:

CF = Coincidence Factor = 0.9

CFM=Outside Air Flow in cubic feet per minute

EER = Provided by customer. If SEER provided, SEER\*0.875.

Eff\_Fan = Efficiency of fan. Provided by customer. If value not provided assume 0.705.

Eff Motor = Efficiency of motor. Provided bycustomer. If value not provided assume 0.855.

ERV\_E = Total Energy Effectiveness of ERV. Provided by manufacturer/customer. If values not provided, fixedplate - sensible heat only = 0.355, fixed plate - sensible&latent heat =0.577, fixedplate - unk = 0.466, rotarywheel = 0.647, heatpipe = 0.31.

Hours = Hours of operation, per day. Provided by customer. If none provided, assume 12.

 $HDD65 = Heating\ Degree\ Days: northern\ -\ design\ cooling\ h = 32.4\ Btu/lbm;\ cooling\ return\ = 28.36\ Btu/lbm,\ HSS65 = 9,833\ degF-days;\ incremental\ cost\ = $1.32/CFM$ 

PD = Additional pressure drop through heat exchanger, inches of water column. Provided by customer. If value is not provided, fixedplate - sensible heat only = 0.00035, fixedplate-sensible&latentheat = 0.00074, fixedplate-unk = 0.00055, rotarywheel = 0.00012, heatpipe=0.00011.

T\_indoor = Customer provided indoor heating conditioned space temperature in degreesF

 $\eta$ = Efficiency of heating equipment. Assume 0.8 unless different efficiency is provided by customer.

deltah\_cooling = difference in enthalpies (btu/lb) between the design day cooling enthalpy and exhaust air heat exchanger inlet enthalpy.

deltah\_heating = difference in enthalpies (btu/lb) between the exhaust air heat exchanger inlet enthalpy and design day heatingenthalpy.

1,000 = conversion factor of watts per kWh

1.000.000 = conversion factor for BTU to Dth

0.75 = factor to account for prevention of freezing of condensate. Control strategies incorporate full air flow by-pass or other strategies that reduce the number of hours of operation at lower temperatures, multiply ERE\_E by 0.75 if not adjusted by manufacturer or customer.

See MN TRM 3.1 for more detail.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ERV - Fixed Plate UPSTR	0.0	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Note: It is assumed cooling savings are equal to the increased fan energy usage.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ERV - Fixed Plate UPSTR	20	1.00	1.00	•	1.00	1.00	1.00	0.47	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
ERV - Fixed Plate UPSTR	25.30%	29.30%	24.30%	21.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
ERV - Fixed Plate UPSTR	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ERV - Fixed Plate UPSTR	0.33	0.12	0.01	0.80

NTG Source: MA 2022 TRM
TRC: \$8.28 / Gross therm
Incentive: \$1.38 / Gross therm

## **ERV - Rotary Wheel UPSTR**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Upstream Measure Sub Type: Energy Recovery

Ventilator

Program: Large C&I Retrofit

#### Measure Description

Installation of a gas fired heated air system with ERV ≥60% total effectiveness.

#### **Baseline Description**

The baseline is a gas fired heating system without ERV.

#### **Savings Principle**

The high efficiency case is a gas fired heated air system with ERV ≥60% total effectiveness.

#### **Savings Method**

Calc

#### Unit

Installed gas fired heating system with ERV.

#### **Savings Equation**

Unit Peak kWh Savings =((4.5\*CFM\*deltah\_cooling)\*(1/EER\*ERV\_E)/1000 - (CFM\*PD/6356/Eff\_Motor/Eff\_fan\*0.746\*2)\*CF

Unit Dth Savings per Year =  $(4.5*CFM*deltah\_heating)/\eta*((HDD65*24)/(T_indoor-T_design))*(Hours/24))/1,000,000*ERV_E*0.75$ 

Where:

CF = Coincidence Factor = 0.9

CFM=Outside Air Flow in cubic feet per minute

EER = Provided by customer. If SEER provided, SEER\*0.875.

Eff\_Fan = Efficiency of fan. Provided by customer. If value not provided assume 0.705.

Eff\_Motor = Efficiency of motor. Provided bycustomer. If value not provided assume 0.855.

ERV\_E = Total Energy Effectiveness of ERV. Provided by manufacturer/customer. If values not provided, fixedplate - sensible heat only = 0.355, fixed plate - sensible&latent heat =0.577, fixedplate - unk = 0.466, rotarywheel = 0.647, heatpipe = 0.31.

Hours = Hours of operation, per day. Provided by customer. If none provided, assume 12.

 $HDD65 = Heating\ Degree\ Days: northern\ -\ design\ cooling\ h = 32.4\ Btu/lbm;\ cooling\ return\ = 28.36\ Btu/lbm,\ HSS65 = 9,833\ degF-days;\ incremental\ cost\ = $1.32/CFM$ 

PD = Additional pressure drop through heat exchanger, inches of water column. Provided by customer. If value is not provided, fixedplate - sensible heat only = 0.00035, fixedplate-sensible&latentheat = 0.00074, fixedplate-unk = 0.00055, rotarywheel = 0.00012, heatpipe=0.00011.

T\_indoor = Customer provided indoor heating conditioned space temperature in degreesF

 $\eta$ = Efficiency of heating equipment. Assume 0.8 unless different efficiency is provided by customer.

deltah\_cooling = difference in enthalpies (btu/lb) between the design day cooling enthalpy and exhaust air heat exchanger inlet enthalpy.

deltah\_heating = difference in enthalpies (btu/lb) between the exhaust air heat exchanger inlet enthalpy and design day heatingenthalpy.

1,000 = conversion factor of watts per kWh

1.000.000 = conversion factor for BTU to Dth

0.75 = factor to account for prevention of freezing of condensate. Control strategies incorporate full air flow by-pass or other strategies that reduce the number of hours of operation at lower temperatures, multiply ERE\_E by 0.75 if not adjusted by manufacturer or customer.

See MN TRM 3.1 for more detail.

## Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ERV - Rotary Wheel UPSTR	0.0	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Note: It is assumed cooling savings are equal to the increased fan energy usage.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ERV - Rotary Wheel UPSTR	20	1.00	1.00		1.00	1.00	1.00	0.47	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
ERV - Rotary Wheel UPSTR	25.30%	29.30%	24.30%	21.00%	

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
ERV - Rotary Wheel UPSTR	0.00	0.00	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ERV - Rotary Wheel UPSTR	0.33	0.12	0.01	0.80

NTG Source: MA 2022 TRM TRC: \$9.65 / Gross therm Incentive: \$1.61 / Gross therm

### **Faucet Aerator**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Faucet Aerator

Program: Large C&I Retrofit

## **Measure Description**

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a commercial setting with service water heated by natural gas.

### **Baseline Description**

The baseline efficiency case is a 2.2 GPM faucet.

#### **Savings Principle**

The high efficiency case is a faucet with 1.5 GPM or less aerator installed.

## **Savings Method**

Deemed

### Unit

Installed faucet aerator.

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: 130.0.

Hours Source: Federal Energy Management Program (2010). Energy Cost Calculator for Faucets and Showerheads. Accessed on 10/12/2011.

Hours Note: The calculator used to determine the deemed savings uses a default operation of 30 minuts/day, 260 days/year. Not applicable for Multifamily applications.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Faucet Aerator	0	0.0000	0.00	1.70	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Faucet Aerator	5	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Faucet Aerator	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: Federal Energy Management Program (2010). Energy Cost Calculator for Faucets and Showerheads. Accessed on 10/12/2011.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

## **Non-Energy Impact Factors**

Measure	asure Water: Gallons		Annual \$	One-time \$
Faucet Aerator	5460.00	5460.00	0.08	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Faucet Aerator	0.07	0.00	0.16	1.09

### **Food Service**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Food Service Measure Sub Type: Year-round

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

### **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Food Service	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Food Service	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Food Service	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Food Service	Calc	Calc	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Food Service	0.07	0.00	0.16	1.09

## Furnace, Blend

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Furnace Measure Sub Type: Blend

Program: Large C&I Retrofit

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Furnace, Blend	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Furnace, Blend	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Furnace, Blend	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Furnace, Blend	Calc	Calc	-0.05	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Furnace, Blend	0.07	0.00	0.16	1.09

# **Furnace, Heating**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Furnace Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Furnace, Heating	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Furnace, Heating	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Furnace, Heating	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Furnace, Heating	Calc	Calc	-0.07	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Furnace, Heating	0.07	0.00	0.16	1.09

## Furnace, Year-Round

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Furnace Measure Sub Type: Year-round

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

### **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Furnace, Year-Round	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Furnace, Year-Round	multi	1.00	1.00	0.87					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Furnace, Year-Round	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-CG-CustGasPY19 - Impact Evaluation of PY2019 Custom Gas Installations

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Furnace, Year-Round	Calc	Calc	0.35	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Furnace, Year-Round	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

## **Heat Pump**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Heat pump Measure Sub Type: Blend

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heat Pump	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heat Pump	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Heat Pump	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Heat Pump	Calc	Calc	-0.07	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heat Pump	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

# Heat Recovery, Blend

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Heat Recovery
 Measure Sub Type: Blend

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heat Recovery, Blend	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heat Recovery, Blend	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Heat Recovery, Blend	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heat Recovery, Blend	Calc	Calc	-0.05	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heat Recovery, Blend	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$6.00 / Gross therm

Incentive: \$3.00 / Gross therm

# Heat Recovery, Heating

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Heat Recovery Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heat Recovery, Heating	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heat Recovery, Heating	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Heat Recovery, Heating	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heat Recovery, Heating	Calc	Calc	-0.07	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heat Recovery, Heating	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$6.00 / Gross therm

Incentive: \$3.00 / Gross therm

# Heat Recovery, Year-Round

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Heat Recovery Measure Sub Type: Year-round

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heat Recovery, Year-Round	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heat Recovery, Year-Round	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Heat Recovery, Year-Round	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons		Annual \$	One-time \$
Heat Recovery, Year-Round	Calc	Calc	0.35	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heat Recovery, Year-Round	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$6.00 / Gross therm

Incentive: \$3.00 / Gross therm

# **High-Pressure Steam Trap HVAC**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Steam Traps Measure Sub Type: Steam Trap

Program: Large C&I Retrofit

#### **Measure Description**

The repair or replacement of malfunctioning steam traps in systems with an operating pressure greater than 15 psig.

#### **Baseline Description**

The baseline efficiency case is a failed steam trap.

#### **Savings Principle**

The high efficiency case is a repaired or replaced steam trap.

#### **Savings Method**

Deemed

#### Unit

Repaired or replaced steam trap.

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
High-Pressure Steam Trap HVAC	0	0.0000	35.60	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: ERS Two-Tier Steam Trap Savings Study; April 26, 2018

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
High-Pressure Steam Trap HVAC	6	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
High-Pressure Steam Trap HVAC	0.00%	0.00%	0.00%	0.00%

Measure Life Source: DNV GL MA 2013,2017 Prescriptive Gas Impact Evaluation: Steam Trap Evaulation Phase 1 & 2

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
High-Pressure Steam Trap HVAC	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
High-Pressure Steam Trap HVAC	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.40 / Gross therm

Incentive: \$2.20 / Gross therm

#### **HVAC**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: HVAC Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
HVAC	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
HVAC	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
HVAC	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
HVAC	Calc	Calc	-0.07	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
HVAC	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$6.00 / Gross therm

Incentive: \$3.00 / Gross therm

### **HVAC** insulation

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: HVAC Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
HVAC insulation	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
HVAC insulation	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
HVAC insulation	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
HVAC insulation	Calc	Calc	-0.07	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
HVAC insulation	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$6.00 / Gross therm
Incentive: \$3.00 / Gross therm

## Low-Flow Showerhead

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow

Showerhead

Program: Large C&I Retrofit

### **Measure Description**

Installation of a low flow showerhead with a flow rate of 1.5 GPM or less in a commercial setting with service water heated by natural gas.

# **Baseline Description**

The baseline efficiency case is a 2.5 GPM showerhead.

#### **Savings Principle**

The high efficiency case is a 1.5 GPM showerhead.

## **Savings Method**

Deemed

#### Unit

Installed low-flow showerhead

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Flow Showerhead	0	0.0000	0.00	5.20	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Flow Showerhead	10	1.00	1.00	1.00		•		•	

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Flow Showerhead	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low-Flow Showerhead	7300.00	7300.00	0.08	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

# Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Low-Pressure Steam Trap HVAC**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Steam Traps Measure Sub Type: Steam Trap

Program: Large C&I Retrofit

#### **Measure Description**

The repair or replacement of malfunctioning steam traps in systems with an operating pressure less than or equal to 15 psig.

#### **Baseline Description**

The baseline efficiency case is a failed steam trap.

#### **Savings Principle**

The high efficiency case is a repaired or replaced steam trap.

#### **Savings Method**

Deemed

#### Unit

Repaired or replaced steam trap.

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Low-Pressure Steam Trap HVAC	0	0.0000	8.40	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: ERS Two-Tier Steam Trap Savings Study; April 26, 2018

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-Pressure Steam Trap HVAC	6	1.00	1.00	1.00					_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Low-Pressure Steam Trap HVAC	0.00%	0.00%	0.00%	0.00%

Measure Life Source: DNV GL MA 2013,2017 Prescriptive Gas Impact Evaluation: Steam Trap Evaulation Phase 1 & 2

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Low-Pressure Steam Trap HVAC	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Low-Pressure Steam Trap HVAC	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.40 / Gross therm

Incentive: \$2.20 / Gross therm

# **Operation & Maintenance**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: O&M Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### **Savings Method**

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Operation & Maintenance	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Operation & Maintenance	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Operation & Maintenance	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Operation & Maintenance	Calc	Calc	-0.07	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Operation & Maintenance	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.50 / Gross therm

Incentive: \$1.25 / Gross therm

# Other, Blend

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Custom Measure Sub Type: Blend

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Other, Blend	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Other, Blend	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Other, Blend	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Other, Blend	Calc	Calc	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Other, Blend	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$6.80 / Gross therm
Incentive: \$3.40 / Gross therm

# Other, Heating

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Other Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Other, Heating	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Other, Heating	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Other, Heating	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Other, Heating	Calc	Calc	-0.07	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Other, Heating	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$6.00 / Gross therm

Incentive: \$3.00 / Gross therm

# Other, Year-Round

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Other Measure Sub Type: Year-round

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Other, Year-Round	Calc	Calc	Calc	Calc	Calc	Calc	0.00

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Other, Year-Round	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Other, Year-Round	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Other, Year-Round	Calc	Calc	0.35	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Other, Year-Round	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$6.00 / Gross therm

Incentive: \$3.00 / Gross therm

# **Pre-Rinse Spray Valve**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Flow Control Measure Sub Type: Low Flow Spray

Valve

Program: Large C&I Retrofit

## **Measure Description**

Retrofitting existing standard spray nozzles in locations where service water is supplied by natural gas fired hot water heater with new low flow pre-rinse spray nozzles with an average flow rate of 1.6 GPM.

#### **Baseline Description**

The baseline efficiency case is a standard efficiency spray valve.

#### **Savings Principle**

The high efficiency case is a low flow pre-rinse spray valve with an average flow rate of 1.6 GPM.

#### **Savings Method**

Deemed

#### Unit

Installed pre-rinse spray valve.

#### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pre-Rinse Spray Valve	0	0.0000	0.00	11.40	0.00	0.00	0.00

Gas DHW MMBtu Source: DNV GL (2014)Impact Evaluation of Massachusetts Prescriptive Gas Pre-Rinse Spray Valve Measure

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Pre-Rinse Spray Valve	8	1.00	1.00	1.00					_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Pre-Rinse Spray Valve	0.00%	0.00%	0.00%	0.00%

Measure Life Source: DNV GL (2014)Impact Evaluation of Massachusetts Prescriptive Gas Pre-Rinse Spray Valve Measure

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Pre-Rinse Spray Valve	6410.00	6410.00	0.08	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Pre-Rinse Spray Valve	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

#### **Process**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: CustomMeasure Type: ProcessMeasure Sub Type: Year-round

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Process	Calc	Calc	Calc	Calc	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Process	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Process	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Process	Calc	Calc	-0.05	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Process	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **Programmable Thermostat**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Thermostat

Program: Large C&I Retrofit

#### **Measure Description**

Installation of programmable thermostats with the ability to adjust heating or air-conditioning operating times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation.

#### **Baseline Description**

The baseline efficiency case is an HVAC system using natural gas to provide space heating without a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system using natural gas to provide space heating with a programmable thermostat installed.

#### **Savings Method**

Deemed

#### Unit

Installed programmable thermostat

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat	0	0.0000	3.20	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: DNV-GL, MA45 Prescriptive Programmable Thermostats, March 2017

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat	15	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Programmable Thermostat	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Programmable Thermostat	0.00	0.00	0.59	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.40 / Gross therm
Incentive: \$2.20 / Gross therm

## **ROOF INSULATION**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Whole Building Measure Type: Insulation Measure Sub Type: Roof

Program: Large C&I Retrofit

**Measure Description** 

Installation of roof insulation in existing facilities.

**Baseline Description** 

The base case is the existing roof insulation level.

**Savings Principle** 

The high efficiency case is the installed insulation level.

**Savings Method** 

Calculated using site-specific inputs

Unit

Completed insulation project.

**Savings Equation** 

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ROOF INSULATION	Calc	Calc	0.25	0.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ROOF INSULATION	25	1.00	1.00	1.00					_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
ROOF INSULATION	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
ROOF INSULATION	0.00	0.00	0	0	

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ROOF INSULATION	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

### **Solar Heat Blend**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Solar heat Measure Sub Type: Blend

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Solar Heat Blend	Calc	Calc	Calc	Calc	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Solar Heat Blend	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Solar Heat Blend	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Solar Heat Blend	Calc	Calc	-0.05	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Solar Heat Blend	0.07	0.00	0.16	1.09

# Solar Heat Year-Round (DHW)

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Solar heat Measure Sub Type: Year-round

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Solar Heat Year-Round (DHW)	Calc	Calc	Calc	Calc	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Solar Heat Year-Round (DHW)	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Solar Heat Year-Round (DHW)	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Solar Heat Year-Round (DHW)	Calc	Calc	0.35	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Solar Heat Year-Round (DHW)	0.07	0.00	0.16	1.09

# **Solar Heating**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Solar heat Measure Sub Type: Heating

Program: Large C&I Retrofit

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Solar Heating	Calc	Calc	Calc	Calc	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Solar Heating	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Solar Heating	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Solar Heating	Calc	Calc	-0.07	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Solar Heating	0.07	0.00	0.16	1.09

## **Steam Trap**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Steam Traps Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Steam Trap	Calc	Calc	Calc	Calc	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Steam Trap	6	1.00	1.00	0.87					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Steam Trap	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: DNV GL MA 2013,2017 Prescriptive Gas Impact Evaluation: Steam Trap Evaulation Phase 1 & 2

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-CG-CustGasPY19 - Impact Evaluation of PY2019 Custom Gas Installations

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Steam Trap	Calc	Calc	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Steam Trap	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.50 / Gross therm
Incentive: \$1.25 / Gross therm

### **Ventilation Reduction**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Ventilation Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Ventilation Reduction	Calc	Calc	Calc	Calc	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Ventilation Reduction	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Ventilation Reduction	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Ventilation Reduction	Calc	Calc	-0.07	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Ventilation Reduction	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.40 / Gross therm
Incentive: \$2.20 / Gross therm

# **Verified Savings**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Verified savings Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Verified Savings	Calc	Calc	Calc	Calc	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Verified Savings	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Verified Savings	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Verified Savings	Calc	Calc	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Verified Savings	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.40 / Gross therm

Incentive: \$2.20 / Gross therm

### **VSDs on HVAC**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: VSD Measure Sub Type: Heating

Program: Large C&I Retrofit

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
VSDs on HVAC	Calc	Calc	Calc	Calc	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSDs on HVAC	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
VSDs on HVAC	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
VSDs on HVAC	Calc	Calc	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
VSDs on HVAC	0.07	0.00	0.16	1.09

### **VSDs on Non-HVAC**

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Custom
 Measure Type: VSD
 Measure Sub Type: Blend

Program: Large C&I Retrofit

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

### **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
VSDs on Non-HVAC	Calc	Calc	Calc	Calc	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSDs on Non-HVAC	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
VSDs on Non-HVAC	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
VSDs on Non-HVAC	Calc	Calc	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
VSDs on Non-HVAC	0.07	0.00	0.16	1.09

# WiFi Tstat - Cooling and Heating

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Controls
 Measure Sub Type: WiFi T-stat

Program: Large C&I Retrofit

### **Measure Description**

A communicating thermostat which allows remote set point adjustment and control via remote application. System requires an outdoor air temperature algorithm in the control logic to operate heating and cooling systems.

### **Baseline Description**

The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system that has a Wi-Fi thermostat installed.

### **Savings Method**

Deemed

### Unit

Installation of WiFi programmable thermostat

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Tstat - Cooling and Heating	0	0	6.60	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Tstat - Cooling and Heating	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
WiFi Tstat - Cooling and Heating	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WiFi Tstat - Cooling and Heating	0.00	0.00	0.59	0.00

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Tstat - Cooling and Heating	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.40 / Gross therm
Incentive: \$2.20 / Gross therm

# WiFi Tstat - Heating Only

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Controls
 Measure Sub Type: WiFi T-stat

Program: Large C&I Retrofit

### **Measure Description**

A communicating thermostat which allows remote set point adjustment and control via remote application. System requires an outdoor air temperature algorithm in the control logic to operate heating and cooling systems Primary Energy Impact: Natural Gas.

### **Baseline Description**

The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.

#### **Savings Principle**

The high efficiency case is an HVAC system that has a Wi-Fi thermostat installed.

### **Savings Method**

Deemed

#### Unit

Installation of WiFi programmable thermostat

#### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WiFi Tstat - Heating Only	0	0	6.60	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Tstat - Heating Only	15	1.00	1.00	1.00		1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WiFi Tstat - Heating Only	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WiFi Tstat - Heating Only	0.00	0.00	0.59	0.00

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WiFi Tstat - Heating Only	0.07	0.00	0.16	1.09

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.40 / Gross therm
Incentive: \$2.20 / Gross therm

## **Advanced Building**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Whole Building Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Advanced Building	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Advanced Building	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Advanced Building	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Advanced Building	Calc	Calc	0.00	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Advanced Building	0.48	0.02	0.03	0.58

### **BOILER RESET 1 STAGE**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Controls Measure Sub Type: Boiler Control

**Program:** Large Commercial New Construction

#### **Measure Description**

Boiler reset controls are devices that improve the efficiency of an existing boiler system by modulating the hot water temperature set point. Reset controls automatically control boiler water temperature based on outdoor temperature using a software program; load controls sense the thermal demand of the heating system and resets the water temperature based on the demand.

## **Baseline Description**

The baseline efficiency case is a boiler without reset or load controls.

### **Savings Principle**

The efficient case is a boiler with reset or load controls, which reset the supply water temperature based on outdoor temperatures and/or building load.

### **Savings Method**

Deemed

### Unit

Installation of boiler reset control on existing boiler

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
BOILER RESET 1 STAGE	0	0.0000	35.50	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
BOILER RESET 1 STAGE	15	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
BOILER RESET 1 STAGE	0.00%	0.00%	0.00%	0.00%

Measure Life Source: ACEEE (2006). Emerging Technologies Report: Advanced Boiler Controls. Prepared for ACEEE.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
BOILER RESET 1 STAGE	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
BOILER RESET 1 STAGE	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.80 / Gross therm

Incentive: \$3.00 / Gross Therm

# **Boiler, Condensing Blend**

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Boiler
 Measure Sub Type: Blend

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler, Condensing Blend	Calc	Calc	0.00	0.00	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Condensing Blend	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Boiler, Condensing Blend	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Boiler, Condensing Blend	Calc	Calc	-0.01	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler, Condensing Blend	0.48	0.02	0.03	0.58

# **Boiler, Condensing Heating**

Fuel: Gas Sector: C&I Program Type: Custom

Measure Category: Custom Measure Type: Boiler Measure Sub Type: Heating

Program: Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW sp custom

Gross Winter kW = deltakW wp custom

Gross MMBtu Gas = deltaMMBtu Gas custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler, Condensing Heating	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Condensing Heating	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Boiler, Condensing Heating	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Boiler, Condensing Heating	Calc	Calc	-0.01	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler, Condensing Heating	0.48	0.02	0.03	0.58

# **Boiler, Condensing Year-Round**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Boiler Measure Sub Type: Year-round

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler, Condensing Year-Round	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Condensing Year-Round	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Boiler, Condensing Year-Round	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Boiler, Condensing Year-Round	Calc	Calc	-0.01	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler, Condensing Year-Round	0.48	0.02	0.03	0.58

# **Boiler, Non-Condensing Blend**

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Boiler
 Measure Sub Type: Blend

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler, Non-Condensing Blend	Calc	Calc	0.00	0.00	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Non-Condensing Blend	multi	1.00	1.00	0.83					

Measure	Winter Peak		Summer Peak	Summer Off-Peak
	Energy %		Energy %	Energy %
Boiler, Non-Condensing Blend	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Boiler, Non-Condensing Blend	Calc	Calc	-0.01	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler, Non-Condensing Blend	0.48	0.02	0.03	0.58

# **Boiler, Non-Condensing Heating**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Boiler Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler, Non-Condensing Heating	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Non-Condensing Heating	multi	1.00	1.00	0.83					

Measure	Winter Peak		Summer Peak	Summer Off-Peak	
	Energy %		Energy %	Energy %	
Boiler, Non-Condensing Heating	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Boiler, Non-Condensing Heating	Calc	Calc	-0.01	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler, Non-Condensing Heating	0.48	0.02	0.03	0.58

# **Boiler, Non-Condensing Year-Round**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Boiler Measure Sub Type: Year-round

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler, Non-Condensing Year- Round	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Non-Condensing Year-Round	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Boiler, Non-Condensing Year-Round	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Boiler, Non-Condensing Year-Round	Calc	Calc	-0.01	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler, Non-Condensing Year-Round	0.48	0.02	0.03	0.58

### Boiler95

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Boiler

Program: Large Commercial New Construction

#### **Measure Description**

The installation of a high efficiency natural gas fired condensing boilers. High efficiency boilers take advantage of improved design, sealed combustion and condensing flue gases in a second heat exchanger to achieve improved efficiency. (Only condensingboilers are offered as prescriptive measures. Program incentives for other boiler types are offered through the custom program.)

## **Baseline Description**

The baseline efficiency assumes compliance with the International Energy Conservation Code (IECC) 2012. Table 19 in Appendix A details the specific efficiency requirements by equipment type and capacity.

#### **Savings Principle**

The high efficiency case assumes a gas-fired boiler that exceeds the efficiency levels required by Rhode Island State Building Code. Actual site efficiencies should be determined on a case-by-case basis.

#### **Savings Method**

Deemed

#### Unit

Installed high-efficiency condensing boiler

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Boiler95	0	0.0000	27.80	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler95	25	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Boiler95	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Energy realization rate is 100% because deemed savings are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Boiler95	0.00	0.00	-0.09	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Boiler95	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.80 / Gross therm

Incentive: \$3.00 / Gross Therm

# **Building Shell**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Whole Building Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

### **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Building Shell	Calc	Calc	Calc	0.00	0.00	Calc	Calc

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Building Shell	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Building Shell	0.00%	0.00%	0.00%	0.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Building Shell	Calc	Calc	0.32	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Building Shell	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

## **CODES AND STANDARDS**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Codes and Measure Type: Codes and Standards Measure Sub Type: Codes and

Standards Standards

Program: Large Commercial New Construction

### **Measure Description**

Energy efficiency code trainings and advocacy work to improve energy efficiency of buildings and equipment within Rhode Island.

### **Baseline Description**

Un-influenced adoption curve of federal minimum codes and standards.

#### **Savings Principle**

Accelerated adoption of advancing energy codes and equipment standards.

### **Savings Method**

Calculated based on attribution study

#### Unit

Adoption of advancing energy codes and equipment standards.

#### **Savings Equation**

Gross kWh = deltakWh custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
CODES AND STANDARDS	Calc	0.0000	Calc	0.00	0.00	0.00	0.00

Electric kWh Source: NMR - Rhode Island Code Compliance Enhancement Initiative Attribution and Savings Study

Gas Heat MMBtu Source: NMR - Rhode Island Code Compliance Enhancement Initiative Attribution and Savings Study

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CODES AND STANDARDS	20	1.00	1.00	1.00					_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
CODES AND STANDARDS	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
CODES AND STANDARDS	0.00	0.00	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
CODES AND STANDARDS	0.00	0.00	0.00	1.00

NTG Note: The Net-to-Gross ratio is assumed to be 100%.

# **Combined Heat and Power (Gas)**

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Custom
 Measure Type: CHP
 Measure Sub Type: Blend

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Combined Heat and Power (Gas)	Calc	Calc	0.00	0.00	Calc	Calc	Calc

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Combined Heat and Power (Gas)	multi	1.00	1.00	0.87					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Combined Heat and Power (Gas)	0.00%	0.00%	0.00%	0.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: RI-20-CG-CustGasPY19 - Impact Evaluation of PY2019 Custom Gas Installations

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Combined Heat and Power (Gas)	Calc	Calc	0	0

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Combined Heat and Power (Gas)	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

# **COMBO COND BOIL/WTR HTR 90+**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Boiler Measure Sub Type: Combo

Condensing

**Program:** Large Commercial New Construction

### **Measure Description**

This measure promotes the installation of a combined high-efficiency boiler and water heating unit. Combined boiler and water heating systems are more efficient than separate systems because they eliminate the standby heat losses of an additional tank.

## **Baseline Description**

The baseline efficiency case is an 80% AFUE boiler with a 0.594 EF water heater.

### **Savings Principle**

The high efficiency case is a condensing, integrated water heater/boiler with an AFUE >= 90%.

#### **Savings Method**

Deemed

#### Unit

Installed high-efficiency condensing combination DHW heater / boiler

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COMBO COND BOIL/WTR HTR 90+	0	0	24.60	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COMBO COND BOIL/WTR HTR 90+	20	1.00	1.00	1.00		1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
COMBO COND BOIL/WTR HTR 90+	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
COMBO COND BOIL/WTR HTR 90+	0.00	0.00	-0.08	0.00

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COMBO COND BOIL/WTR HTR 90+	0.71	0.00	0.00	0.29

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

# **COMBO COND BOIL/WTR HTR 95+**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Boiler Measure Sub Type: Combo

Condensing

**Program:** Large Commercial New Construction

### **Measure Description**

This measure promotes the installation of a combined high-efficiency boiler and water heating unit. Combined boiler and water heating systems are more efficient than separate systems because they eliminate the standby heat losses of an additional tank.

### **Baseline Description**

The baseline efficiency case is an 80% AFUE boiler with a 0.594 EF water heater.

#### **Savings Principle**

The high efficiency case is a condensing, integrated water heater/boiler with an AFUE >= 95%.

#### **Savings Method**

Deemed

#### Unit

Installed high-efficiency condensing combination DHW heater / boiler

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COMBO COND BOIL/WTR HTR 95+	0	0	31.80	0.00	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COMBO COND BOIL/WTR HTR 95+	20	1.00	1.00	1.00		1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
COMBO COND BOIL/WTR HTR 95+	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
COMBO COND BOIL/WTR HTR 95+	0.00	0.00	-0.08	0.00

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COMBO COND BOIL/WTR HTR 95+	0.71	0.00	0.00	0.29

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

TRC: \$3.20 / Gross therm
Incentive: \$2.00 / Gross Therm

# COMBO COND FURN/WTR HTR

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Furnace

Program: Large Commercial New Construction

### **Measure Description**

Installation of a combination furnace/water heater.

### **Baseline Description**

It is assumed that the baseline is an 85% AFUE furnace and a separate high draw gas fired storage water heater with an efficiency rating of 0.63 UEF.

### **Savings Principle**

A new combination 97% AFUE furnace and 0.90 tankless water heater.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency combination condensing furnace/DHW heater

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COMBO COND FURN/WTR HTR	0	0	0.00	0.00	14.30	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COMBO COND FURN/WTR HTR	18	1.00	1.00	1.00		1.00	1.00	0.00	0.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
COMBO COND FURN/WTR HTR	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
COMBO COND FURN/WTR HTR	0.00	0.00	-0.08	0.00

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COMBO COND FURN/WTR HTR	0.71	0.00	0.00	0.29

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

## **Comprehensive Design**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Whole Building Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

### **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Comprehensive Design	Calc	Calc	Calc	0.00	0.00	Calc	Calc

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Comprehensive Design	multi	1.00	1.00	0.97					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Comprehensive Design	0.00%	0.00%	0.00%	0.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Comprehensive Design	Calc	Calc	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Comprehensive Design	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$6.40 / Gross therm

Incentive: \$4.00 / Gross Therm

# **Comprehensive Design Assistance**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Whole Building Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Installed custom efficiency application.

## **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Comprehensive Design Assistance	Calc	Calc	Calc	0.00	0.00	Calc	Calc

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Comprehensive Design Assistance	multi	1.00	1.00	0.97					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Comprehensive Design Assistance	0.00%	0.00%	0.00%	0.00%

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Comprehensive Design Assistance	Calc	Calc	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Comprehensive Design Assistance	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

#### **COND UNIT HEATER 151-300 MBH**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heating Measure Sub Type: Unit Heater

Program: Large Commercial New Construction

## **Measure Description**

The baseline efficiency case is a standard efficiency gas fired unit heater with minimum combustion efficiency of 80%, interrupted or intermittent ignition device (IID), and either power venting or an automatic flue damper.

### **Baseline Description**

The baseline efficiency case is a standard efficiency unit heater.

#### **Savings Principle**

The high efficiency case is a condensing gas unit heater with 90% AFUE or greater.

# **Savings Method**

Deemed

#### Unit

Installed condensing unit heater.

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COND UNIT HEATER 151-300 MBH	0	0.0000	40.90	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COND UNIT HEATER 151-300 MBH	18	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
COND UNIT HEATER 151-300 MBH	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Ecotrope, Inc. (2003). Natural Gas Efficiency and Conservation Measure Resource Assessment for the Residential and Commercial Sectors. Prepared for the Energy Trust of Oregon.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
COND UNIT HEATER 151-300 MBH	0.00	0.00	-0.08	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COND UNIT HEATER 151-300 MBH	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

## **COND WATER HEATER 94%MIN 75-300 MBH**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Condensing

Water Heater

Program: Large Commercial New Construction

### **Measure Description**

The installation of a high-efficiency condensing water heater over 94% and between 75-300 kBtuh.

### **Baseline Description**

The baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code. For condensing stand-alone water heaters, the baseline is a stand-alone tank water heater with a thermal efficiency of 80%.

### **Savings Principle**

The high efficiency case is a condensing stand-alone commercial water heater with a thermal efficiency of 95% or greater and a capacity between 75,000 Btu and 300,000 Btu.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency water heater.

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COND WATER HEATER 94%MIN 75-300 MBH	0	0.0000	0.00	31.80	0.00	0.00	0.00

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COND WATER HEATER 94%MIN 75- 300 MBH	15	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
COND WATER HEATER 94%MIN 75- 300 MBH	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
COND WATER HEATER 94%MIN 75- 300 MBH	0.00	0.00	-0.08	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COND WATER HEATER 94%MIN 75- 300 MBH	0.71	0.00	0.00	0.29

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

TRC: \$6.40 / Gross therm

Incentive: \$4.16 / Gross Therm

# Condensing Boiler <= 300 MBH, 95% AFUE

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Boiler

**Program:** Large Commercial New Construction

#### **Measure Description**

The installation of a high efficiency natural gas fired condensing boilers. High efficiency boilers take advantage of improved design, sealed combustion and condensing flue gases in a second heat exchanger to achieve improved efficiency. (Only condensingboilers are offered as prescriptive measures. Program incentives for other boiler types are offered through the custom program.)

### **Baseline Description**

The baseline efficiency assumes compliance with the International Energy Conservation Code (IECC) 2012. Table 19 in Appendix A details the specific efficiency requirements by equipment type and capacity.

#### **Savings Principle**

The high efficiency case assumes a gas-fired boiler up to 300 MBH that is >= 95% AFUE.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency condensing boiler with 95%+ AFUE

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Condensing Boiler <= 300 MBH, 95% AFUE	0	0.0000	17.70	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: C&I Prescriptive and Custom NTG Omnibus Study (MA20X07-B-CIOMNINTG)

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Condensing Boiler <= 300 MBH, 95% AFUE	25	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Condensing Boiler <= 300 MBH, 95% AFUE	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Energy realization rate is 100% because deemed savings are based on evaluation results.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Condensing Boiler <= 300 MBH, 95% AFUE	0.00	0.00	-0.08	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Condensing Boiler <= 300 MBH, 95% AFUE	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.64 / Gross therm

Incentive: \$2.91 / Gross Therm

# Condensing Boiler <= 300 MBH

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Boiler

**Program:** Large Commercial New Construction

#### **Measure Description**

The installation of a high efficiency natural gas fired condensing boilers. High efficiency boilers take advantage of improved design, sealed combustion and condensing flue gases in a second heat exchanger to achieve improved efficiency. (Only condensingboilers are offered as prescriptive measures. Program incentives for other boiler types are offered through the custom program.)

### **Baseline Description**

The baseline efficiency assumes compliance with the International Energy Conservation Code (IECC) 2012. Table 19 in Appendix A details the specific efficiency requirements by equipment type and capacity.

#### **Savings Principle**

The high efficiency case assumes a gas-fired boiler up to 300 MBH that is >= 90% AFUE.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency condensing boiler with 90%+ AFUE

# **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Condensing Boiler <=300 MBH	0	0.0000	14.70	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: C&I Prescriptive and Custom NTG Omnibus Study (MA20X07-B-CIOMNINTG)

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Condensing Boiler <=300 MBH	25	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Condensing Boiler <=300 MBH	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Energy realization rate is 100% because deemed savings are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Condensing Boiler <=300 MBH	0.00	0.00	-0.08	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Condensing Boiler <=300 MBH	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.80 / Gross therm
Incentive: \$3.00 / Gross Therm

# Condensing Boiler >1,700 MBH

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Boiler

**Program:** Large Commercial New Construction

#### **Measure Description**

The installation of a high efficiency natural gas fired condensing boilers. High efficiency boilers take advantage of improved design, sealed combustion and condensing flue gases in a second heat exchanger to achieve improved efficiency. (Only condensingboilers are offered as prescriptive measures. Program incentives for other boiler types are offered through the custom program.)

### **Baseline Description**

The baseline efficiency assumes compliance with the International Energy Conservation Code (IECC) 2012. Table 19 in Appendix A details the specific efficiency requirements by equipment type and capacity.

#### **Savings Principle**

The high efficiency case assumes a gas-fired boiler 1701+ MBH that is >= 90% AFUE.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency condensing boiler with 90%+ AFUE

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Condensing Boiler >1,700 MBH	0	0.0000	165.30	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: C&I Prescriptive and Custom NTG Omnibus Study (MA20X07-B-CIOMNINTG)

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Condensing Boiler >1,700 MBH	25	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Condensing Boiler >1,700 MBH	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Energy realization rate is 100% because deemed savings are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Condensing Boiler >1,700 MBH	0.00	0.00	-0.08	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Condensing Boiler >1,700 MBH	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.80 / Gross therm
Incentive: \$3.00 / Gross Therm

# Condensing Boiler 1,000-1,700 MBH

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Boiler

**Program:** Large Commercial New Construction

#### **Measure Description**

The installation of a high efficiency natural gas fired condensing boilers. High efficiency boilers take advantage of improved design, sealed combustion and condensing flue gases in a second heat exchanger to achieve improved efficiency. (Only condensingboilers are offered as prescriptive measures. Program incentives for other boiler types are offered through the custom program.)

### **Baseline Description**

The baseline efficiency assumes compliance with the International Energy Conservation Code (IECC) 2012. Table 19 in Appendix A details the specific efficiency requirements by equipment type and capacity.

#### **Savings Principle**

The high efficiency case assumes a gas-fired boiler 1000 to 1700 MBH that is >= 90% AFUE.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency condensing boiler with 90%+ AFUE

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Condensing Boiler 1,000-1,700 MBH	0	0.0000	94.50	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: C&I Prescriptive and Custom NTG Omnibus Study (MA20X07-B-CIOMNINTG)

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Condensing Boiler 1,000-1,700 MBH	25	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Condensing Boiler 1,000-1,700 MBH	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Energy realization rate is 100% because deemed savings are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Condensing Boiler 1,000-1,700 MBH	0.00	0.00	-0.08	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Condensing Boiler 1,000-1,700 MBH	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.80 / Gross therm

Incentive: \$3.00 / Gross Therm

# **Condensing Boiler 300-499 MBH**

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Boiler

**Program:** Large Commercial New Construction

#### **Measure Description**

The installation of a high efficiency natural gas fired condensing boilers. High efficiency boilers take advantage of improved design, sealed combustion and condensing flue gases in a second heat exchanger to achieve improved efficiency. (Only condensingboilers are offered as prescriptive measures. Program incentives for other boiler types are offered through the custom program.)

### **Baseline Description**

The baseline efficiency assumes compliance with the International Energy Conservation Code (IECC) 2012. Table 19 in Appendix A details the specific efficiency requirements by equipment type and capacity.

#### **Savings Principle**

The high efficiency case assumes a gas-fired boiler 300 to 499 MBH that is >= 90% AFUE.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency condensing boiler with 90%+ AFUE

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Condensing Boiler 300-499 MBH	0	0.0000	28.00	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: C&I Prescriptive and Custom NTG Omnibus Study (MA20X07-B-CIOMNINTG)

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Condensing Boiler 300-499 MBH	25	1.00	1.00	1.00					

Measure	e Winter Peak		Summer Peak	Summer Off-Peak
	Energy %		Energy %	Energy %
Condensing Boiler 300-499 MBH	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Energy realization rate is 100% because deemed savings are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	ure Water: Gallons		Annual \$	One-time \$
Condensing Boiler 300-499 MBH	0.00	0.00	-0.08	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Condensing Boiler 300-499 MBH	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.80 / Gross therm
Incentive: \$3.00 / Gross Therm

# **Condensing Boiler 500-999 MBH**

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Boiler

**Program:** Large Commercial New Construction

#### **Measure Description**

The installation of a high efficiency natural gas fired condensing boilers. High efficiency boilers take advantage of improved design, sealed combustion and condensing flue gases in a second heat exchanger to achieve improved efficiency. (Only condensingboilers are offered as prescriptive measures. Program incentives for other boiler types are offered through the custom program.)

## **Baseline Description**

The baseline efficiency assumes compliance with the International Energy Conservation Code (IECC) 2012. Table 19 in Appendix A details the specific efficiency requirements by equipment type and capacity.

#### **Savings Principle**

The high efficiency case assumes a gas-fired boiler 500 to 999 MBH that is >= 90% AFUE.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency condensing boiler with 90%+ AFUE

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Condensing Boiler 500-999 MBH	0	0.0000	51.40	0.00	0.00	0.00	0.00

Gas Heat MMBtu Source: C&I Prescriptive and Custom NTG Omnibus Study (MA20X07-B-CIOMNINTG)

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Condensing Boiler 500-999 MBH	25	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Condensing Boiler 500-999 MBH	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Energy realization rate is 100% because deemed savings are based on evaluation results.

# **Non-Energy Impact Factors**

Measure	Water: Gallons		Annual \$	One-time \$
Condensing Boiler 500-999 MBH	0.00	0.00	-0.08	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Condensing Boiler 500-999 MBH	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.80 / Gross therm
Incentive: \$3.00 / Gross Therm

## **COOKING-COMBO OVEN 1**

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Oven

Program: Large Commercial New Construction

### **Measure Description**

Installation of high efficiency gas-fired ovens.

### **Baseline Description**

The baseline efficiency case is a standard efficiency oven (35% convection mode; 20% steam mode).

### **Savings Principle**

The high efficiency case is an oven that meets or exceeds 44% efficiency convection mode, 38% steam mode.

### **Savings Method**

Deemed

#### Unit

Installed high-efficiency gas-fired oven.

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COOKING-COMBO OVEN 1	0	0	0.00	110.30	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COOKING-COMBO OVEN 1	12	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
COOKING-COMBO OVEN 1	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Food Service Technology Center (2011). Gas Combination Oven Life-Cycle Cost Calculator.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
COOKING-COMBO OVEN 1	0.00	0.00	0.26	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per therm

## **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COOKING-COMBO OVEN 1	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$1.89 / Gross therm
Incentive: \$1.12 / Gross Therm

## **COOKING-CONVECTION OVEN 1**

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Oven

Program: Large Commercial New Construction

**Measure Description** 

Installation of high efficiency gas-fired ovens.

**Baseline Description** 

The baseline efficiency case is a standard efficiency oven (30%).

**Savings Principle** 

The high efficiency case is an oven that meets or exceeds 49% efficiency.

**Savings Method** 

Deemed

Unit

Installed high-efficiency gas-fired oven.

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COOKING-CONVECTION OVEN 1	0	0	0.00	35.70	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COOKING-CONVECTION OVEN 1	12	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
COOKING-CONVECTION OVEN 1	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: Food Service Technology Center (2012). Gas Convection Oven Life-Cycle Cost Calculator. http://www.fishnick.com/saveenergy/tools/calculators/govencalc.php.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

## **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
COOKING-CONVECTION OVEN 1	0.00	0.00	0.26	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COOKING-CONVECTION OVEN 1	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$4.93 / Gross therm
Incentive: \$3.08 / Gross Therm

## **COOKING-CONVEYOR OVEN 1**

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Oven

Program: Large Commercial New Construction

**Measure Description** 

Installation of high efficiency gas-fired ovens.

**Baseline Description** 

The baseline efficiency case is a standard efficiency oven (20%).

**Savings Principle** 

The high efficiency case is an oven that meets or exceeds 42% efficiency.

**Savings Method** 

Deemed

Unit

Installed high-efficiency gas-fired oven.

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COOKING-CONVEYOR OVEN 1	0	0	0.00	88.40	0.00	0.00	0.00

Gas DHW MMBtu Source: Food Service Technology Center (2011). Gas Conveyor Oven Life-Cycle Cost Calculator.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COOKING-CONVEYOR OVEN 1	12	1.00	1.00	1.00					_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
COOKING-CONVEYOR OVEN 1	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Food Service Technology Center (2011). Gas Conveyor Oven Life-Cycle Cost Calculator.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
COOKING-CONVEYOR OVEN 1	0.00	0.00	0.26	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COOKING-CONVEYOR OVEN 1	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$1.99 / Gross therm
Incentive: \$1.24 / Gross Therm

### **COOKING-FRYER-1000**

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Fryer

Program: Large Commercial New Construction

### **Measure Description**

The installation of a natural-gas fired fryer that is either ENERGY Star rated or has a heavy-load cooking efficiency of at least 50%. Qualified fryers use advanced burner and heat exchanger designs to use fuel more efficiently, as well as increased insulation to reduce standby heat loss.

# **Baseline Description**

The baseline efficiency case is a non-Energy Star qualified fryer.

### **Savings Principle**

The high efficiency case is an Energy Star qualified fryer.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency gas-fired fryer.

### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COOKING-FRYER-1000	0	0	0.00	78.30	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COOKING-FRYER-1000	12	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
COOKING-FRYER-1000	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR Qualified Gas Fryer.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
COOKING-FRYER-1000	0.00	0.00	0.26	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COOKING-FRYER-1000	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.66 / Gross therm
Incentive: \$1.66 / Gross Therm

## **COOKING-GRIDDLE 1**

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Griddle

Program: Large Commercial New Construction

### **Measure Description**

Installation of a high efficiency gas griddle that meets ENERGY STAR® specifications or have a tested heavy load cooking efficiency of at least 38% and an idle energy rate <= 2,650 Btu/h per square foot of cooking surface utilizing ASTM Standard F1275.

# **Baseline Description**

The baseline efficiency case is a non-ENERGY STAR® qualified gas griddle.

### **Savings Principle**

The high efficiency case is an ENERGY STAR® qualified gas griddle.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency gas-fired griddle

### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COOKING-GRIDDLE 1	0	0	0.00	37.90	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COOKING-GRIDDLE 1	12	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
COOKING-GRIDDLE 1	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Food Service Technology Center (2011). Gas Griddle Life-Cycle Cost Calculation. Accessed on 10/12/2011.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
COOKING-GRIDDLE 1	0.00	0.00	0.26	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COOKING-GRIDDLE 1	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.32 / Gross therm
Incentive: \$1.45 / Gross Therm

# **COOKING-RACK OVEN 1**

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Oven

Program: Large Commercial New Construction

**Measure Description** 

Installation of high efficiency gas-fired ovens.

**Baseline Description** 

The baseline efficiency case is a standard efficiency oven (30%).

**Savings Principle** 

The high efficiency case is an oven that meets or exceeds 50% efficiency.

**Savings Method** 

Deemed

Unit

Installed high-efficiency gas-fired oven.

**Savings Equation** 

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COOKING-RACK OVEN 1	0	0	0.00	211.30	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COOKING-RACK OVEN 1	12	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
COOKING-RACK OVEN 1	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: Food Service Technology Center (2011). Gas Conveyor Oven Life-Cycle Cost Calculator.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
COOKING-RACK OVEN 1	0.00	0.00	0.26	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COOKING-RACK OVEN 1	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.80 / Gross therm
Incentive: \$0.50 / Gross Therm

### **COOKING-STEAMER-1000**

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: Food Service
 Measure Type: Cooking Equipment
 Measure Sub Type: Steamer

Program: Large Commercial New Construction

### **Measure Description**

The installation of an ENERGY STAR® rated natural-gas fired steamer, either connectionless or steam-generator design, with heavy-load cooking efficiency of at least 38%. Qualified steamers reduce heat loss due to better insulation, improved heat exchange, and more efficient steam delivery systems.

### **Baseline Description**

The baseline efficiency case is a steamer with a 15% cooking efficiency. These performance parameters are drawn from a sample of economy grade equipment tested by the Food Service Technology Center based on ASTM F1484.

### **Savings Principle**

The high efficiency case is an ENERGY STAR® rated natural-gas fired steamer, with a tested heavy-load cooking efficiency of at least 38% utilizing ASTM F1484.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency gas-fired steamer.

### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: 4,380.0.

Hours Source: Environmental Protection Agency (2011). Savings Calculator for ENERGY Star Qualified Commercial Kitchen Equipment: Steam Cooker Calcs. Accessed on 10/12/2011.

Hours Note: The deemed savings assumes 4,380 annual operating hours (12 hours a day \* 365 days/year).

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
COOKING-STEAMER-1000	0	0	0.00	370.70	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COOKING-STEAMER-1000	12	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
COOKING-STEAMER-1000	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Environmental Protection Agency (2011). Savings Calculator for ENERGY STAR Qualified Commercial Kitchen Equipment: Steam Cooker Calcs.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: 100% realization rates are assumed because savings are based on researched assumptions by FSTC.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
COOKING-STEAMER-1000	162060.00	162060.00	0.26	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
COOKING-STEAMER-1000	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$0.78 / Gross therm

Incentive: \$0.49 / Gross Therm

### **DIRECT FIRE HEATER**

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Furnace

Program: Large Commercial New Construction

### **Measure Description**

The installation of a high efficiency natural gas warm air furnace with an electronically commutated motor (ECM) for the fan. High efficiency furnaces are better at converting fuel into direct heat and better insulated to reduce heat loss. ECM fan motorssignificantly reduce fan motor electric consumption as compared to both shaped-pole and permanent split capacitor motors.

# **Baseline Description**

The baseline efficiency case is a 85% AFUE furnace in the <150 kBTuh size category.

### **Savings Principle**

The high efficiency case is a new furnace with AFUE >= 96% and an electronically commutated motor.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency warm air furnace with ECM fan motor

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
DIRECT FIRE HEATER	0	0	45.20	0.00	0.00	0.00	0.00

### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
DIRECT FIRE HEATER	20	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
DIRECT FIRE HEATER	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
DIRECT FIRE HEATER	0.00	0.00	0.06	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
DIRECT FIRE HEATER	0.48	0.02	0.03	0.58

### **Domestic Hot Water**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: DHW Measure Sub Type: Year-round

**Program:** Large Commercial New Construction

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### Savings Method

Custom

### Unit

Installed custom efficiency application.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Domestic Hot Water	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Domestic Hot Water	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Domestic Hot Water	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Domestic Hot Water	Calc	Calc	0.35	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Domestic Hot Water	0.48	0.02	0.03	0.58

# **Energy Management System (Building)**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: HVAC Measure Sub Type: Heating

Program: Large Commercial New Construction

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### Savings Method

Custom

### Unit

Installed custom efficiency application.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Energy Management System (Building)	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Energy Management System (Building)	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Energy Management System (Building)	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Gas Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Energy Management System (Building)	Calc	Calc	-0.07	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Energy Management System (Building)	0.48	0.02	0.03	0.58

### **ERV - Fixed Plate UPSTR**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Upstream Measure Sub Type: Energy Recovery

Ventilator

**Program:** Large Commercial New Construction

### Measure Description

Installation of a gas fired heated air system with ERV ≥60% total effectiveness.

### **Baseline Description**

The baseline is a gas fired heating system without ERV.

#### **Savings Principle**

The high efficiency case is a gas fired heated air system with ERV ≥60% total effectiveness.

### Savings Method

Calc

### Unit

Installed gas fired heating system with ERV.

### **Savings Equation**

Unit Peak kWh Savings =((4.5\*CFM\*deltah\_cooling)\*(1/EER\*ERV\_E)/1000 - (CFM\*PD/6356/Eff\_Motor/Eff\_fan\*0.746\*2)\*CF

Unit Dth Savings per Year =  $(4.5*CFM*deltah\_heating)/\eta*((HDD65*24)/(T_indoor-T_design))*(Hours/24))/1,000,000*ERV_E*0.75$ 

Where:

CF = Coincidence Factor = 0.9

CFM=Outside Air Flow in cubic feet per minute

EER = Provided by customer. If SEER provided, SEER\*0.875.

Eff\_Fan = Efficiency of fan. Provided by customer. If value not provided assume 0.705.

Eff\_Motor = Efficiency of motor. Provided bycustomer. If value not provided assume 0.855.

ERV\_E = Total Energy Effectiveness of ERV. Provided by manufacturer/customer. If values not provided, fixedplate - sensible heat only = 0.355, fixed plate - sensible&latent heat =0.577, fixedplate - unk = 0.466, rotarywheel = 0.647, heatpipe = 0.31.

Hours = Hours of operation, per day. Provided by customer. If none provided, assume 12.

 $HDD65 = Heating\ Degree\ Days: northern\ -\ design\ cooling\ h = 32.4\ Btu/lbm;\ cooling\ return\ = 28.36\ Btu/lbm,\ HSS65 = 9,833\ degF-days;\ incremental\ cost\ = $1.32/CFM$ 

PD = Additional pressure drop through heat exchanger, inches of water column. Provided by customer. If value is not provided, fixedplate - sensible heat only = 0.00035, fixedplate-sensible&latentheat = 0.00074, fixedplate-unk = 0.00055, rotarywheel = 0.00012, heatpipe=0.00011.

T\_indoor = Customer provided indoor heating conditioned space temperature in degreesF

η= Efficiency of heating equipment. Assume 0.8 unless different efficiency is provided by customer.

deltah\_cooling = difference in enthalpies (btu/lb) between the design day cooling enthalpy and exhaust air heat exchanger inlet enthalpy.

deltah\_heating = difference in enthalpies (btu/lb) between the exhaust air heat exchanger inlet enthalpy and design day heatingenthalpy.

1,000 = conversion factor of watts per kWh

1.000.000 = conversion factor for BTU to Dth

0.75 = factor to account for prevention of freezing of condensate. Control strategies incorporate full air flow by-pass or other strategies that reduce the number of hours of operation at lower temperatures, multiply ERE\_E by 0.75 if not adjusted by manufacturer or customer.

See MN TRM 3.1 for more detail.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ERV - Fixed Plate UPSTR	0.0	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Note: It is assumed cooling savings are equal to the increased fan energy usage.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ERV - Fixed Plate UPSTR	20	1.00	1.00		1.00	1.00	1.00	0.47	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
ERV - Fixed Plate UPSTR	25.30%	29.30%	24.30%	21.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
ERV - Fixed Plate UPSTR	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ERV - Fixed Plate UPSTR	0.33	0.12	0.01	0.80

NTG Source: MA 2022 TRM

TRC: \$8.28 / Gross therm

Incentive: \$1.38 / Gross Therm

# **ERV - Rotary Wheel UPSTR**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Upstream Measure Sub Type: Energy Recovery

Ventilator

Program: Large Commercial New Construction

### Measure Description

Installation of a gas fired heated air system with ERV ≥60% total effectiveness.

### **Baseline Description**

The baseline is a gas fired heating system without ERV.

#### **Savings Principle**

The high efficiency case is a gas fired heated air system with ERV ≥60% total effectiveness.

### Savings Method

Calc

### Unit

Installed gas fired heating system with ERV.

### **Savings Equation**

Unit Peak kWh Savings =((4.5\*CFM\*deltah\_cooling)\*(1/EER\*ERV\_E)/1000 - (CFM\*PD/6356/Eff\_Motor/Eff\_fan\*0.746\*2)\*CF

Unit Dth Savings per Year =  $(4.5*CFM*deltah\_heating)/\eta*((HDD65*24)/(T_indoor-T_design))*(Hours/24))/1,000,000*ERV_E*0.75$ 

Where:

CF = Coincidence Factor = 0.9

CFM=Outside Air Flow in cubic feet per minute

EER = Provided by customer. If SEER provided, SEER\*0.875.

Eff\_Fan = Efficiency of fan. Provided by customer. If value not provided assume 0.705.

Eff\_Motor = Efficiency of motor. Provided bycustomer. If value not provided assume 0.855.

ERV\_E = Total Energy Effectiveness of ERV. Provided by manufacturer/customer. If values not provided, fixedplate - sensible heat only = 0.355, fixed plate - sensible&latent heat =0.577, fixedplate - unk = 0.466, rotarywheel = 0.647, heatpipe = 0.31.

Hours = Hours of operation, per day. Provided by customer. If none provided, assume 12.

 $HDD65 = Heating\ Degree\ Days: northern\ -\ design\ cooling\ h = 32.4\ Btu/lbm;\ cooling\ return\ = 28.36\ Btu/lbm,\ HSS65 = 9,833\ degF-days;\ incremental\ cost\ = $1.32/CFM$ 

PD = Additional pressure drop through heat exchanger, inches of water column. Provided by customer. If value is not provided, fixedplate - sensible heat only = 0.00035, fixedplate-sensible&latentheat = 0.00074, fixedplate-unk = 0.00055, rotarywheel = 0.00012, heatpipe=0.00011.

T\_indoor = Customer provided indoor heating conditioned space temperature in degreesF

 $\eta$ = Efficiency of heating equipment. Assume 0.8 unless different efficiency is provided by customer.

deltah\_cooling = difference in enthalpies (btu/lb) between the design day cooling enthalpy and exhaust air heat exchanger inlet enthalpy.

deltah\_heating = difference in enthalpies (btu/lb) between the exhaust air heat exchanger inlet enthalpy and design day heatingenthalpy.

1,000 = conversion factor of watts per kWh

1.000.000 = conversion factor for BTU to Dth

0.75 = factor to account for prevention of freezing of condensate. Control strategies incorporate full air flow by-pass or other strategies that reduce the number of hours of operation at lower temperatures, multiply ERE\_E by 0.75 if not adjusted by manufacturer or customer.

See MN TRM 3.1 for more detail.

Hours: N/A.

### Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
ERV - Rotary Wheel UPSTR	0.0	Calc	Calc	0.00	0.00	0.00	0.00

Electric kWh Note: It is assumed cooling savings are equal to the increased fan energy usage.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ERV - Rotary Wheel UPSTR	20	1.00	1.00		1.00	1.00	1.00	0.47	0.22

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
ERV - Rotary Wheel UPSTR	25.30%	29.30%	24.30%	21.00%	

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRwp Note: Realization rate is 100% since gross savings values are based on evaluation results.

CFsp Source: Guidehouse, MA Residential Baseline Study
CFwp Source: Guidehouse, MA Residential Baseline Study

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
ERV - Rotary Wheel UPSTR	0.00	0.00	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
ERV - Rotary Wheel UPSTR	0.33	0.12	0.01	0.80

NTG Source: MA 2022 TRM TRC: \$9.65 / Gross therm

Incentive: \$1.61 / Gross Therm

## **Food Service**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Food Service Measure Sub Type: Year-round

**Program:** Large Commercial New Construction

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

# **Savings Method**

Custom

### Unit

Installed custom efficiency application.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Food Service	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Food Service	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Food Service	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Food Service	Calc	Calc	0.00	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Food Service	0.48	0.02	0.03	0.58

# Furnace, Blend

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Furnace
 Measure Sub Type: Blend

**Program:** Large Commercial New Construction

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### Savings Method

Custom

### Unit

Installed custom efficiency application.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Furnace, Blend	Calc	Calc	0.00	0.00	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Furnace, Blend	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Furnace, Blend	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Furnace, Blend	Calc	Calc	0.00	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Furnace, Blend	0.48	0.02	0.03	0.58

# **Furnace, Heating**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Furnace Measure Sub Type: Heating

**Program:** Large Commercial New Construction

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### Savings Method

Custom

### Unit

Installed custom efficiency application.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Furnace, Heating	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Furnace, Heating	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Furnace, Heating	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Furnace, Heating	Calc	Calc	-0.07	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Furnace, Heating	0.48	0.02	0.03	0.58

# Furnace, Year-Round

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Furnace Measure Sub Type: Year-round

**Program:** Large Commercial New Construction

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### Savings Method

Custom

### Unit

Installed custom efficiency application.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Furnace, Year-Round	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Furnace, Year-Round	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Furnace, Year-Round	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Furnace, Year-Round	Calc	Calc	0.35	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Furnace, Year-Round	0.48	0.02	0.03	0.58

## Furnace95ECM

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Furnace

**Program:** Large Commercial New Construction

### **Measure Description**

The installation of a high efficiency natural gas warm air furnace with an electronically commutated motor (ECM) for the fan. High efficiency furnaces are better at converting fuel into direct heat and better insulated to reduce heat loss. ECM fan motorssignificantly reduce fan motor electric consumption as compared to both shaped-pole and permanent split capacitor motors.

# **Baseline Description**

The baseline efficiency case is a 85% AFUE furnace in the <150 kBTuh size category.

### **Savings Principle**

The high efficiency case is a new furnace with AFUE >= 95% and an electronically commutated motor.

### Savings Method

Deemed

### Unit

Installed high-efficiency warm air furnace with ECM fan motor

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Furnace95ECM	168.0	0.1240	5.70	0.00	0.00	0.00	0.00

Electric kWh Source: Energy & Resource Solutions (2011). BFM Impact Evaluation Report. Prepared for the Electric and Gas Program Administrators of Massachusetts.

Electric kW Source: Energy & Resource Solutions (2011). BFM Impact Evaluation Report. Prepared for the Electric and Gas Program Administrators of Massachusetts.

Gas Heat MMBtu Source: DNV GL (2015) Recalculation of Prescriptive Gas Furnace Savings Using a new Baseline

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Furnace95ECM	18	1.00	1.00	1.00		1.00	1.00	0.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Furnace95ECM	38.00%	62.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Source: P72 Prescriptive C&I Loadshapes of Savings
CFwp Source: P72 Prescriptive C&I Loadshapes of Savings

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Furnace95ECM	0.00	0.00	0.05	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Furnace95ECM	0.48	0.02	0.03	0.58

## Furnace97ECM

 Sector: C&I
 Fuel: Gas
 Program Type: Prescriptive

 Measure Category: HVAC
 Measure Type: Heating
 Measure Sub Type: Furnace

**Program:** Large Commercial New Construction

### **Measure Description**

The installation of a high efficiency natural gas warm air furnace with an electronically commutated motor (ECM) for the fan. High efficiency furnaces are better at converting fuel into direct heat and better insulated to reduce heat loss. ECM fan motorssignificantly reduce fan motor electric consumption as compared to both shaped-pole and permanent split capacitor motors.

### **Baseline Description**

The baseline efficiency case is a 85% AFUE furnace in the <150 kBTuh size category.

### **Savings Principle**

The high efficiency case is a new furnace with AFUE >= 97% and an electronically commutated motor.

### **Savings Method**

Deemed

### Unit

Installed high-efficiency warm air furnace with ECM fan motor

### **Savings Equation**

Gross kWh = Qty × deltakWh

Gross kW = Qty × deltakW

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltakWh = Average annual kWh reduction per unit.

deltakW = Average kW reduction per unit.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Furnace97ECM	168.0	0.1240	6.70	0.00	0.00	0.00	0.00

Electric kWh Source: Energy & Resource Solutions (2011). BFM Impact Evaluation Report. Prepared for the Electric and Gas Program Administrators of Massachusetts.

Electric kW Source: Energy & Resource Solutions (2011). BFM Impact Evaluation Report. Prepared for the Electric and Gas Program Administrators of Massachusetts.

Gas Heat MMBtu Source: DNV GL (2015) Recalculation of Prescriptive Gas Furnace Savings Using a new Baseline

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Furnace97ECM	18	1.00	1.00	1.00		1.00	1.00	0.00	1.00

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Furnace97ECM	38.00%	62.00%	0.00%	0.00%	

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

RRsp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

RRwp Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

CFsp Source: P72 Prescriptive C&I Loadshapes of Savings
CFwp Source: P72 Prescriptive C&I Loadshapes of Savings

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Furnace97ECM	0.00	0.00	0.05	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Furnace97ECM	0.48	0.02	0.03	0.58

# **Gas Driven Cooling**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Cooling Measure Sub Type: Year-round

**Program:** Large Commercial New Construction

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### Savings Method

Custom

### Unit

Installed custom efficiency application.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Gas Driven Cooling	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Gas Driven Cooling	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Gas Driven Cooling	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Gas Driven Cooling	Calc	Calc	0	0	

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Gas Driven Cooling	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.56 / Gross therm

Incentive: \$1.60 / Gross Therm

# **Heat Pump**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Heat Pump Measure Sub Type: Year-round

**Program:** Large Commercial New Construction

### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### Savings Method

Custom

### Unit

Installed custom efficiency application.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heat Pump	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heat Pump	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Heat Pump	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heat Pump	Calc	Calc	0	0

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heat Pump	0.48	0.02	0.03	0.58

# Heat Recovery, Blend

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Heat Recovery
 Measure Sub Type: Blend

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heat Recovery, Blend	Calc	Calc	0.00	0.00	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heat Recovery, Blend	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heat Recovery, Blend	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Heat Recovery, Blend	Calc	Calc	0.00	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heat Recovery, Blend	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.56 / Gross therm

Incentive: \$1.60 / Gross Therm

# Heat Recovery, Heating

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Heat Recovery Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heat Recovery, Heating	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heat Recovery, Heating	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Heat Recovery, Heating	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heat Recovery, Heating	Calc	Calc	-0.07	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heat Recovery, Heating	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.56 / Gross therm

Incentive: \$1.60 / Gross Therm

# Heat Recovery, Year-Round

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Heat Recovery Measure Sub Type: Year-round

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Heat Recovery, Year-Round	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heat Recovery, Year-Round	multi	1.00	1.00	0.83					

Measure	sure Winter Peak		Summer Peak	Summer Off-Peak	
	Energy %		Energy %	Energy %	
Heat Recovery, Year-Round	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Heat Recovery, Year-Round	Calc	Calc	0.35	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Heat Recovery, Year-Round	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.56 / Gross therm

Incentive: \$1.60 / Gross Therm

#### **HVAC**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: HVAC Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
HVAC	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
HVAC	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
HVAC	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
HVAC	Calc	Calc	-0.07	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
HVAC	0.48	0.02	0.03	0.58

### **HVAC Insulation**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: HVAC Measure Sub Type: Heating

Program: Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
HVAC Insulation	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
HVAC Insulation	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
HVAC Insulation	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
HVAC Insulation	Calc	Calc	-0.07	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
HVAC Insulation	0.48	0.02	0.03	0.58

#### **INFRARED HEATER - LOW INT**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: HVAC Measure Type: Heating Measure Sub Type: Infrared Heater

Program: Large Commercial New Construction

#### **Measure Description**

The installation of a gas-fired low intensity infrared heating system in place of a unit heater, furnace, or other standard efficiency equipment. Infrared heating uses radiant heat as opposed to warm air to heat buildings. In commercial environments withhigh air exchange rates, heat loss is minimal because the space's heat comes from surfaces rather than air.

#### **Baseline Description**

The baseline efficiency case is a standard efficiency gas-fired unit heater with combustion efficiency of 80%.

#### **Savings Principle**

The high efficiency case is a gas-fired low-intensity infrared heating unit.

#### **Savings Method**

Deemed

#### Unit

Installed infrared heater

#### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
INFRARED HEATER - LOW INT	0	0.0000	12.00	0.00	0.00	0.00	0.00

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
INFRARED HEATER - LOW INT	17	1.00	1.00	1.00		•		•	

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
INFRARED HEATER - LOW INT	0.00%	0.00%	0.00%	0.00%

Measure Life Source: Nexant (2006). DSM Market Characterization Report. Prepared for Questar Gas.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is 100% since gross savings values are based on evaluation results.

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
INFRARED HEATER - LOW INT	0.00	0.00	0.06	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

Impacts Study

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
INFRARED HEATER - LOW INT	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.56 / Gross therm
Incentive: \$1.60 / Gross Therm

## Kitchen Equipment

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Food Service Measure Sub Type: Year-round

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Kitchen Equipment	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Kitchen Equipment	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Kitchen Equipment	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Kitchen Equipment	Calc	Calc	3.40	0	

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Kitchen Equipment	0.48	0.02	0.03	0.58

### Other Blend

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Other
 Measure Sub Type: Blend

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Other Blend	Calc	Calc	0.00	0.00	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Other Blend	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Other Blend	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Other Blend	Calc	Calc	-0.03	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Other Blend	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.56 / Gross therm

Incentive: \$1.60 / Gross Therm

# **Other Heating**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Other Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Other Heating	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Other Heating	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Other Heating	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Other Heating	Calc	Calc	-0.07	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Other Heating	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.56 / Gross therm

Incentive: \$1.60 / Gross Therm

### Other Year-Round

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Other Measure Sub Type: Year-round

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Other Year-Round	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Other Year-Round	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Other Year-Round	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Other Year-Round	Calc	Calc	0.35	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Other Year-Round	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.56 / Gross therm

Incentive: \$1.60 / Gross Therm

#### **Process**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: CustomMeasure Type: ProcessMeasure Sub Type: Year-round

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Process	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Process	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Process	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Process	Calc	Calc	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Process	0.48	0.02	0.03	0.58

### **Solar Heat Blend**

 Sector: C&I
 Fuel: Gas
 Program Type: Custom

 Measure Category: Custom
 Measure Type: Solar heat
 Measure Sub Type: Blend

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Solar Heat Blend	Calc	Calc	0.00	0.00	Calc	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Solar Heat Blend	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Solar Heat Blend	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Solar Heat Blend	Calc	Calc	0	0	

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Solar Heat Blend	0.48	0.02	0.03	0.58

# Solar Heat Year-Round (DHW)

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Solar heat Measure Sub Type: Year-round

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Solar Heat Year-Round (DHW)	Calc	Calc	0.00	Calc	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Solar Heat Year-Round (DHW)	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Solar Heat Year-Round (DHW)	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Solar Heat Year-Round (DHW)	Calc	Calc	0.08	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Solar Heat Year-Round (DHW)	0.48	0.02	0.03	0.58

# **Solar Heating**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Solar heat Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Solar Heating	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Solar Heating	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Solar Heating	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Solar Heating	Calc	Calc	-0.07	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Solar Heating	0.48	0.02	0.03	0.58

### Steam Boiler

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Boiler Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Steam Boiler	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Steam Boiler	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
Steam Boiler	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
Steam Boiler	Calc	Calc	0.35	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Steam Boiler	0.48	0.02	0.03	0.58

# **Steam Trap**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Steam Traps Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

## **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

### **Savings Method**

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Steam Trap	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Steam Trap	6	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Steam Trap	0.00%	0.00%	0.00%	0.00%	

Measure Life Source: DNV GL MA 2013,2017 Prescriptive Gas Impact Evaluation: Steam Trap Evaulation Phase 1 & 2

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Source: PY2020 Custom Gas Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Steam Trap	Calc	Calc	-0.05	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

#### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Steam Trap	0.48	0.02	0.03	0.58

### **Ventilation Reduction**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: Ventilation Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

#### **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Ventilation Reduction	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Ventilation Reduction	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
Ventilation Reduction	0.00%	0.00%	0.00%	0.00%	

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

### **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
Ventilation Reduction	Calc	Calc	-0.07	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

### **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
Ventilation Reduction	0.48	0.02	0.03	0.58

### **VSDs on HVAC**

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: VSD Measure Sub Type: Heating

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

### **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

## Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
VSDs on HVAC	Calc	Calc	Calc	0.00	0.00	Calc	Calc

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSDs on HVAC	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
VSDs on HVAC	0.00%	0.00%	0.00%	0.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
VSDs on HVAC	Calc	Calc	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
VSDs on HVAC	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.35 / Gross therm

Incentive: \$1.28 / Gross Therm

#### VSDs on Non-HVAC

Sector: C&I Fuel: Gas Program Type: Custom

Measure Category: Custom Measure Type: VSD Measure Sub Type: Year-round

**Program:** Large Commercial New Construction

#### **Measure Description**

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

# **Baseline Description**

For Lost Opportunity projects, the baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code or industry accepted standard practice. For retrofit projects, the baseline efficiency case isbased on site-specific information.

#### **Savings Principle**

The high efficiency case is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis. The project must be proven cost-effective in order to qualify for energy efficiency incentives.

#### Savings Method

Custom

#### Unit

Installed custom efficiency application.

# **Savings Equation**

Gross kWh = deltakWh\_custom

Gross Summer kW = deltakW\_sp\_custom

Gross Winter kW = deltakW\_wp\_custom

Gross MMBtu Gas = deltaMMBtu\_Gas\_custom

Gross MMBtu Oil = deltaMMBtu\_Oil\_custom

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
VSDs on Non-HVAC	Calc	Calc	0.00	Calc	0.00	Calc	Calc

#### **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSDs on Non-HVAC	multi	1.00	1.00	0.83					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak	
	Energy %	Energy %	Energy %	Energy %	
VSDs on Non-HVAC	0.00%	0.00%	0.00%	0.00%	

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%. RRe Source: PY2020 Custom Gas Impact Evaluation

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
VSDs on Non-HVAC	Calc	Calc	0	0

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
VSDs on Non-HVAC	0.48	0.02	0.03	0.58

NTG Source: PY2019 C&I Free Ridership/Spillover study

TRC: \$2.35 / Gross therm

Incentive: \$1.28 / Gross Therm

#### **WATER HEATER - INDIRECT**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Indirect Water

Heater

Program: Large Commercial New Construction

#### **Measure Description**

The installation of a an indirect water heater that uses a storage tank that is heated by the main boiler. The energy stored by the water tank allows the boiler to turn off and on less often.

#### **Baseline Description**

The baseline efficiency case assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code. For condensing stand-alone water heaters, the baseline is a stand-alone tank water heater with a thermal efficiency of 80%.

### **Savings Principle**

The high efficiency case is an indirect water heater with a Combined Appliance Efficiency (CAE) of 85% or greater.

#### **Savings Method**

Deemed

#### Unit

Installed high-efficiency water heater.

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WATER HEATER - INDIRECT	0	0.0000	0.00	19.00	0.00	0.00	0.00

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WATER HEATER - INDIRECT	15	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WATER HEATER - INDIRECT	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$	
WATER HEATER - INDIRECT	0.00	0.00	0.08	0	

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WATER HEATER - INDIRECT	0.64	0.00	0.00	0.36

NTG Source: MA C&I HVAC & Water Heater NTG & Market Effects Measurement

TRC: \$3.37 / Gross therm

Incentive: \$2.10 / Gross Therm

## **WATER HEATER - ON-DEMAND 94**

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Tankless Water

Heater

Program: Large Commercial New Construction

#### **Measure Description**

Tankless water heaters circulate water through a heat exchanger to be heated for immediate use, eliminating the standby heat loss associated with a storage tank.

#### **Baseline Description**

The baseline efficiency case is a standalone tank water heater with an energy factor of 0.61.

#### **Savings Principle**

The high efficiency case is a tankless water heater that is ENERGY STAR® rated with an Energy Factor of at least 0.94.

#### **Savings Method**

Deemed

#### Unit

Installed high-efficiency water heater.

#### **Savings Equation**

Gross MMBtu Gas = Qty × deltaMMBtu Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WATER HEATER - ON-DEMAND 94	0	0.0000	0.00	9.40	0.00	0.00	0.00

Gas DHW MMBtu Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

# **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WATER HEATER - ON-DEMAND 94	20	1.00	1.00	1.00					

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WATER HEATER - ON-DEMAND 94	0.00%	0.00%	0.00%	0.00%

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

# Non-Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WATER HEATER - ON-DEMAND 94	0.00	0.00	0.35	0

Annual \$ Source: O&M and Non-O&M NEI Study (MA20X10-B-CIOMMNEI)

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WATER HEATER - ON-DEMAND 94	0.62	0.00	0.00	0.38

NTG Source: MA C&I HVAC & Water Heater NTG & Market Effects Measurement

#### WATER HEATER - ON-DEMAND 95

Sector: C&I Fuel: Gas Program Type: Prescriptive

Measure Category: Water Heating Measure Type: Water Heater Measure Sub Type: Tankless Water

Heater

Program: Large Commercial New Construction

#### **Measure Description**

Condensing tankless water heaters heat water more efficiently by using either a larger heat exchanger or a second heat exchanger to reduce the flue-gas temperature below dewpoint, and heating water for immediate use, eliminating the standby heat loss associated with a storage tank.

# **Baseline Description**

The baseline efficiency case is a standalone tank water heater with an energy factor of 0.61.

#### **Savings Principle**

The high efficiency case is a tankless water heater that is ENERGY STAR® rated with an Energy Factor of at least 0.95.

#### **Savings Method**

Deemed

#### Unit

Installed high-efficiency water heater.

#### **Savings Equation**

Gross MMBtu\_Gas = Qty × deltaMMBtu\_Gas

Where:

Qty = Total number of units.

deltaMMBtu\_Gas = Average annual natural gas reduction per unit.

Hours: N/A.

# Measure Gross Savings per Unit

Measure	kWh	kW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
WATER HEATER - ON-DEMAND 95	0	0.0000	0.00	9.50	0.00	0.00	0.00

Gas DHW MMBtu Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

## **Energy Impact Factors**

Measure	Measure Life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WATER HEATER - ON-DEMAND 95	20	1.00	1.00	1.00					_

Measure	Winter Peak	Winter Off-Peak	Summer Peak	Summer Off-Peak
	Energy %	Energy %	Energy %	Energy %
WATER HEATER - ON-DEMAND 95	0.00%	0.00%	0.00%	0.00%

Measure Life Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

ISR Note: All installations have 100% in-service rate since programs include verification of equipment installations.

SPF Note: Savings persistence is assumed to be 100%.

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value.

# **Non-Energy Impact Factors**

Measure	Water: Gallons	Sewer: Gallons	Annual \$	One-time \$
WATER HEATER - ON-DEMAND 95	0.00	0.00	0.09	0

Annual \$ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy

**Impacts Study** 

Annual \$ Note: NEI per therm

# **Net-to-Gross Factors**

Measure	FR	Sop	Sonp	NTG
WATER HEATER - ON-DEMAND 95	0.62	0.00	0.00	0.38

NTG Source: MA C&I HVAC & Water Heater NTG & Market Effects Measurement

# **Appendix A: Tables**

Table 1: Lighting Power Densities Using the Building Area Method (WATTSb,i)

Building Area Type	Lighting Power Density (W/ft2) [1]
Automotive Facility	0.75
Convention Center	0.64
Court House	0.79
Dining: Bar Lounge/Leisure	0.80
Dining: Cafeteria/Fast Food	0.76
Dining: Family	0.71
Dormitory	0.53
Exercise Center	0.72
Fire Stations	0.56
Gymnasium	0.76
Healthcare-Clinic	0.81
Hospital	0.96
Hotel/Motel	0.56
Library	0.83
Manufacturing Facility	0.82
Motion Picture Theatre	0.44
Multi-Family	0.45
Museum	0.55
Office	0.64
Parking Garage	0.18
Penitentiary	0.69
Performing Arts Theatre	0.84
Police Station	0.66
Post Office	0.65
Religious Building	0.67
Retail	0.84
School/University	0.72
Sports Arena	0.76
Town Hall	0.69
Transportation	0.50
Warehouse	0.45
Workshop	0.91

[1] IECC 2021

Table 2: Lighting Power Densities Using the Space-by-Space Method (WATTSb,i)

Common Space Types	Lighting Power Density (W/ft²)
Atrium – Less than 40 feet in Height	0.48
Atrium – Greater than 40 feet in Height	0.60
Audience/seating	
In an Auditorium	0.61
In a Gymnasium	0.23
In a Motion Picture Theater	0.27
In a Penitentiary	0.67
In a Performing Arts Theater	1.16
In a religious building	0.72
In a sports arena	0.33
Otherwise	0.33
Banking Activity Area	0.61
Classroom/lecture/training	
In a penitentiary	0.89
Otherwise	0.71
Computer room, data center	0.9
Conference/meeting/multipurpose	0.97
Copy/print room	0.31
Corridor	
In a facility for the visually impaired (not primarily used by staff)	0.71
In a hospital	0.71
Otherwise	0.41
Courtroom	1.20
Dining Area	
Bar/lounge/leisure dining	0.86
Cafeteria/fast food dining	0.40
Facility for the visually impaired (not primarily used by staff)	1.27
Family dining area	0.60
Penitentiary	0.42
Otherwise	0.43
Electrical/mechanical	0.43
Emergency vehicle garage	0.52
Food preparation	1.09
Guestroom	0.41
Laboratory	
In or as a classroom	1.11
Otherwise	1.33
Laundry/washing area	0.53
Loading dock, interior	0.88
Lobby	
For an elevator	0.65

Facility for the visually impaired (not primarily used by staff)	1.69
In a hotel	0.51
In a motion picture theater	0.23
In a performing arts theater	1.25
Otherwise	0.84
Locker room	0.52
Lounge/Breakroom	
In a healthcare facility	0.42
Otherwise	0.59
Office - enclosed	0.74
Office – open plan	0.61
Parking area, interior	0.15
Pharmacy Area	1.66
Restroom	0.63
Restroom in a facility for the visually impaired (not primarily used by staff)	1.26
Sales area	1.05
Seating area, general	0.23
Stairwell	0.49
Storage	0.38
Vehicular maintenance area	0.60
Workshop	1.26
BUILDING SPECIFIC SPACE-BY-SPACE TYPES	
Automotive – service/repair	0.60
Convention Center – exhibit space	0.61
Dormitory living quarters	0.50
Facility for the visually impaired	
In a chapel	0.70
In a recreation room	1.77
Fire station – sleeping quarters	0.23
Gymnasium/fitness center	
Exercise area	0.9
Playing area	0.85
Healthcare clinic/hospital	
Imaging room	0.94
Exam/treatment	1.4
Medical Supplies	0.62
Nursery	0.92
Nurse Station	1.17
Operating Room	2.26
Patient room	0.68
Physical therapy room	0.91
Recovery Room	1.25
Library	
Reading Area	0.96

Stacks	1.18
Manufacturing Facility	
Detailed manufacturing area	0.80
Equipment room	0.76
Extra high-bay area (greater than 50 ft floor to ceiling height)	1.42
High-bay area ( 25-50 ft floor to ceiling height)	1.24
Low-bay area (less than 25 ft floor to ceiling height)	0.86
Museum	1.2
General exhibition area	0.31
Restoration room	1.10
Performing arts theater - dressing room	0.41
Post office – sorting area	0.76
Religious buildings	
Fellowship hall	0.54
Worship/pulpit/choir area	0.85
Retail	
Dressing/fitting area	0.51
Mall concourse	0.82
Sports arena – playing area	
Class 1 Facility	2.94
Class 2 Facility	2.01
Class 3 Facility	1.30
Class 4 Facility	0.86
Transportation	
Air/train/bus baggage area	0.39
Airport concourse	0.25
Terminal – ticket counter	0.51
Warehouse	
For smaller, hand-carried items	0.33
Medium/bulky material	0.69

[1] IECC 2021

Table 3: New Construction Proposed Lighting Wattage Tables

Device Code	Device Description	Rated Watts
	LED Exit Signs	
1E0002	2.0 WATT LED	2
1E0003	3.0 WATT LED	3
1E0005	5.0 WLED	5
1E0005C	0.5 WATT LEC	0.5
1E0008	8.0 WLED	8
1E0015	1.5 WATT LED	1.5
1E0105	10.5 WATT LED	10.5
	Compact Fluorescents (CFL's)	
2C0007S	2/7W COMPACT HW	18
1C0005S	5W COMPACT HW	7
1C0007S	7W COMPACT HW	9
1C0009S	9W COMPACT HW	11
1C0011S	11W COMPACT HW	13
1C0013S	13W COMPACT HW	15
1C0018E	18W COMPACT HW ELIG	20
1C0018S	18W COMPACT HW	20
1C0022S	22W COMPACT HW	24
1C0023E	1/23W COMPACT HW ELIG	25
1C0026E	26W COMPACT HW ELIG	28
1C0026S	26W COMPACT HW	28
1C0028S	28W COMPACT HW	30
1C0032E	32W COMPACT HW ELIG	34
1C0032S	32W CIRCLINE HW	34
1C0042E	1/42W COMPACT HW ELIG	48
1C0044S	44W CIRCLINE HW	46
1C0057E	1/57W COMPACT HW ELIG	65
1C2232S	22/32W CIRCLINE HW	58
1C2D10E	10W 2D COMPACT HW ELIG	12
1C2D16E	16W 2D COMPACT HW ELIG	18
1C2D21E	21W 2D COMPACT HW ELIG	22
1C2D28E	28W 2D COMPACT HW ELIG	28
1C2D38E	38W 2D COMP.HW ELIG	36

Device Code	Device Description	Rated <u>Watts</u>	
	Compact Fluorescents (CFL's) (cont)		
1C3240S	32/40W CIRCLINE HW	80	
2C0005S	2/5W COMPACT HW	14	
2C0009S	2/9W COMPACT HW	22	
2C0011S	2/11W COMPACT HW	26	
2C0013E	2/13W COMPACT HW ELIG	28	
2C0013S	2/13W COMPACT HW	30	
2C0018E	2/18W COMP. HW ELIG	40	
2C0026E	2/26W COMP. HW ELIG	54	
2C0032E	2/32W COMPACT HW ELIG	68	
2C0042E	2/42W COMPACT HW ELIG	100	
3C0009S	3/9W COMPACT HW	33	
3C0013S	3/13W COMPACT HW	45	
3C0018E	3/18W COMPACT HW ELIG	60	
3C0026E	3/26W COMPACT HW ELIG	82	
3C0032E	3/32W COMPACT HW ELIG	114	
3C0042E	3/42W COMPACT HW ELIG	141	
4C0018E	4/18W COMPACT HW ELIG	80	
4C0026E	4/26W COMPACT HW ELIG	108	
4C0032E	4/32W COMPACT HW ELIG	152	
4C0042E	4/42W COMPACT HW ELIG	188	
6C0026E	6/26W COMPACT HW ELIG	162	
6C0032E	6/32W COMPACT HW ELIG	228	
6C0042E	6/42W COMPACT HW ELIG	282	
8C0026E	8/26W COMPACT HW ELIG	216	
8C0032E	8/32W COMPACT HW ELIG	304	
8C0042E	8/42W COMPACT HW ELIG	376	
	T5 Systems		
1F14SSE	1L2' 14W T5/ELIG	16	
2F14SSE	2L2' 14W T5/ELIG	32	
3F14SSE	3L2' 14W T5/ELIG	50	
4F14SSE	4L2' 14W T5/ELIG	68	
1F24HSE	1L2' 24W T5HO/ELIG	29	
2F24HSE	2L2' 24W T5HO/ELIG	52	
3F24HSE	3L2' 24W T5HO/ELIG	80	

<u>Device Code</u>	Device Description	Rated <u>Watts</u>
	T5 Systems (cont.)	
1F21SSE	1L3' 21W T5/ELIG	24
2F21SSE	2L3' 21W T5/ELIG	47
1F39HSE	1L3' 39W T5HO/ELIG	42
2F39HSE	2L3' 39W T5HO/ELIG	85
1F28SSE	1L4' 28W T5/ELIG	32
2F28SSE	2L4' 28W T5/ELIG	63
3F28SSE	3L4' 28W T5/ELIG	95
4F28SSE	4L4' 28W T5/ELIG	126
6F28SSE	6L4' 28W T5/ELIG	189
1F47HSE	1L4' 47W T5HO/ELIG	53
2F47HSE	2L4' 47W T5HO/ELIG	103
3F47HSE	3L4' 47W T5HO/ELIG	157
4F47HSE	4L4' 47W T5HO/ELIG	200
5F47HSE	5L4' 47W T5HO/ELIG	260
6F47HSE	6L4' 47W T5HO/ELIG	303
1F50HSE	1L4' 50W T5HO/ELIG	58
2F50HSE	2L4' 50W T5HO/ELIG	110
3F50HSE	3L4' 50W T5HO/ELIG	168
4F50HSE	4L4' 50W T5HO/ELIG	215
5F50HSE	5L4' 50W T5HO/ELIG	278
6F50HSE	6L4' 50W T5HO/ELIG	325
1F54HSE	1L4' 54W T5HO/ELIG	59
2F54HSE	2L4' 54W T5HO/ELIG	117
3F54HSE	3L4' 54W T5HO/ELIG	177
4F54HSE	4L4' 54W T5HO/ELIG	234
5F54HSE	5L4' 54W T5HO/ELIG	294
6F54HSE	6L4' 54W T5HO/ELIG	351
8F54HSE	8L4' 54W T5HO/ELIG	468
10F54HSE	10L4' 54W T5HO/ELIG	585
	Two Foot High Efficient T8 Systems	
1F17ESL	1L2' 17W T8EE/ELEE LOW PWR	14
1F17ESN	1L2' 17W T8EE/ELEE	17
1F17ESH	1L2' 17W T8EE/ELEE HIGH PWR	20
1F28BXE	1L2' F28BX/ELIG	32

<u>Device Code</u>	Device Description	Rated Watts
2F17ESL	2L2' 17W T8EE/ELEE LOW PWR	27
2F17ESN	2L2' 17W T8EE/ELEE	32
2F17ESH	2L2' 17W T8EE/ELEE HIGH PWR	40
2F28BXE	2L2' F28BX/ELIG	63
3F17ESL	3L2' 17W T8EE/ELEE LOW PWR	39
3F17ESN	3L2' 17W T8EE/ELEE	46
3F17ESH	3L2' 17W T8EE/ELEE HIGH PWR	61
3F28BXE	3L2' F28BX/ELIG	94
	Three Foot High Efficient T8 Systems	
1F25ESL	1L3' 25W T8EE/ELEE LOW PWR	21
1F25ESN	1L3' 25W T8EE/ELEE	24
1F25ESH	1L3' 25W T8EE/ELEE HIGH PWR	30
2F25ESL	2L3' 25W T8EE/ELEE LOW PWR	40
2F25ESN	2L3' 25W T8EE/ELEE	45
2F25ESH	2L3' 25W T8EE/ELEE HIGH PWR	60
3F25ESL	3L3' 25W T8EE/ELEE LOW PWR	58
3F25ESN	3L3' 25W T8EE/ELEE	67
3F25ESH	3L3' 25W T8EE/ELEE HIGH PWR	90
	Four Foot T8 High Efficient / Reduce Wattage S	Systems
1F25EEH	1L4' 25W T8EE/ELEE HIGH PWR	30
1F25EEE	1L4' 25W T8EE/ELEE	22
1F25EEL	1L4' 25W T8EE/ELEE LOW PWR	19
2F25EEH	2L4' 25W T8EE/ELEE HIGH PWR	57
2F25EEE	2L4' 25W T8EE/ELEE	43
2F25EEL	2L4' 25W T8EE/ELEE LOW PWR	37
3F25EEH	3L4' 25W T8EE/ELEE HIGH PWR	86
3F25EEE	3L4' 25W T8EE/ELEE	64
3F25EEL	3L4' 25W T8EE/ELEE LOW PWR	57
4F25EEH	4L4' 25W T8EE/ELEE HIGH PWR	111
4F25EEE	4L4' 25W T8EE/ELEE	86
4F25EEL	4L4' 25W T8EE/ELEE LOW PWR	75
1F28EEH	1L4' 28W T8EE/ELEE HIGH PWR	33
1F28EEE	1L4' 28W T8EE/ELEE	24
1F28EEL	1L4' 28W T8EE/ELEE LOW PWR	22
2F28EEH	2L4' 28WT8EE/ELEE HIGH PWR	64

<u>Device Code</u>	<u>Device Description</u>	Rated <u>Watts</u>
2F28EEE	2L4' 28W T8EE/ELEE	48
2F28EEL	2L4' 28W T8EE/ELEE LOW PWR	42
3F28EEH	3L4' 28W T8EE/ELEE HIGH PWR	96
3F28EEE	3L4' 28W T8EE/ELEE	72
3F28EEL	3L4' 28W T8EE/ELEE LOW PWR	63
4F28EEH	4L4' 28W T8EE/ELEE HIGH PWR	126
4F28EEE	4L4' 28W T8EE/ELEE	94
4F28EEL	4L4' 28W T8EE/ELEE LOW PWR	83
1F30EEH	1L4' 30W T8EE/ELEE HIGH PWR	36
1F30EEE	1L4' 30W T8EE/ELEE	26
1F30EEL	1L4' 30W T8EE/ELEE LOW PWR	24
2F30EEH	2L4' 30WT8EE/ELEE HIGH PWR	69
2F30EEE	2L4' 30W T8EE/ELEE	52
2F30EEL	2L4' 30W T8EE/ELEE LOW PWR	45
3F30EEH	3L4' 30W T8EE/ELEE HIGH PWR	103
3F30EEE	3L4' 30W T8EE/ELEE	77
3F30EEL	3L4' 30W T8EE/ELEE LOW PWR	68
Fo	ur Foot T8 High Efficient / Reduce Wattage Syst	ems (cont.)
4F30EEH	4L4' 30W T8EE/ELEE HIGH PWR	133
4F30EEE	4L4' 30W T8EE/ELEE	101
4F30EEL	4L4' 30W T8EE/ELEE LOW PWR	89
1F32EEH	1L4' 32W T8EE/ELEE HIGH PWR	38
1F32EEE	1L4' 32W T8EE/ELEE	28
1F32EEL	1L4' 32W T8EE/ELEE LOW PWR	25
2F32EEH	2L4' 32W T8EE/ELEE HIGH PWR	73
2F32EEE	2L4' 32W T8EE/ELEE	53
2F32EEL	2L4' 32W T8EE/ELEE LOW PWR	47
3F32EEH	3L4' 32W T8EE/ELEE HIGH PWR	109
3F32EEE	3L4' 32W T8EE/ELEE	82
3F32EEL	3L4' 32W T8EE/ELEE LOW PWR	72
4F32EEH	4L4' 32W T8EE/ELEE HIGH PWR	141
4F32EEE	4L4' 32W T8EE/ELEE	107
4F32EEL	4L4' 32W T8EE/ELEE LOW PWR	95
6F32EEH	6L4' 32W T8EE/ELEE HIGH PWR	218
6F32EEE	6L4' 32W T8EE/ELEE	168
6F32EEL	6L4' 32W T8EE/ELEE LOW PWR	146

Device Code	Device Description	Rated <u>Watts</u>
	Eight Foot T8 Systems	
1F59SSE	1L8' T8/ELIG	60
1F80SSE	1L8' T8 HO/ELIG	85
2F59SSE	2L8' T8/ELIG	109
2F59SSL	2L8' T8/ELIG LOW PWR	100
2F80SSE	2L8' T8 HO/ELIG	160
	LED Lighting Fixtures	
1L002	2 WATT LED	2
1L003	3 WATT LED	3
1L004	4 WATT LED	4
1L005	5 WATT LED	5
1L006	6 WATT LED	6
1L007	7 WATT LED	7
1L008	8 WATT LED	8
1L009	9 WATT LED	9
1L010	10 WATT LED	10
1L011	11 WATT LED	11
1L012	12 WATT LED	12
1L013	13 WATT LED	13
1L014	14 WATT LED	14
1L015	15 WATT LED	15
1L016	16 WATT LED	16
1L017	17 WATT LED	17
	LED Lighting Fixtures (cont.)	
1L018	18 WATT LED	18
1L019	19 WATT LED	19
1L020	20 WATT LED	20
1L021	21 WATT LED	21
1L022	22 WATT LED	22
1L023	23 WATT LED	23
1L024	24 WATT LED	24
1L025	25 WATT LED	25
1L026	26 WATT LED	26
1L027	27 WATT LED	27
1L028	28 WATT LED	28
1L029	29 WATT LED	29

<u>Device Code</u>	<b>Device Description</b>	Rated Watts
1L030	30 WATT LED	30
1L031	31 WATT LED	31
1L032	32 WATT LED	32
1L033	33 WATT LED	33
1L034	34 WATT LED	34
1L035	35 WATT LED	35
1L036	36 WATT LED	36
1L037	37 WATT LED	37
1L038	38 WATT LED	38
1L039	39 WATT LED	39
1L040	40 WATT LED	40
1L041	41 WATT LED	41
1L042	42 WATT LED	42
1L043	43 WATT LED	43
1L044	44 WATT LED	44
1L045	45 WATT LED	45
1L046	46 WATT LED	46
1L047	47 WATT LED	47
1L048	48 WATT LED	48
1L049	49 WATT LED	49
1L050	50 WATT LED	50
1L055	55 WATT LED	55
1L060	60 WATT LED	60
1L070	70 WATT LED	70
1L073	73 WATT LED	73
1L075	75 WATT LED	75
1L080	90 WATT LED	90
1L085	85 WATT LED	85
1L090	90 WATT LED	90
	LED Lighting Fixtures (cont.)	
1L095	95 WATT LED	95
1L100	100 WATT LED	100
1L106	106 WATT LED	106
1L107	107 WATT LED	107
1L116	116 WATT LED	116
1L120	120 WATT LED	120
1L125	125 WATT LED	125

1L130	130 WATT LED	130	
1L135	135 WATT LED	135	
1L140	140 WATT LED	140	
1L145	145 WATT LED	145	
1L150	150 WATT LED	150	
1L155	155 WATT LED	155	
1L160	160 WATT LED	160	
1L165	165 WATT LED	165	
1L170	170 WATT LED	170	
1L175	175 WATT LED	175	
1L180	180 WATT LED	180	
1L185	185 WATT LED	185	
1L190	190 WATT LED	190	
1L200	200 WATT LED	200	
1L210	210 WATT LED	210	
1L220	220 WATT LED	220	
1L240	240 WATT LED	240	
	Electronic Metal Halide Lamps		
1M0150E	150W METAL HALIDE EB	160	
1M0200E	200W METAL HALIDE EB	215	
1M0250E	250W METAL HALIDE EB	270	
1M0320E	320W METAL HALIDE EB	345	
1M0350E	350W METAL HALIDE EB	375	
1M0400E	400W METAL HALIDE EB	430	
1M0450E	400W METAL HALIDE EB	480	
	MH Track Lighting		
1M0020E	20W MH SPOT	25	
1M0025E	25W MH SPOT	25	
1M0035E	35W MH SPOT	44	
1M0039E	39W MH SPOT	47	
1M0050E	50W MH SPOT	60	
1M0070E	70W MH SPOT	80	
1M0100E	100W MH SPOT	111	
1M0150E	150W MH SPOT	162	

Table 4: Retrofit Existing Lighting Wattage Tables

		Rated
<u>Device Code</u>	<u>Device Description</u>	Watts
	Incandescent Lamps	
110015	15W INC	15
110020	20W INC	20
110025	25W INC	25
110034	34W INC	34
110036	36W INC	36
110040	40W INC	40
110042	42W INC	42
110045	45W INC	45
110050	50W INC	50
110052	52W INC	52
110054	54W INC	54
110055	55W INC	55
110060	60W INC	60
110065	65W INC	65
110067	67W INC	67
110069	69W INC	69
110072	72W INC	72
110075	75W INC	75
110080	80W INC	80
110085	85W INC	85
110090	90W INC	90
110093	93W INC	93
110100	100W INC	100
110120	120W INC	120
110125	125W INC	125
110135	135W INC	135
110150	150W INC	150
110200	200W INC	200
110300	300W INC	300
110448	448W INC	448
110500	500W INC	500
110750	750W INC	750
111000	1000W INC	1000
111500	1500W INC	1500
	Low Voltage Halogen Finture Linguister Transf	formar)
1R0020	Low Voltage Halogen Fixture (includes Transf	30
1R0020 1R0025	25W LV HALOGEN FIXT	35
1R0025 1R0035	35W LV HALOGEN FIXT	45
	ow Voltage Halogen Fixture (includes Transform	
1R0042	42W LV HALOGEN FIXT	52
1R0042 1R0050	50W LV HALOGEN FIXT	60
1R0065	65W LV HALOGEN FIXT	75
TI//0002	OUVY LY TIALOULIVITAT	73

1R0075	75W LV HALOGEN FIXT	85
	Halogen/Quartz Lamps	
<u>Device Code</u>	Device Description	Rated
1T0035	35W HALOGEN LAMP	<u>Watts</u> 35
1T0040	40W HALOGEN LAMP	40
1T0042	42W HALOGEN LAMP	42
1T0045	45W HALOGEN LAMP	45
1T0047	47W HALOGEN LAMP	47
1T0050	50W HALOGEN LAMP	50
1T0052	52W HALOGEN LAMP	52
1T0055	55W HALOGEN LAMP	55
1T0060	60W HALOGEN LAMP	60
1T0072	72W HALOGEN LAMP	72
1T0075	75W HALOGEN LAMP	75
1T0090	90W HALOGEN LAMP	90
1T0100	100W HALOGEN LAMP	100
1T0150	150W HALOGEN LAMP	150
1T0200	200W HALOGEN LAMP	200
1T0250	250W HALOGEN LAMP	250
1T0300	300W HALOGEN LAMP	300
1T0350	350W HALOGEN LAMP	350
1T0400	400W HALOGEN LAMP	400
1T0425	425W HALOGEN LAMP	425
1T0500	500W HALOGEN LAMP	500
1T0750	750W HALOGEN LAMP	750
1T0900	900W HALOGEN LAMP	900
1T1000	1000W HALOGEN LAMP	1000
1T1200	1200W HALOGEN LAMP	1200
1T1500	1500W HALOGEN LAMP	1500
<u>.                                      </u>		
	Mercury Vapor (MV)	
1V0040S	40W MERCURY	50
1V0050S	50W MERCURY	75
1V0075S	75W MERCURY	95
1V0100S	100W MERCURY	120
1V0175S	175W MERCURY	205
1V0250S	250W MERCURY	290
1V0400S	400W MERCURY	455
41/07000	Low Pressure Sodium (LPS)	
1V0700S	700W MERCURY	775
1V1000S	1000W MERCURY	1075
2V0400S	2/400W MERCURY	880
1L0035S	35W LPS	60
1L0055S	55W LPS	85
1L0090S	90W LPS	130
1L0135S	135W LPS	180
1L0180S	180W LPS	230

	High Pressure Sodium (HPS)	
1H0035S	35W HPS	45
1H0050S	50W HPS	65
1H0070S	70W HPS	90
1H0100S	100W HPS	130
Davies Cada	Davies Description	Rated
Device Code	Device Description	<u>Watts</u>
1H0150S	150W HPS	190
1H0200S	200W HPS	240
1H0225S	225W HPS	275
1H0250S	250W HPS	295
1H0310S	310W HPS	350
1H0360S	360W HPS	435
1H0400S	400W HPS	460
1H0600S	600W HPS	675
1H0750S	750W HPS	835
1H1000S	1000W HPS	1085
	Metal Halide (MH)	
1M0032S	32W METAL HALIDE	40
1M0050S	50W METAL HALIDE	65
1M0070S	70W METAL HALIDE	95
1M0100S	100W METAL HALIDE	120
1M0150S	150W METAL HALIDE	190
1M0175S	175W METAL HALIDE	205
1M0250S	250W METAL HALIDE	295
1M0360S	360W METAL HALIDE	430
1M0400S	400W METAL HALIDE	455
1M0750S	750W METAL HALIDE	825
1M1000S	1000W METAL HALIDE	1075
1M1500S	1500W METAL HALIDE	1615
1M1800S	1800W METAL HALIDE	1875
	Dulas Charl Mahal Halida Laran /Dallash	
1M0100P	Pulse Start Metal Halide Lamp/Ballast 100W MH CWA	128
1M0100P	100W MH LINEAR	118
1M0150P	150W MH CWA	190
1M0150F 1M0150R	150W MH LINEAR	172
1M0175P	175W MH CWA	208
1M0175R	175W MH LINEAR	190
1M0200P	200W MH CWA	232
1M0200F	200W MH LINEAR	218
1M0250P	250W MH CWA	288
1M0250F	250W MH LINEAR	265
1M0300P	300W MH CWA	342
1M0300F	300W MH LINEAR	324
1M0320P	320W MH CWA	365

1M0320R	320W MH LINEAR	345
1M0350P	350W MH CWA	400
1M0350R	350W MH LINEAR	375
1M0400P	400W MH CWA	455
1M0400R	400W MH LINEAR	430
1M0450P	450W MH CWA	508
1M0450R	450W MH LINEAR	480
1M0750P	750W MH CWA	815
1M0750R	750W MH LINEAR	805
1M0875P	875W MH CWA	950
Davisa Cada	Dovice Description	Rated
<u>Device Code</u>	<u>Device Description</u>	<u>Watts</u>
1M0875R	875W MH LINEAR	927
1M1000P	1000W MH CWA	1080
	Two Foot T8 / T12 Systems	
1F20SSS	F20T12/HPF(1)	32
1F80BXE	1L2' F80BXE/ELIG	90
1F55BXE	1L2' F55BX/ELIG	56
2F17SSE	2L2' 17W T8/ELIG	37
2F17SSL	2L2' 17W T8/ELIG LOW POWER	27
2F17SSM	2L2' 17W T8/EEMAG	45
2F20SSS	F20T12/HPF(2)	56
2F24HSS	2L2' 24 T12HO/STD/STD	85
2F40BXE	2L2' F40BX/ELIG	72
2F50BXE	2L2' F50BX/ELIG	108
2F55BXE	2L2'55BXE/ELIG	112
3F17SSE	3L2' 17W T8/ELIG	53
3F17SSL	3L2' 17W T8/ELIG LOW POWER	39
	Two Foot T8 / T12 Systems (cont.)	
3F20SSS	F20T12/HPF(3)	78
3F40BXE	3L2' F40BX/ELIG	102
3F50BXE	3L2' F50BX/ELIG	162
3F55BXE	3L2' F55BX/ELIG	168
4F17SSE	4L2' 17W T8/ELIG	62
4F36BXE	4L2' F36BX/ELIG	148
4F40BXE	4L2' F40BX/ELIG	144
4F40BXH	4L 40W T5 (Std.) HIGH LMN	170
4F50BXE	4L2' F50BX/ELIG	216
4F55BXE	4L2' F55BX/ELIG	224
5F40BXE	5L2' F40BX/ELIG	190
5F50BXE	5L2' F50BX/ELIG	270
5F55BXE	5L2' F55BX/ELIG	280
6F36BXE	6L2' F36BX/ELIG	212
6F40BXE	6L2' F40BX/ELIG	204
6F50BXE	6L2' F50BX/ELIG	324
6F55BXE	6L2' F55BX/ELIG	336
8F36BXE	8L2' F36BX/ELIG	296

8F40BXE	8L2' F40BX/ELIG	288
8F50BXE	8L2' F50BX/ELIG	432
8F55BXE	8L2' F55BX/ELIG	448
9F36BXE	9L2' F36BX/ELIG	318
9F40BXE	9L2' F40BX/ELIG	306
9F50BXE	9L2' F50BX/ELIG	486
9F55BXE	9L2' F55BX/ELIG	504
12F40BE	12L2' F40BX/ELIG	408
12F50BE	12L2' F50BX/ELIG	648
12F55BE	12L2' F55BX/ELIG	672
	Three Foot T8 / T12 Systems	
1F30SEM	1L3' 30W T12 EE/EEMAG	38
<u>Device Code</u>	Device Description	Rated Watts
1F30SES	1L3' 30W T12 EE/STD	42
1F30SSS	1L3' 30W T12 STD/STD	46
1F25SSE	1L3' 25W T8/ELIG	24
1F25SSH	1L3' 25W T8/ELIG HIGH LMN	28
2F30SEE	2L3' 30W T12 EE/ELIG	49
2F30SEM	2L3' 30W T12 EE/EEMAG	66
2F30SES	2L3' 30W T12 EE/STD	73
2F30SSS	2L3' 30W T12 STD/STD	80
2F25SSE	2L3' 25W T8/ELIG	47
2F25SSM	2L3' 25W T8/EEMAG	65
	Three Foot T8 / T12 Systems	
3F30SSS	3L3' 30W T12 STD/STD	140
3F30SES	3L3' 30W T12 EE/STD	127
3F25SSE	3L3' 25W T8/ELIG	68
4F25SSE	4L3' 25W T8/ELIG	88
	Four Foot F48 T8 Systems	
1F48SES	1L4' F48T12EE/STD	50
1F48SSS	1L4' F48T12/STD	60
2F48SES	2L4' F48T12EE/STD	82
2F48SSS	2L4' F48T12/STD	102
3F48SES	3L4' F48T12EE/STD	132
3F48SSS	3L4' F48T12/STD	162
4F48SES	4L4' F48T12EE/STD	164
4F48SSS	4L4' F48T12/STD	204
1F48HES	1L4' F48HO/EE/STD	80
1F48HSS	1L4' F48H0/STD/STD	85
2F48HES	2L4' F48HO/EE/STD	135
2F48HSS	2L4' F48H0/STD/STD	145
3F48HES	3L4' F48HO/EE/STD	215
3F48HSS	3L4' F48H0/STD/STD	230
4F48HES	4L4' F48HO/EE/STD	270
4F48HSS	4L4' F48H0/STD/STD	290

Four Foot F48VHO T12 Systems		
1F48VES	1L4' F48VHO/EE/STD	123
1F48VSS	1L4' F48VHO/STD/STD	138
2F48VES	2L4' F48VHO/EE/STD	210
2F48VSS	2L4' F48VHO/STD/STD	240
3F48VES	3L4' F48VHO/EE/STD	333
3F48VSS	3L4' F48VHO/STD/STD	378
4F48VES	4L4' F48VHO/EE/STD	420
4F48VSS	4L4' F48VHO/STD/STD	480
	Four Foot T12 Systems	
1F40SEE	1L4' EE/ELIG	38
1F40SEM	1L4' EE/EEMAG	40
1F40SES	1L4' EE/STD	50
1F40SSE	1L4' STD/ELIG	46
		Rated
Device Code	<u>Device Description</u>	<u>Watts</u>
1F40SSM	1L4' STD/EEMAG	50
1F40SSS	1L4' STD/STD	57
1F40HSE	1L4' HO/STD/ELIG	59
	Four Foot T12 Systems (cont.)	
2F40SEE	2L4' EE/ELIG	60
2F40SEM	2L4' EE/EEMAG	70
2F40SES	2L4' EE/STD	80
2F40SSE	2L4' STD/ELIG	72
2F40SSM	2L4' STD/EEMAG	86
2F40SSS	2L4' STD/STD	94
3F40SEE	3L4' EE/ELIG	90
3F40SEM	3L4' EE/EEMAG	110
3F40SES	3L4' EE/STD	130
3F40SSE	3L4' STD/ELIG	110
3F40SSM	3L4' STD/EEMAG	136
3F40SSS	3L4' STD/STD	151
4F40SEE	4L4' EE/ELIG	120
4F40SEM	4L4' EE/EEMAG	140
4F40SES	4L4' EE/STD	160
4F40SSE	4L4' STD/ELIG	144
4F40SSM	4L4' STD/EEMAG	172
4F40SSS	4L4' STD/STD	188
6F40SSS	6L4' STD/STD	282
	Four Foot T8 Systems	
1F32SSE	1L4' T8/ELIG	30
1F32SSL	1L4' T8/ELIG LOW POWER	26
1F32SSM	1L4' T8/EEMAG	37
1F32SSH	1L4' T8/ELIG HIGH LMN	36
2F32SSE	2L4' T8/ELIG	60

2F32SSH	2L4' T8/ELIG HIGH LMN	78
2F32SSL	2L4' T8/ELIG LOW PWR	52
2F32SSM	2L4' T8/EEMAG	70
3F32SSE	3L4' T8/ELIG	88
3F32SSH	3L4' T8/ELIG HIGH LMN	112
3F32SSL	3L4' T8/ELIG LOW POWER	76
3F32SSM	3L4' T8/EEMAG	107
4F32SSE	4L4' T8/ELIG	112
4F32SSH	4L4' T8/ELIG HIGH LMN	156
4F32SSL	4L4' T8/ELIG LOW PWR	98
4F32SSM	4L4' T8/EEMAG	140
5F32SSE	5L4' T8/ELIG	148
5F32SSH	5L4' T8/ELIG HIGH LMN	190
6F32SSE	6L4' T8/ELIG	174
8F32SSH	8L4' T8/ELIG HIGH LMN	312
	Five Foot T8 / T12 Systems	
1F60HSM	1L5' HO/STD/EEMAG	90
1F60HSE	1L5' HO/STD/ELIG	70
1F60SSM	1L5'/STD/EEMAG	73
Device Code	Device Description	Rated
	-	<u>Watts</u>
1F60TSM	1L5' T10HO/STD/EEMAG	135
2F40HSE	2L5' HO/STD/ELIG	123
2F40TSE	2L5'T8/ELIG	68
2F60HSM	2L5' HO/STD/EEMAG	178
2F60SSM	2L5'/STD/EEMAG	122
3F40TSE	3L5'T8/ELIG	106
	Ch. Fact T42 0 T42U0 Contains	
45721105	Six Foot T12 & T12HO Systems	90
1F72HSE	1L6' T8HO/ELIG	80
1F72HSS	1L6' F72HO/STD/STD	113
1F72SSM	1LG' STD/EEMAG	80
1F72SSS	1L6' STD/STD	95
2F72HSE	2L6'T8 H0/ELIG	160
2F72HSM	2L6' F72HO/STD/EEMAG 2L6' F72HO/STD	193
2F72HSS 2F72SSM	2L6 F7ZHO/STD 2L6' STD/EEMAG	195 135
2F72SSS	2L6 STD/EEWAG 2L6' STD/STD	173
2F72333	210 310/310	173
	Eight Foot T12HO Systems	
1F96HES	1L8' HO/EE/STD	125
1F96HSS	1L8' HO/STD/STD	135
2F96HEE	2L8' HO/EE/ELIG	170
2F96HEM	2L8' HO/EE/EEMAG	207
2F96HES	2L8' HO/EE/STD	227
2F96HSE	2L8' HO/STD/ELIG	195
2F96HSM	2L8' HO/STD/EEMAG	237
2F96HSS	2L8' HO/STD/STD	257
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3F96HES	3L8' HO/EE/STD	352
3F96HSS	3L8' HO/STD/STD	392
4F96HEE	4L8' HO/EE/ELIG	340
4F96HEM	4L8' HO/EE/EEMAG	414
4F96HES	4L8' HO/EE/STD	454
4F96HSE	4L8' HO/STD/ELIG	390
4F96HSM	4L8' HO/STD/EEMAG	474
4F96HSS	4L8' HO/STD/STD	514
	Eight Foot T12VHO Systems	
1F96VES	1L8' VHO/EE/STD	200
1F96VSS	1L8' VHO/STD/STD	230
2F96VES	2L8' VHO/EE/STD	390
2F96VSS	2L8' VHO/STD/STD	450
3F96VES	3L8' VHO/EE/STD	590
3F96VSS	3L8' VHO/STD/STD	680
4F96VES	4L8' VHO/EE/STD	780
4F96VSS	4L8' VHO/STD/STD	900
	Eight Foot T8 Systems	
1F59SSE	1L8' T8/ELIG	60
1F80SSE	1L8' T8 HO/ELIG	85
2F59SSE	2L8' T8/ELIG	109
2F59SSL	2L8' T8/ELIG LOW PWR	100
Device Code	Device Description	Rated
<u>Device Code</u>	Device Description	<u>Watts</u>
<u>Device Code</u> 2F80SSE	Device Description  2L8' T8 HO/ELIG	
	2L8' T8 HO/ELIG	<u>Watts</u>
2F80SSE	2L8' T8 HO/ELIG  Eight Foot T12 Systems	<u>Watts</u> 160
2F80SSE 1F96SEE	2L8' T8 HO/ELIG  Eight Foot T12 Systems  1L8' EE/ELIG	<u>Watts</u> 160
2F80SSE 1F96SEE 1F96SES	2L8' T8 HO/ELIG  Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD	<u>Watts</u> 160 60 83
2F80SSE  1F96SEE  1F96SES  1F96SSE	2L8' T8 HO/ELIG  Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG	<u>Watts</u> 160  60 83 70
2F80SSE  1F96SEE  1F96SES  1F96SSE  1F96SSS	2L8' T8 HO/ELIG  Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD	<u>Watts</u> 160  60 83 70 100
2F80SSE  1F96SEE  1F96SES  1F96SSE  1F96SSS  2F96SEE	2L8' T8 HO/ELIG  Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG	<u>Watts</u> 160  60 83 70 100 109
2F80SSE  1F96SEE  1F96SES  1F96SSE  1F96SSS  2F96SEE  2F96SEM	Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG	Watts 160  60 83 70 100 109 123
2F80SSE  1F96SEE 1F96SES 1F96SSE 1F96SSS 2F96SEE 2F96SEM 2F96SES	Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG  2L8' EE/ELIG	Watts 160  60 83 70 100 109 123 138
2F80SSE  1F96SEE 1F96SES 1F96SSE 1F96SSS 2F96SEE 2F96SEM 2F96SES 2F96SSE	Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG  2L8' EE/ELIG	Watts 160  60 83 70 100 109 123 138 134
2F80SSE  1F96SEE  1F96SES  1F96SSE  1F96SSS  2F96SEE  2F96SEM  2F96SES  2F96SSE  2F96SSE  2F96SSE	Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG  2L8' EE/ELIG  2L8' EE/ELIG	Watts 160  60 83 70 100 109 123 138 134 158
2F80SSE  1F96SEE 1F96SES 1F96SSE 1F96SSS 2F96SEE 2F96SEM 2F96SES 2F96SSE 2F96SSE 2F96SSM 2F96SSS	Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG  2L8' EE/ELIG  2L8' EE/ELIG	Watts 160  60 83 70 100 109 123 138 134 158 173
2F80SSE  1F96SEE 1F96SES 1F96SSE 1F96SSS 2F96SEE 2F96SEM 2F96SES 2F96SSE 2F96SSE 2F96SSE 3F96SSS 3F96SES	2L8' T8 HO/ELIG  Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG  2L8' EE/ELIG  2L8' EE/ELIG  2L8' STD/ELIG  2L8' STD/ELIG  3L8' STD/ELIG  3L8' STD/ELIG  3L8' STD/ELIG  3L8' STD/ELIG	Watts 160  60 83 70 100 109 123 138 134 158 173 221
2F80SSE  1F96SEE  1F96SES  1F96SSE  1F96SSS  2F96SEE  2F96SEM  2F96SES  2F96SSE  2F96SSS  3F96SSS  3F96SSS	Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG  2L8' EE/EEMAG  2L8' EE/STD  2L8' STD/ELIG  2L8' STD/ELIG  3L8' STD/ELIG	Watts 160  60 83 70 100 109 123 138 134 158 173 221 273
2F80SSE  1F96SEE 1F96SES 1F96SSE 2F96SEE 2F96SEM 2F96SES 2F96SSE 2F96SSE 2F96SSS 3F96SSS 3F96SSS 4F96SEE	Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG  2L8' EE/ELIG  2L8' EE/ELIG  3L8' STD/STD  3L8' STD/ELIG  3L8' STD/ELIG  4L8' STD/ELIG  4L8' STD/STD  3L8' STD/STD  3L8' STD/STD	Watts 160  60 83 70 100 109 123 138 134 158 173 221 273 218
2F80SSE  1F96SEE 1F96SES 1F96SSE 1F96SSS 2F96SEE 2F96SEM 2F96SES 2F96SSE 2F96SSE 3F96SSS 3F96SES 3F96SES 4F96SEM	Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG  2L8' EE/ELIG  2L8' EE/ELIG  2L8' EE/ELIG  3L8' STD/STD  3L8' STD/ELIG  4L8' STD/STD  3L8' STD/STD  3L8' STD/STD  3L8' STD/STD  4L8' EE/ELIG	Watts 160  60 83 70 100 109 123 138 134 158 173 221 273 218 246
2F80SSE  1F96SEE 1F96SES 1F96SSE 1F96SSS 2F96SEE 2F96SEM 2F96SES 2F96SSE 2F96SSE 3F96SSS 3F96SSS 4F96SES 4F96SEB	Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG  2L8' EE/ELIG  2L8' EE/ELIG  2L8' EE/ELIG  3L8' STD/ELIG  4L8' STD/ELIG  4L8' STD/ELIG  4L8' STD/ELIG  4L8' STD/ELIG  4L8' STD/STD  3L8' STD/STD  4L8' EE/STD  4L8' EE/STD	Watts 160  60 83 70 100 109 123 138 134 158 173 221 273 218 246 276
2F80SSE  1F96SEE  1F96SES  1F96SSE  1F96SSS  2F96SEE  2F96SEM  2F96SES  2F96SSE  2F96SSS  3F96SSS  3F96SSS  4F96SEE  4F96SEE  4F96SEE	Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG  2L8' EE/ELIG  2L8' EE/ELIG  2L8' EE/EMAG  2L8' STD/ELIG  2L8' STD/ELIG  4L8' STD/STD  3L8' STD/STD  3L8' EE/STD  4L8' STD/STD  4L8' EE/STD  4L8' EE/ELIG	Watts 160  60 83 70 100 109 123 138 134 158 173 221 273 218 246 276 268
2F80SSE  1F96SEE 1F96SES 1F96SSE 1F96SSS 2F96SEE 2F96SEM 2F96SES 2F96SSE 2F96SSE 3F96SSS 3F96SSS 4F96SES 4F96SEB	Eight Foot T12 Systems  1L8' EE/ELIG  1L8' EE/STD  1L8' STD/ELIG  1L8' STD/STD  2L8' EE/ELIG  2L8' EE/ELIG  2L8' EE/ELIG  2L8' EE/ELIG  3L8' STD/ELIG  4L8' STD/ELIG  4L8' STD/ELIG  4L8' STD/ELIG  4L8' STD/ELIG  4L8' STD/STD  3L8' STD/STD  4L8' EE/STD  4L8' EE/STD	Watts 160  60 83 70 100 109 123 138 134 158 173 221 273 218 246 276

Table 5: Retrofit Proposed Lighting Wattage Tables

		Rated
<u>Device Code</u>	Device Description	<u>Watts</u>
	LED Exit Signs	
1E0002	2.0 WATT LED	2
1E0003	3.0 WATT LED	3
1E0005	5.0 WLED	5
1E0005C	0.5 WATT LEC	0.5
1E0008	8.0 WLED	8
1E0015	1.5 WATT LED	1.5
1E0105	10.5 WATT LED	10.5
	Compact Fluorescents (CFL's)	
2C0007S	2/7W COMPACT HW	18
1C0005S	5W COMPACT HW	7
1C0007S	7W COMPACT HW	9
1C0009S	9W COMPACT HW	11
1C0011S	11W COMPACT HW	13
1C0013S	13W COMPACT HW	15
1C0018E	18W COMPACT HW ELIG	20
1C0018S	18W COMPACT HW	20
1C0022S	22W COMPACT HW	24
1C0023E	1/23W COMPACT HW ELIG	25
1C0026E	26W COMPACT HW ELIG	28
1C0026S	26W COMPACT HW	28
1C0028S	28W COMPACT HW	30
1C0032E	32W COMPACT HW ELIG	34
1C0032S	32W CIRCLINE HW	34
1C0042E	1/42W COMPACT HW ELIG	48
1C0044S	44W CIRCLINE HW	46
1C0057E	1/57W COMPACT HW ELIG	65
1C2232S	22/32W CIRCLINE HW	58
1C2D10E	10W 2D COMPACT HW ELIG	12
1C2D16E	16W 2D COMPACT HW ELIG	18
1C2D21E	21W 2D COMPACT HW ELIG	22
1C2D28E	28W 2D COMPACT HW ELIG	28
1C2D38E	38W 2D COMP.HW ELIG	36
1C3240S	32/40W CIRCLINE HW	80
2C0005S	2/5W COMPACT HW	14

DMPACT HW 22  DMPACT HW 26  MPACT HW ELIG 28  DMPACT HW 30  escents (CFL's) (cont.)  MP. HW ELIG 40  MP. HW ELIG 54  MPACT HW ELIG 68	
MPACT HW ELIG 28  DMPACT HW 30  escents (CFL's) (cont.)  MP. HW ELIG 40  MP. HW ELIG 54	
OMPACT HW 30 escents (CFL's) (cont.) OMP. HW ELIG 40 OMP. HW ELIG 54	
escents (CFL's) (cont.)  MP. HW ELIG 40  MP. HW ELIG 54	
MP. HW ELIG 40 MP. HW ELIG 54	
MP. HW ELIG 54	
1PACT HW ELIG 68	
1 33	
1PACT HW ELIG 100	
OMPACT HW 33	
OMPACT HW 45	
1PACT HW ELIG 60	
1PACT HW ELIG 82	
114 IPACT HW ELIG	
19ACT HW ELIG 141	
1PACT HW ELIG 80	
1PACT HW ELIG 108	
152 152	
1PACT HW ELIG 188	
162 162	
1PACT HW ELIG 228	
1PACT HW ELIG 282	
1PACT HW ELIG 216	
1PACT HW ELIG 304	
MPACT HW ELIG 376	
Systems	
, , , , , , , , , , , , , , , , , , ,	
	MPACT HW ELIG 100  DMPACT HW ELIG 100  DMPACT HW 33  DMPACT HW 45  MPACT HW ELIG 60  MPACT HW ELIG 82  MPACT HW ELIG 114  MPACT HW ELIG 141  MPACT HW ELIG 80  MPACT HW ELIG 108  MPACT HW ELIG 108  MPACT HW ELIG 152  MPACT HW ELIG 162  MPACT HW ELIG 228  MPACT HW ELIG 228  MPACT HW ELIG 216  MPACT HW ELIG 304

<u>Device Code</u>	<u>Device Description</u>	Rated <u>Watts</u>
1F28SSE	1L4' 28W T5/ELIG	32
2F28SSE	2L4' 28W T5/ELIG	63
3F28SSE	3L4' 28W T5/ELIG	95
4F28SSE	4L4' 28W T5/ELIG	126
6F28SSE	6L4' 28W T5/ELIG	189
1F47HSE	1L4' 47W T5HO/ELIG	53
2F47HSE	2L4' 47W T5HO/ELIG	103
3F47HSE	3L4' 47W T5HO/ELIG	157
	T5 Systems (cont.)	
4F47HSE	4L4' 47W T5HO/ELIG	200
5F47HSE	5L4' 47W T5HO/ELIG	260
6F47HSE	6L4' 47W T5HO/ELIG	303
1F50HSE	1L4' 50W T5HO/ELIG	58
2F50HSE	2L4' 50W T5HO/ELIG	110
3F50HSE	3L4' 50W T5HO/ELIG	168
4F50HSE	4L4' 50W T5HO/ELIG	215
5F50HSE	5L4' 50W T5HO/ELIG	278
6F50HSE	6L4' 50W T5HO/ELIG	325
1F54HSE	1L4' 54W T5HO/ELIG	59
2F54HSE	2L4' 54W T5HO/ELIG	117
3F54HSE	3L4' 54W T5HO/ELIG	177
4F54HSE	4L4' 54W T5HO/ELIG	234
5F54HSE	5L4' 54W T5HO/ELIG	294
6F54HSE	6L4' 54W T5HO/ELIG	351
8F54HSE	8L4' 54W T5HO/ELIG	468
10F54HSE	10L4' 54W T5HO/ELIG	585
	-	
	Two Foot High Efficient T8 Systems	
1F17ESL	1L2' 17W T8EE/ELEE LOW PWR	14
1F17ESN	1L2' 17W T8EE/ELEE	17
1F17ESH	1L2' 17W T8EE/ELEE HIGH PWR	20
1F28BXE	1L2' F28BX/ELIG	32
2F17ESL	2L2' 17W T8EE/ELEE LOW PWR	27
2F17ESN	2L2' 17W T8EE/ELEE	32
2F17ESH	2L2' 17W T8EE/ELEE HIGH PWR	40
2F28BXE	2L2' F28BX/ELIG	63
3F17ESL	3L2' 17W T8EE/ELEE LOW PWR	39
3F17ESN	3L2' 17W T8EE/ELEE	46

<u>Device Code</u>	Device Description	Rated Watts
3F17ESH	3L2' 17W T8EE/ELEE HIGH PWR	61
3F28BXE	3L2' F28BX/ELIG	94
	Three Foot High Efficient T8 Systems	
1F25ESL	1L3' 25W T8EE/ELEE LOW PWR	21
1F25ESN	1L3' 25W T8EE/ELEE	24
1F25ESH	1L3' 25W T8EE/ELEE HIGH PWR	30
2F25ESL	2L3' 25W T8EE/ELEE LOW PWR	40
2F25ESN	2L3' 25W T8EE/ELEE	45
2F25ESH	2L3' 25W T8EE/ELEE HIGH PWR	60
3F25ESL	3L3' 25W T8EE/ELEE LOW PWR	58
3F25ESN	3L3' 25W T8EE/ELEE	67
3F25ESH	3L3' 25W T8EE/ELEE HIGH PWR	90
	Four Foot T8 High Efficient / Reduce Wattage System	s
1F25EEH	1L4' 25W T8EE/ELEE HIGH PWR	30
1F25EEE	1L4' 25W T8EE/ELEE	22
1F25EEL	1L4' 25W T8EE/ELEE LOW PWR	19
2F25EEH	2L4' 25W T8EE/ELEE HIGH PWR	57
2F25EEE	2L4' 25W T8EE/ELEE	43
2F25EEL	2L4' 25W T8EE/ELEE LOW PWR	37
3F25EEH	3L4' 25W T8EE/ELEE HIGH PWR	86
3F25EEE	3L4' 25W T8EE/ELEE	64
3F25EEL	3L4' 25W T8EE/ELEE LOW PWR	57
4F25EEH	4L4' 25W T8EE/ELEE HIGH PWR	111
4F25EEE	4L4' 25W T8EE/ELEE	86
4F25EEL	4L4' 25W T8EE/ELEE LOW PWR	75
1F28EEH	1L4' 28W T8EE/ELEE HIGH PWR	33
1F28EEE	1L4' 28W T8EE/ELEE	24
1F28EEL	1L4' 28W T8EE/ELEE LOW PWR	22
2F28EEH	2L4' 28WT8EE/ELEE HIGH PWR	64
2F28EEE	2L4' 28W T8EE/ELEE	48
2F28EEL	2L4' 28W T8EE/ELEE LOW PWR	42
3F28EEH	3L4' 28W T8EE/ELEE HIGH PWR	96
3F28EEE	3L4' 28W T8EE/ELEE	72
3F28EEL	3L4' 28W T8EE/ELEE LOW PWR	63
4F28EEH	4L4' 28W T8EE/ELEE HIGH PWR	126
4F28EEE	4L4' 28W T8EE/ELEE	94
4F28EEL	4L4' 28W T8EE/ELEE LOW PWR	83
1F30EEH	1L4' 30W T8EE/ELEE HIGH PWR	36

Device Code	Device Description	Rated <u>Watts</u>
1F30EEE	1L4' 30W T8EE/ELEE	26
1F30EEL	1L4' 30W T8EE/ELEE LOW PWR	24
2F30EEH	2L4' 30WT8EE/ELEE HIGH PWR	69
2F30EEE	2L4' 30W T8EE/ELEE	52
2F30EEL	2L4' 30W T8EE/ELEE LOW PWR	45
3F30EEH	3L4' 30W T8EE/ELEE HIGH PWR	103
3F30EEE	3L4' 30W T8EE/ELEE	77
3F30EEL	3L4' 30W T8EE/ELEE LOW PWR	68
4F30EEH	4L4' 30W T8EE/ELEE HIGH PWR	133
4F30EEE	4L4' 30W T8EE/ELEE	101
4F30EEL	4L4' 30W T8EE/ELEE LOW PWR	89
1F32EEH	1L4' 32W T8EE/ELEE HIGH PWR	38
1F32EEE	1L4' 32W T8EE/ELEE	28
1F32EEL	1L4' 32W T8EE/ELEE LOW PWR	25
2F32EEH	2L4' 32W T8EE/ELEE HIGH PWR	73
2F32EEE	2L4' 32W T8EE/ELEE	53
Fou	ır Foot T8 High Efficient / Reduce Wattage Systems (co	ont.)
2F32EEL	2L4' 32W T8EE/ELEE LOW PWR	47
3F32EEH	3L4' 32W T8EE/ELEE HIGH PWR	109
3F32EEE	3L4' 32W T8EE/ELEE	82
3F32EEL	3L4' 32W T8EE/ELEE LOW PWR	72
4F32EEH	4L4' 32W T8EE/ELEE HIGH PWR	141
4F32EEE	4L4' 32W T8EE/ELEE	107
4F32EEL	4L4' 32W T8EE/ELEE LOW PWR	95
6F32EEH	6L4' 32W T8EE/ELEE HIGH PWR	218
6F32EEE	6L4' 32W T8EE/ELEE	168
6F32EEL	6L4' 32W T8EE/ELEE LOW PWR	146
	Eight Foot T8 Systems	
1F59SSE	1L8' T8/ELIG	60
1F80SSE	1L8' T8 HO/ELIG	85
2F59SSE	2L8' T8/ELIG	109
2F59SSL	2L8' T8/ELIG LOW PWR	100
2F80SSE	2L8' T8 HO/ELIG	160
	LED Lighting Fixtures	
1L002	2 WATT LED	2
1L002 1L003	3 WATT LED	3
11002	3 WATT LED	ა

<u>Device Code</u>	<b>Device Description</b>	Rated <u>Watts</u>
1L004	4 WATT LED	4
1L005	5 WATT LED	5
1L006	6 WATT LED	6
1L007	7 WATT LED	7
1L008	8 WATT LED	8
1L009	9 WATT LED	9
1L010	10 WATT LED	10
1L011	11 WATT LED	11
1L012	12 WATT LED	12
1L013	13 WATT LED	13
1L014	14 WATT LED	14
1L015	15 WATT LED	15
1L016	16 WATT LED	16
1L017	17 WATT LED	17
1L018	18 WATT LED	18
1L019	19 WATT LED	19
1L020	20 WATT LED	20
1L021	21 WATT LED	21
1L022	22 WATT LED	22
1L023	23 WATT LED	23
	LED Lighting Fixtures (cont.)	
1L024	24 WATT LED	24
1L025	25 WATT LED	25
1L026	26 WATT LED	26
1L027	27 WATT LED	27
1L028	28 WATT LED	28
1L029	29 WATT LED	29
1L030	30 WATT LED	30
1L031	31 WATT LED	31
1L032	32 WATT LED	32
1L033	33 WATT LED	33
1L034	34 WATT LED	34
1L035	35 WATT LED	35
1L036	36 WATT LED	36
1L037	37 WATT LED	37
1L038	38 WATT LED	38
1L039	39 WATT LED	39
1L040	40 WATT LED	40

<u>Device Code</u>	Device Description	Rated
		<u>Watts</u>
1L041	41 WATT LED	41
1L042	42 WATT LED	42
1L043	43 WATT LED	43
1L044	44 WATT LED	44
1L045	45 WATT LED	45
1L046	46 WATT LED	46
1L047	47 WATT LED	47
1L048	48 WATT LED	48
1L049	49 WATT LED	49
1L050	50 WATT LED	50
1L055	55 WATT LED	55
1L060	60 WATT LED	60
1L070	70 WATT LED	70
1L073	73 WATT LED	73
1L075	75 WATT LED	75
1L080	90 WATT LED	90
1L085	85 WATT LED	85
1L090	90 WATT LED	90
1L095	95 WATT LED	95
1L100	100 WATT LED	100
1L106	106 WATT LED	106
1L107	107 WATT LED	107
1L116	116 WATT LED	116
1L120	120 WATT LED	120
	LED Lighting Fixtures (cont.)	
1L125	125 WATT LED	125
1L130	130 WATT LED	130
1L135	135 WATT LED	135
1L140	140 WATT LED	140
1L145	145 WATT LED	145
1L150	150 WATT LED	150
1L155	155 WATT LED	155
1L160	160 WATT LED	160
1L165	165 WATT LED	165
1L170	170 WATT LED	170
1L175	175 WATT LED	175
1L180	180 WATT LED	180
1L185	185 WATT LED	185

1L190	190 WATT LED	190
1L200	200 WATT LED	200
1L210	210 WATT LED	210
1L220	220 WATT LED	220
1L240	240 WATT LED	240
	Electronic Metal Halide Lamps	
1M0150E	150W METAL HALIDE EB	160
1M0200E	200W METAL HALIDE EB	215
1M0250E	250W METAL HALIDE EB	270
1M0320E	320W METAL HALIDE EB	345
1M0350E	350W METAL HALIDE EB	375
1M0400E	400W METAL HALIDE EB	430
1M0450E	400W METAL HALIDE EB	480
	MH Track Lighting	
1M0020E	20W MH SPOT	25
1M0025E	25W MH SPOT	25
1M0035E	35W MH SPOT	44
1M0039E	39W MH SPOT	47
1M0050E	50W MH SPOT	60
1M0070E	70W MH SPOT	80
1M0100E	100W MH SPOT	111
1M0150E	150W MH SPOT	162

Table 6a: Upstream Lighting Savings<sup>1</sup>

Product type	Category	Installation	Gross kW	HVAC Interactive Effect
G24 LED	4	<b>Rate</b> 49%	Saved per Unit 0.0216	(kWh) 103%
G24 LLD		45%	0.0210	
A-line, 40/60w	4	49%	0.0306	103%
A-line, 75/100w	4	49%	0.043	103%
Decoratives	4	49%	0.0192	103%
LED Retrofit kit, <25W	2	98%	0.0434	103%
LED Retrofit kit, >25W	2	98%	0.0561	103%
MR16	4	49%	0.0311	103%
PAR20	4	49%	0.0396	103%
PAR30	4	49%	0.0537	103%
PAR38	4	49%	0.0623	103%
Stairwell Kit, 2ft w/sensor	2	97%	0.0358 <sup>2</sup>	100%²
Stairwell Kit, 4ft w/sensor	2	97%	0.0309 <sup>2</sup>	100%²
TLED, 2ft	1	96%	0.0079	102%
TLED, 4ft	1	96%	0.0158	102%

<sup>(1)</sup> Values in the table are from DNV (2021). Impact Evaluation of PY2019 Rhode Island C&I Upstream Lighting Initiative.

<sup>(2)</sup> Controls were not updated as part of the aforementioned study.

Table 6b: Upstream Lighting Hours of Use

Building Type	Hours of Use <sup>1</sup>
College & University	4,132
Grocery/Food Sales	5,920
Hospital	5,601
Industrial/Manufacturing	5,229
K-12 School	2,902
Lodging	4,194
Medical Office	3,673
Office Building	4,171
Other	4,141
Parking Garage	8,760
Restaurant/Food Service	4,891
Retail	4,957
Warehouse and storage	6,512

<sup>(1)</sup> DNV (2021). Impact Evaluation of PY2019 Rhode Island C&I Upstream Lighting Initiative.

Table 7: Efficiency Requirements for C&I Air Conditioning and Heat Pump Systems

Equipment Type	Unit Type	Tier	Size Category <sup>1</sup>	Sub Category	Full Load Cooling Efficiency		Seasonal/ Part Load Cooling Efficiency		Heating Efficiency <sup>2</sup>
		1	< 65 kBtuh	Split or	12.0 EER	and	15.0 SEER	-	-
Air-Cooled	AC	2	(<5.4 Tons)	Package System	12.0 EER	and	17.0 SEER	-	-
Air-Cooled	AC	1	≥ 65 kBtuh and < 135 kBtuh (≥ 5.4	Split System and	12.0 EER	and	13.5 IEER	-	-
		2	Tons and < 11.3 Tons)	Single Package	12.0 EER	and	18.0 IEER	-	1
Air-Cooled	AC	1	≥ 135 kBtuh and < 240 kBtuh (≥ 11.3	Split System and	11.5 EER	and	13.0 IEER	-	-
	2 Tons and < 20 Tons)	Single Package	11.5 EER	and	17.5 IEER	-	-		
Air-Cooled	AC	1	≥ 240 kBtuh and <760 kBtuh (≥ 20	Split System and	10.1 EER	and	12.0 IEER	-	-
		2	Tons and < 63.3 Tons)	Single Package	10.1 EER	and	16.0 IEER	-	-
Air-Cooled	AC	1	≥ 760 kBtuh	Split System and	9.8 EER	and	13.0 IEER	-	-
		2	(≥ 63.3 Tons)	Single Package	9.8 EER	and	16.0 IEER	-	-
Air Caalad		1	≥ 65 kBtuh and < 135	Split System and	11.1 EER		13.5 IEER	1	3.4 COP
Air-Cooled	HP	2	kBtuh (≥ 5.4 Tons and < 11.3 Tons)	Single Package	11.1 EER	and	18.0 IEER	and	3.4 COP
Air-Cooled	НР	1	≥ 135 kBtuh and < 240 kBtuh (≥ 11.3	Split System and	10.7 EER	and	12.5 IEER	and	3.3 COP
		2	Tons and < 20 Tons)	Single Package	10.7 EER		17.0 IEER		3.3 COP
		1		Split	9.6 EER		12.0 IEER		3.3 COP
Air-Cooled	HP 2	2	≥ 240 kBtuh (≥ 20 Tons)	System and Single Package	9.6 EER	and	16.0 IEER	and	3.3 COP
Water-Cooled	Water Source	1	Any Size	Split System and	14.0 EER		-	and	4.6 COP
	HP	2		Single Package	17.0 EER		-	and	4.6 COP
Water-Cooled	Ground Source Closed Loop HP	1	Any Size	Split System and Single Package	15.0 EER		-	and	3.4 COP

Water-Cooled	Ground Source Open Loop HP	1	Any Size	Split System and Single Package	19.0 EER		-	and	4.0 COP
Water-Cooled or Evaporatively- Cooled	AC	1	< 65 kBtuh (< 5.4 Tons)	Split System and Single Package	13.5 EER	and	14.0 IEER		-
Water-Cooled or Evaporatively- Cooled	AC	1	≥ 65 kBtuh and < 240 kBtuh (≥ 5.4 Tons and < 20 Tons)	Split System and Single Package	13.0 EER	and	15.5 IEER		-
Water-Cooled or Evaporatively- Cooled	AC	1	≥ 240 kBtuh (≥ 20 Tons)	Split System and Single Package	12.5 EER	and	14.5 IEER		-
Air Source	VRF	1	≥ 65 kBtuh and < 135 kBtuh (≥ 5.4	Split	11.5 EER	and	20.0 IEER	and	3.4 COP
		2	Tons and < 11.3 tons)	System	11.5 EER		24.0 IEER		3.8 COP
Air Source	VRF	1	≥ 135 kBtuh and < 240 kBtuh (≥ 11.3	Split	11.0 EER	and	18.0 IEER	and	3.3 COP
		2	Tons and < 20 tons)	System	11.0 EER		24.0 IEER		3.6 COP
Air Source	VRF	1	≥ 240 kBtuh	Split	9.6 EER	and	18.0 IEER	and	3.3 COP
7 III Source	• • • • • • • • • • • • • • • • • • • •	2	(≥ 20 Tons)	System	9.6 EER	unu	24.0 IEER	una	3.6 COP
Water Source	VRF	1	≥ 65 kBtuh and < 135 kBtuh (≥ 5.4	Split	12.5 EER and		22.0	and	4.4 COP
		2	Tons and < 11.3 tons)	System	12.5 EER		26.0		4.8 COP
		1	≥ 135 kBtuh		11.0 EER		20.0		4.2 COP
Water Source	VRF	2	and < 240 kBtuh (≥ 11.3 Tons and < 20 tons)	Split System	11.0 EER	and	24.0	and	4.8 COP
Water Source	VPE	1	≥ 240 kBtuh	Split	11.0 EER	and	17.0	and	4.0 COP
1 5 · · ·	VRF 2		(≥ 20 Tons)	System	11.0 EER	ailu	20.0	and	4.6 COP

<sup>&</sup>lt;sup>1</sup> Equipment capacity is AHRI rated capacity or capacity at AHRI rating conditions for units without an AHRI rating

<sup>&</sup>lt;sup>2</sup> Heating efficiency applies only to heat pumps

Table 8: Efficiency Requirements for C&I Heat Pumps

Equipment Type	Unit Type	Tier	Size Category <sup>1</sup>	Full Load Cooling Efficiency	Seasonal/P art Load Cooling Efficiency	Heating Efficiency <sup>2</sup>	AHRI HCR³
НР	Central Heat Pump	-	< 5.4 tons	-	16 SEER	9.5 HSPF	60%
НР	Ducted/Ductl ess MSHP Multi-Zone	-	< 5.4 tons	-	16 SEER	9.5 HPSF	58%
НР	Ductless MSHP Single- Zone	-	< 5.4 tons	-	18 SEER	10 HPSF	58%

<sup>&</sup>lt;sup>1</sup> Equipment capacity is AHRI rated capacity or capacity at AHRI rating conditions for units without an AHRI rating

<sup>&</sup>lt;sup>2</sup> Heating efficiency applies only to heat pumps

<sup>&</sup>lt;sup>3</sup> Heating capacity ratio (17°F / 47°F)

Table 9: Water Chilling Packages - Minimum Efficiency Requirements

Equipment Type	Size Category (Tons)	Units	Full Load	IPLV
Air-cooled chillers	< 150	EER	10.52	13.75
Air-cooled chillers	≥ 150		10.52	14.03
Water cooled, electrically	<75	kW/ton	0.702	0.540
operated, positive	≥ 75 and < 150	kW/ton	0.698	0.527
displacement (rotary screw	≥ 150 and < 300	kW/ton	0.612	0.486
and scroll)	≥ 300 and < 600	0 EER 10.52 13 0 EER 10.52 14 6 kW/ton 0.702 0.5 6 kW/ton 0.698 0.5 1 < 300 kW/ton 0.612 0.4 1 < 600 kW/ton 0.588 0.4 0 kW/ton 0.571 0.4 1 < 300 kW/ton 0.571 0.4	0.441	
	< 150	kW/ton	0.571	0.405
Water cooled, electrically operated, centrifugal	≥ 150 and < 300	kW/ton	0.571	0.405
operated, centinugui	≥ 300 and < 1000	kW/ton	EER       10.52         EER       10.52         kW/ton       0.702         kW/ton       0.698         kW/ton       0.612         kW/ton       0.588         kW/ton       0.571         kW/ton       0.571	0.360

Air cooled oil free compressors are classified here as air cooled and water cooled oil free compressors are classified here as centrifugal.

Unit must meet or exceed either the FL or IPLV minimum qualifying efficiency.

Table 10. Chiller Load Factors [Removed]

Table 11: Cooling and Heating Equivalent Full Load Hours

Building (or Space) Type	Cooling Full Load Hours (EFLH <sub>cool</sub> )	Heating Full Load Hours (EFLH <sub>heat</sub> )	
Rhode Island Energy	817	1137	
(NE – South Coastal)	617	1137	

Average Cooling EFLHs from the 2010 NEEP HVAC Loadshape study.[1]

Average Heating EFLHs derived from 2010 NEEP HVAC Loadshape study[2] and the Connecticut Program Savings

Document for 2011 Program Year. [3]

Table 12: Savings Factors for ECM HVAC Fan Motors

[Removed]

Table 13: Savings Factors for Cooler Night Covers

[Removed]

Table 14: Savings Factors for C&I VSDs (kWh/HP and kW/HP) [Removed]

Table 15 [removed]

Table 16: HVAC Interactive Effects for C&I Lighting [Removed]

Table 17 [removed]

Table 18 [removed]

Table 19: Baseline Efficiency Requirements for C&I Gas-Fired Boilers

Equipment Type	Subcategory	Size Category (Input)	Minimum Efficiency <sup>a</sup>
Boilers, hot water		<300,000 Btu/h	90% AFUE for Tier 1 95% AFUE for Tier 2
	Gas-fired	>=300,000 Btu/h and <=2,000,000 Btu/h	90% Et

a. Annual Fuel Utilization Efficiency (AFUE), Thermal efficiency (Et)

Table 20: Energy initiative, Prescriptive Lighting

Measure	RRe	RR sp	RR wp	Measure Life	Source/Notes for Measure Life
Daylight Dimming Controls	92.9%	99.2%	99.2%	9	С
Integrated Controls	92.9%	99.2%	99.2%	11	С
Occupancy Sensors Controls	100%	93.6%	93.6%	9	С
Exterior Fixtures 24/7	92.9%	99.2%	99.2%	5	b
Exterior Controls, Photocells	100%	98.2%	98.2%	9	С
Exterior Fixtures, Dusk/Dawn	92.9%	99.2%	99.2%	5	b
Exterior Controls, Streetlights	92.9%	99.2%	99.2%	9	С
Compact Fluorescents	92.9%	99.2%	99.2%	2	b
High Intensity Discharge Systems	107%	107%	107%	5	b
Fluorescent System w/Ballast	92.9%	99.2%	99.2%	6	b
Case Refrigeration lighting	92.9%	99.2%	99.2%	6	b
General lighting	92.9%	99.2%	99.2%	6	b
Replacement Lighting	92.9%	99.2%	99.2%	6	b
LED Exit Signs	103.2%	96.1%	96.1%	6	b

a. Realization Rate entries come from the 2022 BC Model and are the weighted average from 2018 pre post.

b. DNV (2022). Rhode Island C&I Lighting Market Characterization and Adjusted Measure Life Study

c. Dan Mellinger's Lighting Control Measure Life Memo

Table 21: Design 2000, Prescriptive Lighting

Measure	RRe	RR sp	RR wp	NTG	Measure	Source / Notes
					Life	for Measure Life
Daylight Dimming Controls	94.8%	99.6%	99.6%	75.7%	9	d
Integrated Controls	94.8%	99.6%	99.6%	75.7%	11	d
Occupancy Sensors Controls	108%	108%	108%	75.7%	9	d
Exterior Fixtures 24/7	94.8%	99.6%	99.6%	75.7%	15	е
Exterior Controls, Photocells	78%	78%	78%	75.7%	9	d
Exterior Fixtures,	94.8%	99.6%	99.6%	75.7%	15	е
Dusk/Dawn						
Exterior Controls,	94.8%	99.6%	99.6%	75.7%	9	d
Streetlights						
Compact Fluorescents	94.8%	99.6%	99.6%	75.7%	15	е
High Intensity Discharge	94.8%	99.6%	99.6%	75.7%	15	е
Systems						
Fluorescent System	94.8%	99.6%	99.6%	75.7%	15	е
w/Ballast						
Case Refrigeration lighting	94.8%	99.6%	99.6%	75.7%	15	е
General lighting	94.8%	99.6%	99.6%	75.7%	15	е
Replacement Lighting	94.8%	99.6%	99.6%	75.7%	6	С
LED Exit Signs	94.8%	99.6%	99.6%	75.7%	15	е

a. Realization Rate entries come from PY2019 C&I Free-Ridership and Spillover Study. Prepared by Tetra Tech.

b. DNV (2022). Rhode Island C&I Lighting Market Characterization and Adjusted Measure Life Study

c. Dan Mellinger's Lighting Control Measure Life Memo

d. Based on MA 2023 BC Model. Assuming all Design 2000 lighting is for new building and major renovation.

## **Appendix B: Non-Energy Impacts**

Table 1: Per Measure Residential Non-Energy Impacts for Electric and Gas Programs

End Use	TRM Measures	NEI	Description	Value or Algorithm	Basis	Duration
Lighting	Indoor Fixture  Outdoor Fixture  LED Fixture	Lighting Quality and Lifetime	O&M savings due to more efficient fixtures	\$3.50	per measur e	One Time
	LED Bulb	Lighting Quality and Lifetime	O&M savings due to more efficient bulbs	\$3.00	per measur e	One Time
	All Measures with oil savings	National Security	Reducing the need for foreign energy imports thereby increasing national security	nergy imports thereby increasing S1 83		Annual
Various	All electric measures with kWh savings and all gas measures with MMBTU savings.	Rate Discounts	Financial savings to utility as a result of a smaller portion of energy being sold at the low income rate	Elec: (kwh savings per measure)*(A16-A60) Gas: (therms savings per measure)*(R12- R13)	per measur e	Annual

<sup>(1)</sup> The NEIs in this table represent impacts that accrue specifically to measures in the 2023 Rhode Island portfolio of programs.

<sup>(2)</sup> Lighting Quality and Lifetime Source: "Massachusetts Program Administrators: Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation," NMR Group, Inc., Tetra Tech. 8.15.2011

Table 2: Annual per kWh Non-Energy Impacts for Commercial and Industrial Electric Programs

Program		End Use	NEI S		Source
		Lighting	O&M	0.020	1
Prescr		Motors/Drives	O&M, Non-O&M	0.003	3
		EMS	O&M, Non-O&M	0.111	3
	Prescriptive	Envelope	O&M, Non-O&M	0.11	3
		Lighting Controls	O&M, Non-O&M	0.07	3
		Refrigeration	O&M, H&S, etc.	0.001	3
		Food Service	O&M, H&S, etc.	0.01	3
		EMS	O&M, Non-O&M	0.037	3
New Construction		Envelope	O&M, Non-O&M	0.036	3
	Custom	Lighting Controls	O&M, Non-O&M	0.087	3
		Refrigeration	O&M, Non-O&M	0.012	3
		Process	O&M, Non-O&M	0.091	3
		HVAC	O&M, Non-O&M	0.02	3
		Motors/Drives	O&M, Non-O&M	0.018	3
		Compressed Air	O&M	0.026	1
		Food Service	O&M, H&S, etc.	0.01	3
		HVAC	Administrative costs, other costs, other labor costs, O&M, rent revenue	0.11	2
		Lighting	Administrative costs, material handling, material movement, other labor costs, O&M, sales revenue, waste disposal	0.027	2
		Refrigeration	Administrative costs, material handling, material movement, other costs, other labor costs, O&M, product spoilage, rent revenue, sales revenue,	0.047	2
Retrofit	Prescriptive	EMS	O&M, Non-O&M	0.116	3
		Envelope	O&M, Non-O&M	0.119	3
		Lighting Controls	O&M, Non-O&M	0.101	3
		Motors/Drives	O&M, Non-O&M	0.003	3
		Process	O&M, Non-O&M	0.098	3

	Compressed Air	Administrative costs, material handling, material movement, other costs,	0.056	2
	Food Service	O&M, H&S, etc.	0.01	3
	EMS	O&M, Non-O&M	0.042	3
	Envelope	O&M, Non-O&M	0.045	3
	Lighting Controls	O&M, Non-O&M	0.084	3
	Motors/Drives	O&M, Non-O&M	0.018	3
	Refrigeration	Administrative costs, material handling, material movement, other costs, other labor costs, O&M, product spoilage, rent revenue, sales revenue,	0.0474	2
	HVAC	O&M, Non-O&M	0.037	3
Custom	CHP Systems	Administrative costs, O&M	-0.0147	2
	Lighting	Administrative costs, material handling, material movement, other costs, other labor costs, O&M, product spoilage, rent revenue, sales revenue,	0.059	2
	Process	O&M, Non-O&M	0.098	3
	Compressed Air	Administrative costs, material handling, material movement, other costs, other labor costs, O&M, product spoilage, rent revenue, sales revenue,	0.056	2
	Food Service	O&M, H&S, etc.	0.01	3

<sup>(1)</sup> Tetra Tech (2015) Stage 2 Results - Commercial and Industrial New Construction Non-Energy Impacts Study - Final Report

<sup>(2)</sup> Tetra Tech (2012), Final Report - Commercial and Industrial Non-Energy Impacts Study

<sup>(3)</sup> DNV (2021). O&M and Non-O&M NEI Study (MA20X10-B-CIOMNEI)

Table 3: Annual per Therm Non-Energy Impacts for Commercial and Industrial Gas Programs

Program		End Use	NEI	Annual \$/Therm	Source
		Boilers	Admin costs, material movement, other costs, other labor, O&M, product spoilage, waste disposal	-0.08	1
		Other Gas Heating	Admin costs, material movement, other costs, other labor, O&M, product spoilage, waste disposal	0.05	1
		Hot Water	O&M, Non-O&M	0.08	3
	Prescriptive	EMS	O&M, Non-O&M	0.68	3
		HVAC	O&M, Non-O&M	0.56	3
New		HVAC/Heat Recovery	Admin costs, material movement, other costs, other labor, O&M, product spoilage, waste disposal	0.24	1
Construction		Envelope	O&M, Non-O&M	0.32	3
		Commercial Kitchen	Admin costs, material movement, other costs, other labor, O&M, product spoilage, waste disposal	3.40	1
	Custom	Hot Water	O&M, Non-O&M	0.35	3
		Process	O&M, Non-O&M	-0.05	3
		HVAC	O&M, Non-O&M	-0.07	3
		Other	Admin costs, material movement, other costs, other labor, O&M, product spoilage, waste disposal	-0.03	1
		Envelope	O&M, Non-O&M	0.32	3
		HVAC	Admin costs, material movement, other costs, other labor, O&M, product spoilage, waste disposal	1.35	2
	Prescriptive	Hot Water	O&M, Non-O&M	0.08	3
		EMS	O&M, Non-O&M	0.68	3
		Envelope	O&M, Non-O&M	0.32	3
Retrofit		HVAC	Admin costs, material movement, other costs, other labor, O&M, product spoilage, waste disposal	0.23	2
	Custom	Hot Water	O&M, Non-O&M	0.35	3
	Custom	Process	O&M, Non-O&M	-0.05	3
		EMS	O&M, Non-O&M	0.04	3
		Envelope	O&M, Non-O&M	0.32	3

<sup>(1)</sup> Tetra Tech (2015) Stage 2 Results - Commercial and Industrial New Construction Non-Energy Impacts Study - Final Report

<sup>(2)</sup> Tetra Tech (2012), Final Report - Commercial and Industrial Non-Energy Impacts Study

<sup>(3)</sup> DNV (2021). O&M and Non-O&M NEI Study (MA20X10-B-CIOMNEI)

**Table 4: Per Participant Non-Energy Impacts for Residential Electric Measures** 

Program	NEI	Description	Measure Category	Value	Duration
	Thermal Comfort	Greater participant- perceived comfort in home		\$91.50	Annual
Residential New	Noise Reduction	Less participant-perceived noise in the home	Heating System	\$47.53	Annual
Construction	Asthma Related	Combustion stove NOx	Heating System	\$3.28	Annual
	Astrima Related	ERV/HRV reduction of formaldehyde		\$0.02	Annual
			Cool Smart AC System	\$2.24	
			Cool Smart HP System	\$2.88	
	Thermal Comfort	Greater participant- perceived comfort in home	Ductless Mini Split HP System	\$2.53	Annual
			Down size 1/2 ton	\$0.19	Annuai
			QIV and Check up	\$0.47	
			Thermostats	\$3.07	
	Noise Reduction	Less participant-perceived noise in the home	Cool Smart AC System	\$2.03	Annual
Residential Cooling			Cool Smart AC System	\$0.65	
and Heating Equipment		Increased home durability	Cool Smart HP System	\$0.84	
Equipment	Hama Dunahilitu	from better quality	Ductless Mini Split HP System	\$0.65	A.a.aa.l
	Home Durability	heating, cooling and	Down size 1/2 ton	\$0.07	Annual
		structural materials	QIV and Check up	\$0.18	
			Thermostats	\$1.33	
		Reduced maintenance	Cool Smart AC System	\$1.07	
	Equipment	costs of owning newer	Cool Smart HP System	\$1.34	Annual
	Maintenance	and/or more efficient	Ductless Mini Split HP System	\$0.95	Annual
		appliance equipment	Down size 1/2 ton	\$0.37	

Program	NEI	Description	Measure Category	Value	Duration
			QIV and Check up	\$0.87	
			Cool Smart AC System	\$0.07	
		Fewer colds and viruses,	Cool Smart HP System	\$0.09	
	Health Benefits	improved indoor air quality and ease of maintaining	Ductless Mini Split HP System	\$0.08	Annual
	nearth benefits	healthy relative humidity	Down size 1/2 ton	\$0.01	Alliludi
		from weatherization	QIV and Check up	\$0.01	
			Thermostats	\$0.13	
Energy Star Lighting	Lighting Quality and Lifetime	Better lighting quality and longer life	Residential Lighting - Bulbs	\$3.00	One-Time
Ellergy Star Lighting	Lighting Quality and Lifetime	Better lighting quality and longer life	Residential Lighting - Fixtures	\$3.50	One-Time
	Arrearages	Reduced arrearage carrying costs as a result of customers being more able to pay their lower bills		\$2.61	Annual
Single Family -	Bad Debt Write- offs	Reduced costs to utility of uncollectable, unpaid balances as a result of customers being more able to pay their lower bills		\$3.74	Annual
Income Eligible Services	Terminations and Reconnections	Reduced costs associated with terminations and reconnections to utility due to nonpayment as a result of customers being more able to pay their lower bills	Basic Educational Measures	\$0.43	Annual
	Customer Calls and Collections	Utility savings in staff time and materials for fewer customer calls as a result of more timely bill		\$0.58	Annual

Program	NEI	Description	Measure Category	Value	Duration
		payments			
	Notices	Financial savings to utility as a result of fewer notices sent to customers for late payments and terminations		\$0.34	Annual
	Improved Safety	Reduced risk of fire and fire-related property damage		\$2.67	Annual
	Price Hedging		NA	\$0.005/kWh	One-Time
		mfort Greater participant- perceived comfort in home	Insulation	\$30.13	
			Air Sealing	\$35.89	
	Thermal Comfort		Heating System / Heat Pump	\$33.24	Annual
	mermar comfort		Duct sealing	\$0.81	Aillidai
			Pipe wrap	\$6.60	
			Thermostat	\$5.78	
	Noise Reduction	Less participant-perceived	Insulation	\$13.56	Annual
	Noise Reduction	noise in the home	Air Sealing	\$16.39	Alliluai
			Insulation	\$8.76	
			Air Sealing	\$10.61	
		Increased home durability	Heat pumps	\$9.72	
	Homo Durahility	from better quality	Thermostat	\$1.68	Annual
	Home Durability	heating, cooling and	Hot Water System	\$0.20	Allitual
		structural materials	Air Sealing	\$5.69	
			Duct Sealing	\$0.23	
			Heating System	\$27.43	

Program	NEI	Description	Measure Category	Value	Duration
			HP Water Heater	\$0.20	
		Reduced maintenance	Heating System	\$9.72	
	Equipment Maintenance	costs of owning newer and/or more efficient appliance equipment	Heat Pumps	\$27.43	Annual
			Insulation	\$193.15	
		Fewer colds and viruses,	Duct sealing	\$5.17	
	Health Benefits	improved indoor air quality	Pipe wrap	\$42.43	Annual
	nealth Benefits	and ease of maintaining healthy relative humidity	Air Sealing	\$230.08	Affiliai
		from weatherization	Heating System/Heat Pumps	213.13	
			Thermostat	37.07	
	Safety-Related Emergency Calls	Financial savings to the utility as a result of fewer safety related emergency calls being made	Heating System/Heat Pumps	\$8.43	Annual
		Reduced risk of fire and	Insulation	\$17.40	
			Air Sealing	\$2.24	
	Improved Safety	fire-related property	Heating System/ Heat Pumps	\$18.87	Annual
		damage	Hot Water System	\$4.44	
			Replacement Freezer/Refrigerator	\$1.40	
	Thermal Comfort	Greater participant- perceived comfort in home	Window AC	\$49.50	Annual
	Property Value		Replacement Freezer/Refrigerator	\$26.61	One-Time
	Increase		Showerhead	\$1.72	
EnergyWise Single			Insulation	\$25.15	
	Thermal Comfort	Greater participant- perceived comfort in home	Air Sealing	\$10.13	Annual
Family		perceived connort in nome	Thermostat	\$3.99	
	Noise Reduction	Less participant-perceived	Insulation	\$11.54	Annual

Program	NEI	Description	Measure Category	Value	Duration
		noise in the home	Air Sealing	\$4.88	
			Insulation	\$9.82	
		in terms of maintenance requirements because of	Air Sealing	\$3.95	
	Home Durability	better quality heating, cooling and structural materials	Thermostat	\$1.33	Annual
		Fewer colds and viruses,	Insulation	\$0.80	
		improved indoor air quality and ease of maintaining	Air Sealing	\$0.32	
	Health Benefits	healthy relative humidity as a result of weatherization in home	Thermostat	\$0.13	Annual
	Property Value		Showerheads	\$0.37	One-Time
	Increase		Refrigerator	\$1.44	One-Time
			Residential Window	\$6.72	Annual
5 140	Thermal Comfort	Greater participant- perceived comfort in home	Insulation	\$25.15	
EnergyWise Multifamily			Air Sealing	\$10.13	Annual
, with the same of			Thermostat	\$3.99	
	Noise Reduction	Less participant-perceived	Insulation	\$11.54	Annual
	Noise Reduction	noise in the home	Air Sealing	\$4.88	Allilual
		Increased home durability	Insulation	\$9.82	
		in terms of maintenance	Air Sealing	\$2.58	
	Home Durability	requirements because of better quality heating,	Aerator	\$0.37	Annual
		cooling and structural	Showerheads	\$0.37	
		materials	Thermostat	\$4.05	
		Fewer colds and viruses, improved indoor air quality and ease of maintaining healthy relative humidity	Insulation	\$0.80	Annual
	Health Benefits		Air Sealing	\$0.32	Ailliudi

Program	NEI	Description	Measure Category	Value	Duration
		as a result of weatherization in home	Thermostat	\$0.13	
		Financial savings to owners	Showerheads/Aerator	\$0.01	
	Rental Units	of MF rental housing as a result of increased	Air Sealing	\$0.07	Annual
	Marketability	marketability of the more	Refrigerator	\$0.34	Ailliuai
		efficient housing.	Thermostat	\$0.11	
		Savings to owners of MF	Showerheads/Aerator	\$0.20	
	Reduced Tenant	rental housing in terms of staff time and materials as	Air Sealing	\$1.37	Annual
	Complaints	a result of fewer tenant complaints with the more efficient measures.	Refrigerator	\$12.90	Annual
			Thermostat	\$2.16	
	Operations &		Common Area Lighting	\$0.03/kWh	Annual
	Maintenance		Common Area Lighting	\$14.12	Annual
	Equipment Maintenance	Reduced maintenance costs of owning newer and/or more efficient appliance equipment	Thermostat	\$3.91	Annual
	Lighting Quality	Better lighting quality and	Lighting - Bulbs	\$3.00	One-Time
	and Lifetime	longer life	Lighting - Fixtures	\$3.50	One-Time
	Rental Property Value Increase		Refrigerator	\$6.86	Annual
EnergyWise Income Eligible Multifamily Retrofit	Arrearages	Reduced arrearage carrying costs as a result of customers being more able to pay lower bills	N/A	\$2.61	Annual

Program	NEI	Description	Measure Category	Value	Duration
	Bad Debt Write- offs	Reduced costs to utility of uncollectable, unpaid balances as a result of customers being more able to pay their lower bills		\$3.74	Annual
	Terminations and Reconnections	Reduced costs associated with terminations and reconnections to utility due to nonpayment as a result of customers being more able to pay their lower bills		\$0.43	Annual
	Customer Calls and Collections	Utility savings in staff time and materials for fewer customer calls as a result of more timely bill payments		\$0.58	Annual
	Price Hedging			\$0.005/kWh	One-Time
	Notices	Financial savings to utility as a result of fewer notices sent to customers for late payments and terminations		\$0.34	Annual
			Insulation	\$342.24	
	Thermal Comfort	Greater participant-	Heating System	\$741.52	Annual
	Thermal Comfort	perceived comfort in home	Heat Pumps – Oil	\$836.39	Alliudi
			Air Sealing	\$342.24	
	Noise Reduction	Less participant-perceived	Insulation	\$13.56	Annual
	Noise Reduction	noise in the home	Air Sealing	\$16.39	Amadi
	Home Durability	Increased home durability in terms of maintenance	Insulation	\$8.76	Annual
	Trome Durability		Air Sealing	\$2.58	Alliadi

Program	NEI	Description	Measure Category	Value	Duration
		requirements because of	Heating System	\$27.43	
		better quality heating, cooling and structural	Thermostat	\$4.05	
		materials	Showerheads/Aerator	\$0.37	
		Fewer colds and viruses,	Insulation	\$11.76	
		improved indoor air quality and ease of maintaining	Heating System	\$25.48	
	Health Benefits	healthy relative humidity as a result of weatherization in home	Air Sealing	\$11.76	Annual
		Reduced risk of fire and	Insulation	\$3.12	
	Improved Safety	fire-related property	Air Sealing	\$3.12	Annual
		damage	Heating System	\$6.76	
		Reduced bad days due to rest/sleep	Insulation	\$11.76	
	Home Productivity		Air Sealing	\$11.76	Annual
			Heating System	\$25.48	
			Air Sealing	\$0.07	
		Financial savings to owners of MF rental housing as a	Water Heater	\$0.01	
	Rental Units Marketability	result of increased	Thermostat	\$0.11	Annual
		marketability of the more efficient housing.	Common Area Lighting/Fixtures	\$0.44	
			Showerheads/Aerator	\$0.01	
		Savings to owners of MF	Air Sealing	\$1.37	
	Reduced Tenant Complaints	rental housing in terms of staff time and materials as	Water Heater	\$0.20	Annual
		a result of fewer tenant complaints with the more	Thermostat	\$2.16	Aiiiudi
		efficient measures.	Showerheads/Aerator	\$0.20	

Program	NEI	Description	Measure Category	Value	Duration
	Safety-Related Emergency Calls	Financial savings to the utility as a result of fewer safety related emergency calls being made	Heating System	\$8.43	Annual
			Common Area Lighting /Fixtures	\$0.03/kWh	Annual
	Lighting Quality		Common Area Lighting/Fixtures	\$16.95	Annual
	and Lifetime		Common Area Lighting	\$3.00	One-Time
			Common Area Fixtures	\$3.50	One-Time
	Rental Property Value Increase		Common Area Lighting/Fixtures	\$7.83	One-Time
	Equipment Maintenance	Reduced maintenance costs of owning newer and/or more efficient appliance equipment	Heating System	\$27.43	
			Thermostat	\$3.91	Annual

## Sources:

- (1) Residential New Construction Source: Massachusetts Program Administrators: Massachusetts Special and Cross-Sector Studies Area, Residential New Construction Quick Hit Non-Energy Impacts (NEI) Evaluation, prepared by NMR Group, Inc. and Three3, Inc.
- (2) EnergyWise Single Family and Income Eligible Services Single Family Sources: For Thermal Comfort, Health Benefits, and Improved Safety "Massachusetts Special and Cross-Cutting Research Area: Low-Income Single-Family Health- and Safety-Related Non-Energy Impacts (NEIs) Study (August 5, 2016) prepared by Three3, Inc. and NMR Group." For other NEIs "Massachusetts Program Administrators: Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation," NMR Group, Inc., Tetra Tech. 8.15.2011
- (3) EnergyWise Multifamily Retrofit Source: Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation, prepared by NMR Group, Inc. and Tetra Tech. Massachusetts Market-Rate Rental Property NEI Study, prepared by NMR Group and DNV GL.
- (4) EnergyWise Income Eligible Multifamily Retrofit Source: EnergyWise Multifamily Retrofit Source: Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation, prepared by NMR Group, Inc. and Tetra Tech. Massachusetts Market-Rate Rental Property NEI Study, prepared by NMR Group and DNV GL. Massachusetts Low-Income Multifamily Health- and Safety-Related NEIs Study, prepared by NMR Group, Inc. and Three3, Inc.
- (5) Price Hedging Source: Lawrence Berkeley National Laboratory (2002). Quantifying the Value That Wind Power Provides as a Hedge Against Volatile Natural Gas Prices.

**Table 5: Per Participant Non-Energy Impacts for Residential Gas Programs** 

Program	NEI	Description	Measure Category	Value	Duration
			Combo Condensing boiler/DHW	\$1.21	
			Furnace w/ECM	\$27.18	
	Thermal Comfort	Greater participant- perceived comfort in home	Boiler 90%	\$27.61	Annual
		perceived connort in nome	Boiler 95%	\$27.49	
			Thermostat	\$3.99	
			Combo Condensing boiler/DHW	\$0.39	
			DHW - Condensing	\$0.70	
		Increased home durability in terms of maintenance	DHW - Tankless	\$1.23	
	Home Durahility	requirements because of	DHW - Stand Alone	\$1.30	Annual
Residential	Home Durability	better quality heating, cooling and structural materials	Furnace w/ECM	\$7.12	Annual
Heating and			Boiler 90%	\$7.33	
Cooling			Boiler 95%	\$7.28	
equipment			Thermostat	\$1.33	
		Reduced maintenance	Combo Condensing boiler/DHW	\$1.10	
	Fauinment Maintenance	costs of owning newer	Furnace w/ECM	\$11.98	Annual
	Equipment Maintenance	and/or more efficient appliance equipment	Boiler 90%	\$13.88	Annuai
			Boiler 95%	\$13.47	
		Fewer colds and viruses,	Combo Condensing boiler/DHW	\$0.04	
		improved indoor air	Furnace w/ECM	\$0.87	
	Health Benefits	quality and ease of maintaining healthy	Boiler 90%	\$0.89	Annual
		relative humidity from	Boiler 95%	\$0.88	
		weatherization	Thermostat	\$0.13	
			Air Sealing	\$10.13	
EnergyWise Single Family	Thermal Comfort	Greater participant- perceived comfort in home	Thermostat	\$3.99	
Jingle Lailing			Insulation	\$25.15	

Program	NEI	Description	Measure Category	Value	Duration
	Noise Reduction	Less participant-perceived	Air Sealing	\$4.88	Annual
	Noise Reduction	noise in the home	Insulation	\$11.54	Alliludi
		Increased home durability	Air Sealing	\$3.95	
	Home Durability	from better quality heating, cooling and	Thermostat	\$1.33	Annual
		structural materials	Insulation	\$9.82	Annual Annual Annual Annual Annual Annual
		Fewer colds and viruses, improved indoor air	Air Sealing	\$0.32	
	Health Benefits	quality and ease of	Thermostat	\$0.13	Annual
	Treaten Benefits	maintaining healthy relative humidity from weatherization	Insulation	\$0.80	
	Thermal Comfort	Greater participant- perceived comfort in home	Insulation	\$25.15	
			Duct Sealing	\$0.16	Annual
			Thermostat	\$3.99	Annuai
			Air Sealing	\$10.13	
	Noise Reduction	Less participant-perceived noise in the home	Insulation	\$11.54	Annual
			Air Sealing	\$4.88	Annuai
For a way Adding Advited	Property Durability	Increased home durability in terms of maintenance	Insulation	\$9.82	
EnergyWise Multi Family / C&I			Duct Sealing	\$0.06	
Multifamily		requirements because of better quality heating,	Thermostat	\$4.05	Annual
		cooling and structural	Showerhead/Aerators	\$0.37	
		materials	Air Sealing	\$3.95	
		Fewer colds and viruses,	Insulation	\$0.80	
	Health Benefits improved indoor air quality and ease of maintaining healthy relative humidity as a result of weatherization in		Duct Sealing	\$0.01	
			Thermostat	\$0.13	Annual
		Air Sealing	\$0.32		

Program	NEI	Description	Measure Category	Value	Duration
		home			
	Equipment Maintenance	Reduced maintenance costs of owning newer and/or more efficient appliance equipment	Thermostat	\$3.91	Annual
		Financial savings to owners of MF rental housing as a	Thermostat	\$0.11	
	Rental Units Marketability	result of increased marketability of the more efficient housing.	Showerhead/Aerators	\$0.01	Annual
	Reduced Tenant	Savings to owners of MF rental housing in terms of staff time and materials as	Thermostat	\$2.16	Annual
	Complaints		Showerhead/Aerators	\$0.20	
	Safety-Related Emergency Calls	Financial savings to the utility as a result of fewer safety related emergency calls being made	Heating System	\$8.43	Annual
	Thermal Comfort	Greater participant- perceived comfort in home	Insulation	\$30.13	
			Air Sealing	\$35.89	Annual
Single Family -		perceived connort in nome	Heating System	\$33.24	
Income Eligible Services	Noise Reduction	Less participant-perceived	Insulation	\$13.56	Annual
Services	Noise Reduction	noise in the home	Air Sealing	\$16.39	Alliludi
		Increased home durability	Insulation	\$8.76	
	Home Durability in terms of maintenance requirements because of better quality heating, cooling and structural materials		Air Sealing	\$10.61	
		Heating System	\$27.43	Annual	

Program	NEI	Description	Measure Category	Value	Duration
	Equipment Maintenance	Reduced maintenance costs of owning newer and/or more efficient appliance equipment	Heating System	\$9.72	Annual
		Fewer colds and viruses,	Insulation	\$193.15	
		improved indoor air quality and ease of	Air Sealing	\$230.08	
	Health Benefits	maintaining healthy relative humidity as a result of weatherization in home	Heating System	\$213.13	Annual
		Reduced risk of fire and	Insulation	\$17.40	
	Improved Safety	fire-related property damage	Air Sealing	\$2.24	Annual
			Heating System	\$18.87	
	Price Hedging		N/A	\$0.76/MMBtu	One Time
	Arrearages	Reduced arrearage carrying costs as a result of customers being more able to pay their lower bills		\$2.61	Annual
	Bad Debt Write-offs	Reduced costs to utility of uncollectable, unpaid balances as a result of customers being more able to pay their lower bills	Participant	\$3.74	Annual
	Terminations and Reconnections	Reduced costs associated with terminations and reconnections to utility due to nonpayment as a result of customers being more able to pay their lower bills		\$0.43	Annual

Program	NEI	Description	Measure Category	Value	Duration
	Customer Calls and Collections	Utility savings in staff time and materials for fewer customer calls as a result of more timely bill payments		\$0.58	Annual
	Notices	Financial savings to utility as a result of fewer notices sent to customers for late payments and terminations		\$0.34	Annual
		Financial savings to owners	Air Sealing	\$0.07	
	Rental Units Marketability	of LI rental housing as a result of increased marketability of the more	Water Heater	\$0.01	Annual
			Showerhead/Aerators	\$0.01	Allitual
		efficient housing.	Thermostat	\$0.11	
	Improved Safety	Reduced risk of fire and fire-related property damage	Insulation	\$2.40	
			Air Sealing	\$0.31	Annual
EnergyWise			Water Heater	\$0.61	/ initiali
Income Eligible			Heating System	\$2.60	
Multifamily	Property Durability of LI result of result of the control of the c	Financial savings to owners	Air Sealing	\$2.58	
Retrofit		of LI rental housing as a result of more durable and	Water Heater	\$0.37	Annual
		efficient materials being	Showerhead/Aerators	\$0.37	Ailliudi
		installed.	Heating System	\$9.72	
		Savings to owners of LI	Air Sealing	\$1.37	
	Reduced Tenant	rental housing in terms of staff time and materials as	Water Heater	\$0.20	
	Complaints	a result of fewer tenant	Showerhead/Aerators	\$0.20	Annual
		complaints with the more efficient measures.	Thermostat	\$2.16	

Program	NEI	Description	Measure Category	Value	Duration
	Safety-Related Emergency Calls	Financial savings to the utility as a result of fewer safety related emergency calls being made	Heating System	\$8.43	Annual
	Price Hedging		N/A	\$0.76/MMBtu	One Time
	Arrearages	Reduced arrearage carrying costs as a result of customers being more able to pay their lower bills	Participant	\$2.61	Annual
	Bad Debt Write-offs	Reduced costs to utility of uncollectable, unpaid balances as a result of customers being more able to pay their lower bills		\$3.74	Annual
	Terminations and Reconnections	Reduced costs associated with terminations and reconnections to utility due to nonpayment as a result of customers being more able to pay their lower bills		\$0.43	Annual
	Customer Calls and Collections	Utility savings in staff time and materials for fewer customer calls as a result of more timely bill payments		\$0.58	Annual
	Notices	Financial savings to utility as a result of fewer notices sent to customers for late payments and terminations		\$0.34	Annual
	Thermal Comfort	Greater participant-	Insulation	\$42.46	Annual
	mermai Comiori	perceived comfort in home	Duct Sealing	\$0.68	, amuai

Program	NEI	Description	Measure Category	Value	Duration
			Air Sealing	\$31.73	
			Pipe wrap	\$5.56	
			Thermostat	\$4.87	
			Heating System	\$38.92	
	Noise Reduction	Less participant-perceived	Insulation	\$13.56	Annual
	Noise Reduction	noise in the home	Air Sealing	\$16.39	Annual
		Increased home durability	Insulation	\$8.76	
		in terms of maintenance	Duct Sealing	\$0.23	
	b co		Air Sealing	\$10.61	Annual
			Thermostat	\$4.05	
			Heating System	\$9.72	
		Reduced maintenance	Thermostat	\$3.91	
	Equipment Maintenance	costs of owning newer and/or more efficient appliance equipment	Heating System	\$27.43	Annual
		Fewer colds and viruses,	Insulation	\$33.83	
		improved indoor air	Duct Sealing	\$0.13	
	Haalth Banafita	quality and ease of	Air Sealing	\$25.28	Annual
	relative	maintaining healthy relative humidity as a	Pipe wrap	\$1.05	Annual
		result of weatherization in home	Thermostat	\$0.92	
			Heating System	\$31.00	

Sources:

Residential New Construction Source: Massachusetts Program Administrators: Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation, prepared by NMR Group, Inc. and Tetra Tech.

EnergyWise Single Family and Income Eligible Services Single Family Sources: For Thermal Comfort, Health Benefits, and Improved Safety Massachusetts Special and Cross-Cutting Research Area: Low-Income Single-Family Health- and Safety-Related Non-Energy Impacts (NEIs) Study (August 5, 2016) prepared by Three3, Inc. and NMR

Group.For other NEIs - "Massachusetts Program Administrators: Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation," NMR Group, Inc., Tetra Tech. 8.15.2011

EnergyWise Multifamily Retrofit Source: Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation, prepared by NMR Group, Inc. and Tetra Tech. Massachusetts Market-Rate Rental Property NEI Study, prepared by NMR Group and DNV GL.

EnergyWise Income Eligible Multifamily Retrofit Source: EnergyWise Multifamily Retrofit Source: Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation, prepared by NMR Group, Inc. and Tetra Tech. Massachusetts Market-Rate Rental Property NEI Study, prepared by NMR Group and DNV GL. Massachusetts Low-Income Multifamily Health- and Safety-Related NEIs Study (Phase 1), prepared by NMR Group, Inc. and Three3, Inc.

Price Hedging Source: Lawrence Berkeley National Laboratory (2002). Quantifying the Value That Wind Power Provides as a Hedge Against Volatile Natural Gas Prices.

## **Appendix C: Acronyms**

ACRONYM DESCRIPTION
AC Air Conditioning

AFUE Annual Fuel Utilization Efficiency (see the Glossary)

AHU Air Handling Unit

Btu British Thermal Unit (see the Glossary)
CF Coincidence Factor (see the Glossary)

CFL Compact Fluorescent Lamp
CHP Combined Heat and Power

COP Coefficient of Performance (see the Glossary)

DCV Demand Controlled Ventillation

DHW Domestic Hot Water

DOER Department of Energy Resources

DSM Demand Side Management (see the Glossary)

ECM Electrically Commutated Motor

EER Energy Efficiency Ratio (see the Glossary)

EF Efficiency Factor

EFLH Equivalent Full Load Hours (see the Glossary)

ES ENERGY STAR® (see the Glossary)

FCM Forward Capacity Market

FR Free-Ridership (see the Glossary)

HE High-Efficiency

HID High-Intensity Discharge (a lighting technology)

HP Horse Power (see the Glossary)

HSPF Heating Seasonal Performance Factor (see the Glossary)

HVAC Heating, Ventilating, and Air Conditioning

ISO Independent System Operator
ISR In-Service Rate (see the Glossary)

kW Kilo-Watt, a unit of electric demand equal to 1,000 watts

kWh Kilowatt-Hour, a unit of energy (1 kilowatt of power supplied for one hour)

LED Light-Emitting Diode (one type of solid-state lighting)

LCD Liquid Crystal Display (a technology used for computer monitors and similar displays)

MMBtu One million British Thermal Units (see "Btu" in the Glossary)

MW Megawatt – a measure of electric demand equal to 1,000 kilowatts

MWh Megawatt-hour – a measure of energy equal to 1,000 kilowatt-hours

NEB Non-Electric Benefit (see the Glossary)

NEI Non-Energy Impact

NE-ISO New England Independent System Operator

NTG Net-to-Gross (see the Glossary)
O&M Operations and Maintenance

PA Program Administrator (see the Glossary)

PC Personal Computer

RR Realization Rate (see the Glossary)

SEER Seasonal Energy Efficiency Ratio (see the Glossary)

SO Spillover (see the Glossary)

SPF Savings Persistence Factor (see the Glossary)
SSL Solid-State Lighting (e.g., LED lighting)

VSD Variable-Speed Drive

## **Appendix D: Glossary**

This glossary provides definitions as they are applied in this TRM for Rhode Island' energy efficiency programs. Alternate definitions may be used for some terms in other contexts.

TERM	DESCRIPTION			
Adjusted Gross Savings	Gross savings (as calculated by the measure savings algorithms) that have been subsequently adjusted by the application of all impact factors except the net-to-gross factors (free-ridership and spillover).			
AFUE	Annual Fuel Utilization Efficiency. The measure of seasonal or annual efficiency of a furnace or boiler. AFUE takes into account the cyclic on/off operation and associated energy losses of the heating unit as it responds to changes in the load, which in turn is affected by changes in weather and occupant controls.			
Baseline Efficiency	The level of efficiency of the equipment that would have been installed without any influence from the program or, for retrofit cases where site-specific information is available, the actual efficiency of the existing equipment.			
Btu	British thermal unit. A Btu is approximately the amount of energy needed to heat one pound of water by one degree Fahrenheit.			
Coefficient of Performance (COP)	Coefficient of Performance is a measure of the efficiency of a heat pump, air conditioner, or refrigeration system. A COP value is given as the Btu output of a device divided by the Btu input of the device. The input and output are determined at AHRI testing standards conditions designed to reflect peak load operation.			
Coincidence Factor (CF)	Coincidence Factors represent the fraction of connected load expected to occur concurrent to a particular system peak period; separate CF are found for summer and winter peaks. The CF given in the TRM includes both coincidence and diversity factors multiplied into one number. Coincidence factors are provided for peak periods defined by the NE-ISO for FCM purposes and calculated consistent with the FCM methodology.			
Connected Load kW Savings	The connected load kW savings is the power saved by the equipment while in use. In some cases the savings reflect the maximum power draw of equipment at full load. In other cases the connected load may be variable, which must be accounted for in the savings algorithm.			
Deemed Savings	Savings values (electric, fossil fuel and/or non-energy benefits) determined from savings algorithms with assumed values for all algorithm parameters. Alternatively, deemed savings values may be determined from evaluation studies. A measure with deemed savings will have the same savings per unit since all measure assumptions are the same. Deemed savings are used by program administrators to report savings for measures with well-defined performance characteristics relative to baseline efficiency cases. Deemed savings can simplify program planning and design, but may lead to over- or underestimation of savings depending on product performance.			
Deemed Calculated Savings	Savings values (electric, fossil fuel and/or non-energy benefits) that depend on a standard savings algorithm and for which at least one of the algorithm parameters (e.g., hours of operation) is project specific.			
Demand Savings	The reduction in demand due to installation of an energy efficiency measure, usually expressed as kW and measured at the customer's meter (see Connected Load kW Savings).			
Demand Side Management (DSM)	Strategies used to manage energy demand including energy efficiency, load management, fuel substitution, and load building.			

TERM	DESCRIPTION			
Diversity	A characteristic of a variety of electric loads whereby individual maximum demands occur at different times. For example, 50 efficient light fixtures may be installed, but they are not necessarily all on at the same time. See Coincidence Factor.			
Diversity Factor	This TRM uses coincidence factors that incorporate diversity (See Coincidence Factor), thus this TRM has no separate diversity factors. A diversity factor is typically calculated as:  1) the percent of maximum demand savings from energy efficiency measures available at the time of the company's peak demand, or 2) the ratio of the sum of the demands of a group of users to their coincident maximum demand.			
End Use	Refers to the category of end use or service provided by a measure or technology (e.g., lighting, cooling, etc.). For the purpose of this manual, the list of end-uses include:  Lighting HVAC  Refrigeration Hot Water  Food Service Behavior  Compressed Air Motors & Drives  Products Custom			
Energy Efficiency Ratio (EER)	The Energy Efficiency Ratio is a measure of the efficiency of a cooling system at a specified peak, design temperature, or outdoor temperature. In technical terms, EER is the steady-state rate of heat energy removal (i.e. cooling capacity) of a product measured in Btuh output divided by watts input.			
ENERGY STAR® (ES)	Brand name for the voluntary energy efficiency labeling initiative sponsored by the U.S. Environmental Protection Agency.			
Energy Costing Period	<ul> <li>A period of relatively high or low system energy cost, by season. The energy periods defined by ISO-NE are:</li> <li>Summer Peak: 6am-10pm, Monday-Friday (except ISO holidays), June-September</li> <li>Summer Off-Peak: Summer hours not included in the summer peak hours: 10pm-6am, Monday-Friday, all day on Saturday and Sunday, and ISO holidays, June-September</li> <li>Winter Peak: 6am-10pm, Monday-Friday (except ISO holidays), January-May and October-December</li> <li>Winter Off-Peak: Winter hours not included in the sinter peak hours: 10pm-6am, Monday-Friday, all day on Saturday and Sunday, and ISO holidays, January-May and October-December.</li> </ul>			
Equivalent Full Load Hours (EFLH)	The equivalent hours that equipment would need to operate at its peak capacity in order to consume its estimated annual kWh consumption (annual kWh/connected kW).			
Free Rider	A customer who participates in an energy efficiency program, but would have installed some or all of the same measure(s) on their own, with no change in timing of the installation, if the program had not been available.			
Free-Ridership Rate	The percentage of savings attributable to participants who would have installed the measures in the absence of program intervention.			
Gross kW	Expected demand reduction based on a comparison of standard or replaced equipment and equipment installed through an energy efficiency program.			
Gross kWh	Expected kWh reduction based on a comparison of standard or replaced equipment and equipment installed through an energy efficiency program.			
Gross Savings	A saving estimate calculated from objective technical factors. In this TRM, "gross savings" are calculated with the measure algorithms and do not include any application of impact factors. Once impact factors are applied, the savings are called "Adjusted Gross Savings".			

TERM	DESCRIPTION			
High Efficiency (HE)	Refers to the efficiency measures that are installed and promoted by the energy efficiency programs.			
Horsepower (HP)	A unit for measuring the rate of doing work. One horsepower equals about three-fourths of a kilowatt (745.7 watts).			
Heating Seasonal Performance Factor (HSPF)	A measure of the seasonal heating mode efficiencies of heat pumps expressed as the rati of the total heating output to the total seasonal input energy.			
Impact Factor	Generic term for a value used to adjust the gross savings estimated by the savings algorithms in order to reflect the actual savings attributable to the efficiency program. In this TRM, impact factors include realization rates, in-service rates, savings persistence, peak demand coincidence factors, free-ridership, spillover and net-to-gross factors. See the section on Impact Factors for more detail.			
In-Service Rate	The percentage of units that are actually installed. For example, efficient lamps may have an in-service rate less than 100% since some lamps are purchased as replacement units and are not immediately installed. The in-service rate for most measures is 100%.			
Measure Life	The number of years that an efficiency measure is expected to garner savings. These are generally based on engineering lives, but sometimes adjusted based on observations of market conditions.			
Lost Opportunity	Refers to a measure being installed at the time of planned investment in new equipment or systems. Often this reflects either new construction, renovation, remodeling, planned expansion or replacement, or replacement of failure.			
Measure	A product (a piece of equipment), combination of products, or process designed to provide energy and/or demand savings. Measure can also refer to a service or a practice that provides savings. Measure can also refer to a specific combination of technology and market/customer/practice/strategy (e.g., direct install low income CFL).			
Net Savings	The final value of savings that is attributable to a program or measure. Net savings differs from gross savings (or adjusted gross savings) because it includes adjustments due to free-ridership and/or spillover. Net savings is sometimes referred to as "verified" or "final" savings.			
Net-to-Gross Ratio	The ratio of net savings to the adjusted gross savings (for a measure or program). The adjusted gross savings include any adjustment by the impact factors other than free-ridership or spillover. Net-to-gross is usually expressed as a percent.			
Non-Electric Benefits (NEBs)	Quantifiable benefits (beyond electric savings) that are the result of the installation of a measure. Fossil fuel, water, and maintenance are examples of non-electric benefits. Non-electric benefits can be negative (i.e. increased maintenance or increased fossil fuel usage which results from a measure) and therefore are sometimes referred to as "non-electric impacts".			
Non-Participant	A customer that does not directly participate in an efficiency program.			
On-Peak kW	See Summer/Winter On-peak kW			
Operating Hours	Hours that a piece of equipment is expected to be in operation, not necessarily at full load (typically expressed per year).			
Participant	A customer that reduces or otherwise modifies their energy end use patterns due to involvement in an efficiency program. Participation is measured differently in different programs. For several programs, a participant is defined as a customer account (electric or gas). In contrast, the Residential Consumer Products program measures participation by the number of rebates processed.			

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TERM	DESCRIPTION
Prescriptive Measure	A prescriptive measure is generally offered by use of a prescriptive form with a prescribed incentive based on the parameters of the efficient equipment or practice.
Realization Rate (RR)	The ratio of measure savings developed from impact evaluations to the estimated measure savings derived from the TRM savings algorithms. This factor is used to adjust the estimated savings when significant justification for such adjustment exists. The components of the realization rate are described in detail in the section on Impact Factors.
Retrofit	The replacement of a piece of equipment or device before the end of its useful or planned life for the purpose of achieving energy savings. "Retrofit" measures are sometimes referred to as "early retirement" when the removal of the old equipment is aggressively pursued.
Savings Persistence Factor (SPF)	Percentage of first-year energy or demand savings expected to persist over the life of the installed energy efficiency equipment. The SPF is developed by conducting surveys of installed equipment several years after installation to determine the operational capability of the equipment. In contrast, <i>measure persistence</i> takes into account business turnover, early retirement of installed equipment, and other reasons the installed equipment might be removed or discontinued. Measure persistence is generally incorporated as part of the measure life, and therefore is not included as a separate impact factor.
Seasonal Energy Efficiency Ratio (SEER)	A measurement of the efficiency of a central air conditioner over an entire season. In technical terms, SEER is a measure of equipment the total cooling of a central air conditioner or heat pump (in Btu) during the normal cooling season as compared to the total electric energy input (in watt-hours) consumed during the same period.
Sector	A grouping of participants by customer rate class. Programs are organized by these groupings. There are three sectors: Residential, Income Eligibe, and Commercial and Industrial.
Spillover Rate	The percentage of savings attributable to the program, but additional to the gross (tracked) savings of a program. Spillover includes the effects of (a) participants in the program who install additional energy efficient measures outside of the program as a result of hearing about the program and (b) non-participants who install or influence the installation of energy efficient measures as a result of being aware of the program.
Summer/Winter On-Peak kW	The average demand reduction during the summer/winter on-peak period. The summer on-peak period is 1pm-5pm on non-holiday weekdays in June, July and August; the winter on-peak period is 5pm-7pm on non-holiday weekdays in December and January.
Ton	Unit of measure for determining cooling capacity. One ton equals 12,000 Btu.
Watt	A unit of electrical power. Equal to 1/1000 of a kilowatt.

Fuel	TRM Sector	TRM Program Name	TRM Measure Name	Change/Addition Made	Type of Change	Source of Change	Date of Change
Electric, Gas	Res, Income Eligible, C&I	Identify the program name in the TRM	Identify the measure name in the TRM	Describe the change made with the values changed	Type of Change	Identify the source of the change	2023 TRM
Electric	Res, Income Eligible, C&I	Multiple	Multiple	Added missing values for Winter/summer peak coincidence factors that were missing from the TRM but in the BC model	Alignment with BC Model	BC model	9/23/2022
Licetiie	,		,	Made inactive in TRM based on removal from BC model and not			3/23/2022
Electric	C&I	C02a Design 2000plus	ECM Motor - HVAC	existing in InDemand	Alignment with BC Model	BC model	9/23/2022
Electric	C&I	C03b Small Customers under 200kW	Non-refrigerated snack vending machine		Alignment with BC Model	BC model	9/23/2022
Electric	C&I	C03b Small Customers under 200kW	Custom other	Made inactive in TRM based on removal from BC model and not existing in InDemand	Alignment with BC Model	BC model	9/23/2022
Floreste	COL	CO2a Dasina 2000alua	Food consider bloods	Made inactive in TRM based on removal from BC model and not	Alianment with DC Madel	DC model	0/22/2022
Electric	C&I	C02a Design 2000plus	Food service - blank	existing in InDemand  Made inactive in TRM based on removal from BC model and not	Alignment with BC Model	BC model	9/23/2022
Electric	C&I	C03b Small Customers under 200kW	Glass front refrigerated coolers	existing in InDemand  Made inactive in TRM based on removal from BC model and not	Alignment with BC Model	BC model	9/23/2022
Electric	Residential	A02a Energy Star Homes	LED Bulbs (linear)	existing in InDemand	Alignment with BC Model	BC model	9/23/2022
Electric	Residential	A04b Energy Star Products	Low Flow Showerhead thermo Control (ladybug oil. Propane DHW)	Made inactive in TRM based on removal from BC model and not existing in InDemand	Alignment with BC Model	BC model	9/23/2022
Liceare			Low Flow Showerhead thermo Control	Made inactive in TRM based on removal from BC model and not			3/ 23/ 2022
Electric	Residential	A04b Energy Star Products	(ladybug gas DHW)	existing in InDemand	Alignment with BC Model	BC model	9/23/2022
Electric	C&I	C&I Multifamily	Pipe Wrap (Heating)	Made inactive in TRM based on removal from BC model and not existing in InDemand	Alignment with BC Model	BC model	9/23/2022
et	Residential	A03b EnergyWise Multifamily	Rina Ween (Heating)	Made inactive in TRM based on removal from BC model and not	Alignment with BC Model	BC model	0/22/2022
Electric	Residential	AOSD EffergyWise Multifamily	Pipe Wrap (Heating)	existing in InDemand  Made inactive in TRM based on removal from BC model and not	Alignment with BC Model	BC model	9/23/2022
Electric	Residential	A03b EnergywiseMF	Pipe Wrap Heating Oil	existing in InDemand	Alignment with BC Model	BC model	9/23/2022
Electric	C&I	Residential Demand Management	Solar Inverters	Needed to add this to the TRM	Alignment with BC Model		9/16/2022
Electric	C&I	C02a Design 2000plus	ECM Motor - HVAC	removed from TRM 2023 - duplicate measure to ECM-HVAC	Alignment with BC Model	not in InDemand and we already have the prescriptive cool choice ECM-HVAC (Erin C. 7.26.2022)	9/21/2022
						unable to map to a measure in inDemand, propose	
Electric	C&I	C03b Small Customers under 200kW	Custom other	removed from TRM 2023 - set as inactive	Alignment with BC Model	deletion from TRM since there is nothing in InDemand to map to - Erin Crafts 8.1.2022	9/21/2022
Electric	Income Eligible	B03a Low Income Retrofit 1-4	Heating system replacement, Gas	removed from TRM 2023 - set as inactive	Alignment with BC Model	removed from 2023 BC measure list	9/21/2022
Electric	Residential	A04a Energy Star Lighting	LED Bulbs (linear)	removed from TRM 2023 - set as inactive	Alignment with BC Model	discontinued, no longer relevant for this program	9/21/2022
Electric	Residential	A04a Energy Star Lighting	LED Fixture	removed from TRM 2023 - set as inactive	Alignment with BC Model	discontinued, no longer relevant for this program	9/21/2022
Electric	Residential	A04a Energy Star Lighting	LED A Lamps	removed from TRM 2023 - set as inactive	Alignment with BC Model	discontinued, no longer relevant for this program	9/21/2022
Electric	Residential	A04a Energy Star Lighting	LED Bulbs (Specialty)	removed from TRM 2023 - set as inactive	Alignment with BC Model	discontinued, no longer relevant for this program	9/21/2022
Electric	Residential	A04a Energy Star Lighting	School Program LED Bulbs	removed from TRM 2023 - set as inactive	Alignment with BC Model	discontinued, no longer relevant for this program	9/21/2022
Electric	Residential Residential	A04a Energy Star Lighting	HTR LED A Lamps LED Reflector	removed from TRM 2023 - set as inactive	Alignment with BC Model	discontinued, no longer relevant for this program	9/21/2022
Electric Electric	Residential	A04a Energy Star Lighting A04a Energy Star Lighting	LED FoodBank	removed from TRM 2023 - set as inactive removed from TRM 2023 - set as inactive	Alignment with BC Model Alignment with BC Model	discontinued, no longer relevant for this program discontinued, no longer relevant for this program	9/21/2022 9/21/2022
Electric	Residential	A02a Energy Star Homes	Renovation Rehab Cooling tier4	removed from TRM 2023 - set as inactive	Alignment with BC Model	Tier 4 discontinued, not in InDemand	9/21/2022
Electric	Residential	A02a Energy Star Homes	Renovation Rehab Heating_tier4	removed from TRM 2023 - tier 4 is inactive	Alignment with BC Model	Tier 4 discontinued, not in InDemand	9/21/2022
			Renovation Rehab Domestic Hot				
Electric Electric	Residential Residential	A02a Energy Star Homes A02a Energy Star Homes	Water_tier4 Cooling tier4	removed from TRM 2023 - tier 4 is inactive removed from TRM 2023 - tier 4 is inactive	Alignment with BC Model Alignment with BC Model	Tier 4 discontinued, not in InDemand Tier 4 discontinued, not in InDemand	9/21/2022 9/21/2022
Electric	Residential	A02a Energy Star Homes	DHW tier4	removed from TRM 2023 - tier 4 is inactive	Alignment with BC Model	Tier 4 discontinued, not in InDemand	9/21/2022
Electric	Residential	A02a Energy Star Homes	Heating_tier4	removed from TRM 2023 - tier 4 is inactive	Alignment with BC Model	Tier 4 discontinued, not in InDemand	9/21/2022
Electric	Residential	Residential New Construction	Heating_tier4	removed from TRM 2023 - tier 4 is inactive	Alignment with BC Model	Tier 4 discontinued, not in InDemand	9/21/2022
Electric	Residential	Residential New Construction	Hot water heating_tier4	removed from TRM 2023 - tier 4 is inactive	Alignment with BC Model	Tier 4 discontinued, not in InDemand	9/21/2022
			Renovation Rehab Heating_tier4 Cooling				
Electric	Residential	Residential New Construction	Gas	removed from TRM 2023 - tier 4 is inactive	Alignment with BC Model	Tier 4 discontinued, not in InDemand	9/21/2022
Electric	Residential	Residential New Construction	Renovation Rehab Heating_tier4 Renovation Rehab Domestic Hot	removed from TRM 2023 - tier 4 is inactive	Alignment with BC Model	Tier 4 discontinued, not in InDemand	9/21/2022
Electric	Residential	Residential New Construction	Water_tier4 Gas	removed from TRM 2023 - tier 4 is inactive	Alignment with BC Model	Tier 4 discontinued, not in InDemand	9/21/2022
Electric	Residential	Residential New Construction	Cooling_tier4	removed from TRM 2023 - tier 4 is inactive	Alignment with BC Model	Tier 4 discontinued, not in InDemand	9/21/2022
Electric	Res	Residential Demand Management	Solar Inverters, New	Needed to add this to the TRM	Alignment with BC Model		9/16/2022
Gas	Low Income	Low Income Multifamily	Tankless Water Heater	Made inactive in TRM based on removal from BC model and not existing in InDemand	Alignment with BC Model	BC model	9/23/2022
Gas	Low Income	Low Income Multifamily	Indirect Water Heater	Made inactive in TRM based on removal from BC model and not existing in InDemand	Alignment with BC Model	BC model	9/23/2022
Gas	Low Income	Low Income Multifamily	Stand Alone Water Heater	Made inactive in TRM based on removal from BC model and not existing in InDemand	Alignment with BC Model	BC model	9/23/2022
Electric	Res	Residential Demand Management	Solar Inverters, New	Changed EE: Gross Annual kWh saved to 0	Factor update	MA Solar PFC Demo 2021, assume no savings	9/16/2022
Electric	C&I	C02a C&I Lost Opportunity		ML updated to 25	Factor update	Ground Source Heat Pump eTRM Measure Review MA20C15-B-GSHP	7/8/2022
	C&I	C02a C&I Lost Opportunity	Groundwater source (open loop) heat	ML updated to 25	Factor update	Ground Source Heat Pump eTRM Measure Review MA20C15-B-GSHP	7/8/2022

	T						
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
	_					prepared for the Electric and Gas Program Administrators	
Electric	Res	A03b Residential Retrofit	Aerator, Electric	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
		AOOR Desidential Detects	A	Cattle on (Non-continuous and Non-continuous Activities and Non-co	Francisco de la	prepared for the Electric and Gas Program Administrators	. / . /
Electric	Res	A03b Residential Retrofit	Aerator, Electric	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
	Res	A03b Residential Retrofit	Aerator, Oil	Calling (Name and Standards) share and the 40%	Factor update	prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	2 /2 /2222
Electric	res	AOSD RESIDENTIAL RELIGIT	Aerator, Oil	Spillover (Non-participant rate) changed to 4%	ractor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
Electric .	Dec.	AO2h Residential Retrefit	Acceptant Cil	Caille and (Non-postining at sate) shanged to 40/	Footos un doto	prepared for the Electric and Gas Program Administrators	0/0/2022
Electric	Res	A03b Residential Retrofit	Aerator, Oil	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
Electric	Res	A03b Residential Retrofit	Aerator, Others	Spillover (Non-participant rate) changed to 4%	Factor update	prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	0/0/2022
Electric	nes	NOOD VESIGEITIGI METIOTIF	Acidioi, Others	Spinover (NOII-participant rate) changed to 4%	ractor upuate	or massacriusetts, No. 203374, Boulder, Colorado	9/9/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
Electric	Res	A03b Residential Retrofit	Aerator, Others	Spillover (Non-participant rate) changed to 4%	Factor update	prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
Electric	nes	AUSD Residential Retrollt	Aciator, Others	Spillover (Non-participant rate) Changed to 478	ractor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
Electric	Res	A03b Residential Retrofit	Air Sealing Kit, Electric	Spillover (Non-participant rate) changed to 4%	Factor update	prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
Liectric	ines	AOSD RESIDENTIAL RECORD	All Sealing Rt., Electric	Spinover (Non-participant rate) changed to 470	Tactor apaste	of Massachusetts, No. 203374, Boulder, Colorado	3/3/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
Electric	Res	A03b Residential Retrofit	Air Sealing Kit, Oil	Spillover (Non-participant rate) changed to 4%	Factor update	prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
Liectric	nes -	noss residential redistr	7 in Sedining rite, On	Spinover (Non-participant rate) changes to 475	ractor apaate	or massacriasetts, No. 203374, Boarder, edicidad	3/3/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
Electric	Res	A03b Residential Retrofit	Air Sealing Kit, Others	Spillover (Non-participant rate) changed to 4%	Factor update	prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
					·		.,.,
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators	
Electric	Res	A03b Residential Retrofit	LED Bulbs	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
						Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures,	
						prepared for the Electric and Gas Program Administrators	
Electric	Res	A03b Residential Retrofit	LED Bulbs	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
						Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures,	
						prepared for the Electric and Gas Program Administrators	
Electric	Res	A03b Residential Retrofit	LED Bulbs (EISA Exempt)	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
						Cuidebaure las Massachusetts Social attacks	
						Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures,	
						prepared for the Electric and Gas Program Administrators	
Electric	Res	A03b Residential Retrofit	LED Fixture	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
						prepared for the Electric and Gas Program Administrators	
Electric	Res	A03b Residential Retrofit	LED Outdoor Fixture	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
						prepared for the Electric and Gas Program Administrators	
Electric	Res	A03b Residential Retrofit	LED Bulbs Reflectors	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022

						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
						prepared for the Electric and Gas Program Administrators	
Electric	Res	A03b Residential Retrofit	Participant	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
Electric	Res	A03b Residential Retrofit	Pipe Insulation, Electric	Spillover (Non-participant rate) changed to 4%	Factor update	prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
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Electric	Res	A03b Residential Retrofit	Pipe Insulation, Oil	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
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Electric	Res	A03b Residential Retrofit	Pipe Insulation, Others	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
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Electric	Res	A03b Residential Retrofit	Pre-weatherization	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
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Electric	Res	A03b Residential Retrofit	Refrigerator Brush	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
i						Guidehouse Inc., Massachusetts Residential Programs Net-	
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Electric	Res	A03b Residential Retrofit	Showerhead, Electric	Spillover (Non-participant rate) changed to 4%	Factor update	prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	0/0/2022
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Electric Res A03b Residential Retrofit Weatherization, Electric Spillover (Non-participant rate) changed to 4% Factor update of Massachusetts, No. 209974, Boulder, Colorado 9/9/2022  Electric Res A03b Residential Retrofit Weatherization, Oil Spillover (Non-participant rate) changed to 4% Factor update of Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado 9/9/2022  Electric Res A03b Residential Retrofit Weatherization, Oil Spillover (Non-participant rate) changed to 4% Factor update of Massachusetts, No. 209974, Boulder, Colorado 9/9/2022  Guidehouse Inc., Massachusetts, No. 209974, Boulder, Colorado 9/9/2022  Guidehouse Inc., Massachusetts, No. 209974, Boulder, Colorado 9/9/2022  Guidehouse Inc., Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators prepared for the Electric and Gas Program Administrators								
Electric Res AO3b Residential Retrofit Weatherization, Electric Spillover (Non-participant rate) changed to 4% Factor update prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209374, Boulder, Colorado 9/9/2022  Guidehouse Inc., Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209374, Boulder, Colorado 9/9/2022  Electric Res AO3b Residential Retrofit Weatherization, Oil Spillover (Non-participant rate) changed to 4% Factor update of Massachusetts, No. 209374, Boulder, Colorado 9/9/2022  Guidehouse Inc., Massachusetts, No. 209374, Boulder, Colorado 9/9/2022  Guidehouse Inc., Massachusetts Residential Program Administrators of Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators								
Electric Res A03b Residential Retrofit Weatherization, Electric Spillover (Non-participant rate) changed to 4% Factor update of Massachusetts, No. 209974, Boulder, Colorado 9/9/2022  Guidehouse Inc., Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado 9/9/2022  Electric Res A03b Residential Retrofit Weatherization, Oil Spillover (Non-participant rate) changed to 4% Factor update of Massachusetts, No. 209974, Boulder, Colorado 9/9/2022  Guidehouse Inc., Massachusetts, No. 209974, Boulder, Colorado 9/9/2022								
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Electric Res A03b Residential Retrofit Weatherization, Oil Spillover (Non-participant rate) changed to 4% Factor update of Massachusetts, No. 209974, Boulder, Colorado 9/9/2022  Guidehouse Inc., Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado 9/9/2022  Guidehouse Inc., Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators					Company of the second		, sound, colored	3/3/2022
Electric Res A03b Residential Retrofit Weatherization, Oil Spillover (Non-participant rate) changed to 4% Factor update prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado 9/9/2022  Guidehouse Inc., Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators								
Electric Res A03b Residential Retrofit Weatherization, Oil Spillover (Non-participant rate) changed to 4% Factor update of Massachusetts, No. 2097/4, Boulder, Colorado 9/9/2022  Guidehouse Inc., Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators								
Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators	Floorie	Por	A02h Paridontial Patrofit	Weatherization Oil	Spillovor (Non-participant rate) changed to 49/	Factor undato	p species and another section and section	0/0/2022
to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators	Electric	nes	AUSD RESIDENTIAL RELIGIT	weatherization, On	Spinover (Non-participant rate) changed to 4%	ractor upuate	or massacriusetts, No. 203974, Boulder, Colorado	9/9/2022
to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators							Guidehouse Inc., Massachusetts Residential Programs Net-	
							to-Gross Research of RCD and Select Products Measures,	
Electric   Mes   A03b Residential Retrofit   Weatherization, Others   Spillover (Non-participant rate) changed to 4%   Factor update   of Massachusetts, No. 209974, Boulder, Colorado   9/9/2022						L		
	Electric	Kes	AU3b Residential Retrofit	Weatherization, Others	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022

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						Citab and the Manager Profile College	
						Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures,	
		403h B	Standard Bardana and Assum	C-111(N)	Fortage date	prepared for the Electric and Gas Program Administrators	. / . /
Electric	Res	A03b Residential Retrofit	Electrical Resistance to MSHP	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
						· ·	
Floreste	Bee.	A03b Residential Retrofit	update once add new measure	Spillover (Non-participant rate) changed to 4%	Factor update	prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	0/45/2022
Electric	Res	AU3D RESIDENTIAL RETFORM	update once add new measure	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/16/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
		1				prepared for the Electric and Gas Program Administrators	
Electric	Res	A03b Residential Retrofit	update once add new measure	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/16/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	
						prepared for the Electric and Gas Program Administrators	
Electric	Res	A03b Residential Retrofit	update once add new measure	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/16/2022
						Guidehouse Inc., Massachusetts Residential Programs Net-	
						to-Gross Research of RCD and Select Products Measures,	l
1						prepared for the Electric and Gas Program Administrators	
Electric	Res	A03b Residential Retrofit	update once add new measure	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/16/2022
					·	Cadmus, "Commercial Refrigeration Load shape Project	-, -, -
1						Final Report", Northeast Energy Efficiency Partnership,	l
1						Regional Evaluation, Measurement, and Verification	
Electric	C&I	C03b Small C&I Retrofit	Door heater control	Updated CF sp to 0.44 was 0.5	Factor update	Forum, Lexington, MA, 2015 (table 39)	7/7/2022
LICCUIC					apaute	Cadmus, "Commercial Refrigeration Load shape Project	11112022
						Final Report", Northeast Energy Efficiency Partnership,	
						Regional Evaluation, Measurement, and Verification	
Electric	C&I	C03b Small C&I Retrofit	Freezer Door Heater Controls	Updated CF sp to 0.44 was 0.5	Factor update	Forum, Lexington, MA, 2015 (table 39)	7/7/2022
		Anal Desident Lines	WiFi programmable thermostat with	Undersolation of the second of	For the second state	Number of Computing (2010), P. H. L.	= to tag
Electric	Res	A02b Residential HVAC	cooling (oil)	Updated electric kW to 0.050 was 0.1	Factor update	Navigant Consulting (2018). Baseline Loadshape Study	7/8/2022
Electric	Res	A02a Residential Lost Opportunity	Showerheads	Updated electric kW to 0.059 was 0.02	Factor update	Navigant Consulting (2018). Baseline Loadshape Study	7/8/2022
			Duct Sealing - 100 CFM redcution in leaks	L	L .	Navigant (2018) Res 34 Home Energy Services Impact	
Electric	Res	A02b Residential HVAC	15% of flow to 5%	Updated electric kW to 0.310 was 0.3	Factor update	Evaluation	7/8/2022
							l
Electric	Res	A02a Residential Lost Opportunity	Showerheads	Updated electric kWh to 247	Factor update	MA Comprehensive TRM Review MA19R17-B-TRM DRAFT	7/8/2022
			Duct Sealing - 100 CFM redcution in leaks			Navigant (2018) Res 34 Home Energy Services Impact	l
Electric	Res	A02b Residential HVAC	15% of flow to 5%	Updated electric kWh to 442 was 212	Factor update	Evaluation	7/8/2022
Electric	Res	A04b Energy Star Products	Pool Pump(2-speed)	Updated Electric kWh to 639	Factor update	Guidehouse Comprehensive TRM Review	8/22/2022
			Low Flow Showerhead thermo Control			RI-20-RX-IEMFImpact – Impact Evaluation of Income	
Electric	Residential	A04b Residential Appliances	(ladybug gas DHW)	Updated Gas DHW MMBtu to 1.6	Factor update	Eligible Multifamily Program	7/8/2022
1						Guidehouse. (2021). MA Residential Coordinated Delivery	l
1						Virtual Home Energy Assessment Study (MA20R26-B-	l
Electric	Residential	A03b Residential Retrofit	Showerhead, Electric	Updated ISR to 0.85	Factor update	VHEA).	7/8/2022
			·		·		
1						Guidehouse. (2021). MA Residential Coordinated Delivery	l
1						Virtual Home Energy Assessment Study (MA20R26-B-	
Electric	Residential	A03b Residential Retrofit	Showerhead, Oil	Updated ISR to 0.85	Factor update	VHEA).	7/8/2022
LIECUIC		AGSS RESIDENTIAL RELIGIT	S.O. Werneau, On	opeated Shi to 0.05	. actor apaete	vitarij.	1/0/2022
1						Guidehouse. (2021). MA Residential Coordinated Delivery	
1							l
Plants.	Basidantial	AO2h Daoidential Dr Ct	Shawarhand Othors	Hadatad ISB to 0.05	Footos un dot:	Virtual Home Energy Assessment Study (MA20R26-B-	7/0/2000
Electric	Residential	A03b Residential Retrofit	Showerhead, Others	Updated ISR to 0.85	Factor update	VHEA).	7/8/2022
						Guidehouse. (2021). MA Residential Coordinated Delivery	l
						Virtual Home Energy Assessment Study (MA20R26-B-	
Electric	Residential	A03b Residential Retrofit	Aerator, Electric	Updated ISR to 0.86	Factor update	VHEA).	7/8/2022
						Guidehouse. (2021). MA Residential Coordinated Delivery	l
1						Virtual Home Energy Assessment Study (MA20R26-B-	l
Electric	Residential	A03b Residential Retrofit	Aerator, Oil	Updated ISR to 0.86	Factor update	VHEA).	7/8/2022
1						Guidehouse. (2021). MA Residential Coordinated Delivery	l
1						Virtual Home Energy Assessment Study (MA20R26-B-	l
Electric	Residential	A03b Residential Retrofit	Aerator, Others	Updated ISR to 0.86	Factor update	VHEA).	7/8/2022
				- p		<u>'</u>	,,0,2022
1						Guidehouse. (2021). MA Residential Coordinated Delivery	l
						Virtual Home Energy Assessment Study (MA20R26-B-	l
1	i .	A03b Residential Retrofit	Programmable Thermostat, Electric	Updated ISR to 0.88	Factor update	VHEA).	7/8/2022
Electric	Residential						

						Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-	
Electric	Residential	A03b Residential Retrofit	Programmable Thermostat, Oil	Updated ISR to 0.88	Factor update	VHEA).	7/8/2022
						Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-	
Electric	Residential	A03b Residential Retrofit	WiFi Thermostat, AC Only	Updated ISR to 0.88	Factor update	VHEA).	7/8/2022
Electric	Residential	A03b Residential Retrofit	WiFi Thermostat, Oil	Updated ISR to 0.88	Factor update	Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B- VHEA).	7/8/2022
						Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-	
Electric	Residential	A03b Residential Retrofit	WiFi Thermostat, Others	Updated ISR to 0.88	Factor update	VHEA).	7/8/2022
Electric	Residential	A03b Residential Retrofit	Programmable Thermostat, Others	Updated ISR to 0.88	Factor update	Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B- VHEA).	7/8/2022
						Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B-	
Electric	Residential	A03b Residential Retrofit	WiFi Thermostat, Electric	Updated ISR to 0.88	Factor update	VHEA).	7/8/2022
Electric	Residential	A03b Residential Retrofit	LED Outdoor Fixture	Updated ISR to 0.95	Factor update	Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B- VHEA).	7/8/2022
LICCUIT	nesidential	, 1050 Medicinial Netronic	EED GULGOOI FIXTURE	opaace in to 0.33	. octor upuate	vice y.	7/0/2022
Electric	Residential	A03b Residential Retrofit	LED Fixture	Updated ISR to 0.95	Factor update	Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B- VHEA).	7/8/2022
Licetiie							77072022
Electric	Residential	A03b Residential Retrofit	LED Bulbs	Updated ISR to 0.95	Factor update	Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B- VHEA).	7/8/2022
Licetife	nesidential	7 to 50 the side interior	EES SUIDS	opatica ish to 0.55	ractor apacte	The state of the s	7/0/2022
Electric	Residential	A03b Residential Retrofit	LED Bulbs (EISA Exempt)	Updated ISR to 0.95	Factor update	Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B- VHEA).	7/8/2022
Licetiie							77072022
Electric	Residential	A03b Residential Retrofit	LED Bulbs Reflectors	Updated ISR to 0.95	Factor update	Guidehouse. (2021). MA Residential Coordinated Delivery Virtual Home Energy Assessment Study (MA20R26-B- VHEA).	7/8/2022
Electric	C&I	C03a Large C&I Retrofit	LED	Updated kWh RR to 50.47%, kW summer RR 57.82% and kW winter RR to 46.06%. Was 59.6% for all three	Factor update	Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative	7/8/2022
				Updated kWh RR to 92.82%, kW summer RR 104.65% and kW		P81 Process Evaluation of C&I Upstream Lighting Initiative	
Electric	C&I	C03a Large C&I Retrofit	LED High/Low Bay	winter RR to 90.09%  Updated kWh RR to 97.92%, kW summer RR 110.4% and kW winter	Factor update	[new ISRs] Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream	7/8/2022
Electric	C&I	C03a Large C&I Retrofit	Linear LED		Factor update	Lighting Initiative	7/8/2022
Electric	C&I	CO3a Large C&I Retrofit	LED stairwell	Updated kWh RR, summer kW, winter kW to 86%	Factor update	Impact Evaluation of PY2015 RI C&I Upstream Lighting Initiative and P81 MA Process Evaluation of C&I Upstream Lighting Initiative	7/8/2022
						P81 Process Evaluation of C&I Upstream Lighting Initiative	
Electric	C&I	C03a Large C&I Retrofit	LED Exterior	Updated kWh RR, summer kW, winter kW to 95%	Factor update	[new ISRs]	7/8/2022
Electric	Low Income	B03b Low Income Retrofit Multifamily	AIR SEALING OIL	Updated ML to 20	Factor update	'ComEd Effective Useful Life Research Report', May 2018	7/10/2022
Electric	Low Income	B03b Low Income Retrofit Multifamily	AIR SEALING ELEC WITH AC	Updated ML to 20	Factor update	'ComEd Effective Useful Life Research Report', May 2018	7/10/2022
Electric	Residential	A03b Residential Retrofit Multifamily	AIR SEALING OIL	Updated ML to 20	Factor update	'ComEd Effective Useful Life Research Report', May 2018	7/10/2022
Electric	Residential	A03b Residential Retrofit Multifamily	AIR SEALING ELEC WITH AC	Updated ML to 20	Factor update	'ComEd Effective Useful Life Research Report', May 2018	7/10/2022
Electric	Low Income	BO3b Low Income Retrofit Multifamily	Air Sealing	Updated ML to 20	Factor update	'ComEd Effective Useful Life Research Report', May 2018	7/10/2022
Electric	Residential	A03b Residential Retrofit Multifamily	Heating System Retrofit-Boiler	- Process	Factor update	Guidehouse (2021). Comprehensive TRM Review.	7/10/2022
Electric	C&I	C02a C&I Lost Opportunity	Groundwater source (open loop) heat pump	Updated ML to 25	Factor update	Ground Source Heat Pump eTRM Measure Review MA20C15-B-GSHP Ground Source Heat Pump eTRM Measure Review	7/8/2022
Electric	C&I	C02a C&I Lost Opportunity	Ground source (closed loop) heat pump	Updated ML to 25	Factor update	MA20C15-B-GSHP	7/8/2022
Electric	Res	Residential Demand Management	Solar Inverters, Existing	Changed EE: Gross Annual kWh saved to 0	Factor update	MA Solar PFC Demo 2021, assume no savings	9/16/2022
Electric	Residential	A02b Energy Star HVAC	CENTRAL AC	Cooling hours updated to 416	Factor update	Navigant Consulting (2018). RES 1 Baseline Load Shape Study. 2018	7/7/2022

						Navigant Consulting (2018). RES 1 Baseline Load Shape	
Electric	Residential	A02b Energy Star HVAC	Coolsmart HP QIV ES	Cooling hours updated to 416	Factor update	Study. 2018	7/7/2022
Electric	C&I	C02a C&I Lost Opportunity	LEDS	Measure Life Updated to 15	Factor update	MA 2023 BC Model	9/9/2022
Electric	C&I	C02a C&I Lost Opportunity	Lighting Systems	Measure Life Updated to 15	Factor update	MA 2023 BC Model	9/9./2022
Electric	C&I	C02a C&I Lost Opportunity	Performance Lighting	Measure Life Updated to 15	Factor update	MA 2023 BC Model	9/9/2022
Electric	C&I	C02a C&I Lost Opportunity	Prescriptive Lighting	Measure Life Updated to 15 - multiple in BC due to large variety	Factor update	MA 2023 BC Model	9/9/2022
Electric	C&I	C03b Small C&I Retrofit	LED	Measure Life Updated to 2	Factor update	RI C&I Lighting Market and AML Update Study	9/9/2022
Electric	C&I	C03a Large C&I Retrofit	LED Exterior	Measure Life Updated to 5	Factor update	RI C&I Lighting Market and AML Update Study	9/9/2022
Electric	C&I	C03a Large C&I Retrofit	Street Lighting	Measure Life Updated to 5	Factor update	RI C&I Lighting Market and AML Update Study	9/9/2022
Electric	C&I	C03b Small C&I Retrofit	LED EXTERIOR - HW	Measure Life Updated to 5	Factor update	RI C&I Lighting Market and AML Update Study	9/9/2022
Electric	C&I	C03a Large C&I Retrofit	LEDS	Measure Life Updated to 6	Factor update	RI C&I Lighting Market and AML Update Study	9/9/2022
et	C&I	CO2a Lavas CR   Batrafit	December of Lighting / system lighting	Measure Life Updated to 6	Control undate	RI C&I Lighting Market and AML Update Study, assuming no controls	0/0/2022
Electric	C&I	CO3a Large C&I Retrofit CO3a Large C&I Retrofit	Prescriptive Lighting / custom lighting LED stairwell	Measure Life Updated to 6	Factor update Factor update	RI C&I Lighting Market and AML Update Study	9/9/2022
Electric	C&I	C03a Large C&I Retrofit	Linear LED	Measure Life Opdated to 6	Factor update	RI C&I Lighting Market and AML Update Study	9/9/2022
Electric Electric	C&I	C03a Large C&I Retrofit	Street Lighting with controls	Measure Life Opdated to 6	Factor update	RI C&I Lighting Market and AML Update Study	9/9/2022 9/9/2022
Electric	C&I	C03b Small C&I Retrofit	CUSTOM LIGHTING	Measure Life Updated to 6	Factor update	RI C&I Lighting Market and AML Update Study	9/9/2022
Electric	C&I	C03b Small C&I Retrofit	Refridgerated Case LED	Measure Life Updated to 6	Factor update	RI C&I Lighting Market and AML Update Study	9/9/2022
Electric	C&I	CO3b Small C&I Retrofit	Refrigerated case LED	Measure Life Updated to 6	Factor update	RI C&I Lighting Market and AML Update Study	9/9/2022
	C&I	C03b Small C&I Retrofit		Measure Life Updated to 6			
Electric	C&I	C03a Large C&I Retrofit	LED Exit Signs LED High/Low Bay	Measure Life Updated to 7	Factor update Factor update	RI C&I Lighting Market and AML Update Study  RI C&I Lighting Market and AML Update Study	9/9/2022
Electric	C&I			Measure Life Updated to 9	Factor update		9/9/2022
Electric	C&I	C02a C&I Lost Opportunity C03a Large C&I Retrofit	Lighting Controls	Measure Life Opdated to 9  Measure Life Updated to 9	Factor update	Dan Mellinger's Lighting Control ML memo	9/9/2022
Electric			Lighting Controls			Dan Mellinger's Lighting Control ML memo	9/9/2022
Electric	C&I	CO3b Small C&I Retrofit	OCCUPANCY SENSORS	Measure Life Updated to 9	Factor update	Dan Mellinger's Lighting Control ML memo	9/9/2022
Electric	C&I	C03b Small C&I Retrofit	PHOTOCELLS	Measure Life Updated to 9	Factor update	Dan Mellinger's Lighting Control ML memo	9/9/2022
Electric	Res	A04b Energy Star Products	Pool Pump (variable)	Updated Electric kWh to 1284	Factor update	Guidehouse Comprehensive TRM Review	8/22/2022
	COL	CO2 - CO11 + O	D. Malina Chall	Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter	Francisco de C	DV2020 Custom Flortida Image ( 5 1 1 1)	a ta tc
Electric	C&I	C02a C&I Lost Opportunity	Building Shell	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
Floatrio	C&I	C02a C&I Lost Opportunity	Chiller	Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter (84.7%). Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	0/0/2022
Electric	Cai	CO2a C&I LOST OPPORTUNITY	Crimer	( )	ractor update	PT2020 Custom Electric Impact Evaluation	9/9/2022
	C&I	CO2 - CO11 - + O + - 'h	Commence de la	Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter (84.7%), Non Electric RR (83.2%)	Fortage date	BY2020 Control Florida Invada Frankrika	0 /0 /0000
Electric	C&I	C02a C&I Lost Opportunity	Compressed Air		Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
Florest.	COL	CO2a CRII ast Opposituaitu	FNAC	Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter	Footos undata	DV2020 Contain Florida Import Foolunting	0/0/2022
Electric	C&I	C02a C&I Lost Opportunity	EMS	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
	C&I	CO2 - CO11 - + O + - 'h	Fred Control	Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter (84.7%). Non Electric RR (83.2%)	Fortage date	PY2020 Custom Electric Impact Evaluation	0 /0 /0000
Electric	C&I	C02a C&I Lost Opportunity	Food Service		Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C02a C&I Lost Opportunity	Fuel Switch - DHW	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C02a C&I Lost Opportunity	Fuel Switch - HVAC	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C02a C&I Lost Opportunity	Custom HVAC	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C02a C&I Lost Opportunity	Motor	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C02a C&I Lost Opportunity	Other	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C02a C&I Lost Opportunity	Process Cooling	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C02a C&I Lost Opportunity	Process	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C02a C&I Lost Opportunity	Commercial Refridgeration	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C02a C&I Lost Opportunity	VSD-HVAC	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
L			l	Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter	L		
Electric	C&I	C02a C&I Lost Opportunity	VSD-NON HVAC	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter	L .		
Electric	C&I	C03a Large C&I Retrofit	Custom Compressed Air	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter	L .		
Electric	C&I	C03a Large C&I Retrofit	Comprehensive Retrofit (CR)	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	
			_	Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C03a Large C&I Retrofit	Energy management system	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
			L	Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter	L .		
Electric	C&I	C03a Large C&I Retrofit	Food Service	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C03a Large C&I Retrofit	Fuel Switch - DHW	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C03a Large C&I Retrofit	Fuel Switch - HVAC	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			·
Electric	C&I	C03a Large C&I Retrofit	Custom HVAC	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/92022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C03a Large C&I Retrofit	Custom Motor	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C03a Large C&I Retrofit	0 & M	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
				Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter			
Electric	C&I	C03a Large C&I Retrofit	Custom Other	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022

Electric	C&I	C03a Large C&I Retrofit	Process Cooling	Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter (84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
Electric	C&I	C03a Large C&I Retrofit	Custom Process	Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter (84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
Electric	C&I	C03a Large C&I Retrofit	VSD-HVAC	Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter (84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
Electric	Cai	COSA Large Col Retront	V3D-HVAC	Updated kWh RR (83.2%), kW Summer RR(67.2%, kW winter	ractor update	F12020 Custom Electric Impact Evaluation	9/9/2022
Electric	C&I	C03a Large C&I Retrofit	VSD-NON HVAC	(84.7%), Non Electric RR (83.2%)	Factor update	PY2020 Custom Electric Impact Evaluation	9/9/2022
Electric	Res	A02b Energy Star HVAC	HPWH <55 gallon (electric)	Updated kWh savings (1712 kWh)	Factor update	HPWH Quick Hit Study - Water Heater Characterization	9/13/2022
Electric	Res	A02b Energy Star HVAC	HPWH >55 gallon, UEF 2.70 (electric)	Updated kWh savings (360 kWh)	Factor update	HPWH Quick Hit Study - Water Heater Characterization	9/13/2022
				Gas MMBTU updated to 8.6, Electric kWh updated to -171, Electric			
Gas	Residential	A02b Energy Star Heating System	Heat Recovery Ventilation	kW updated to 0.02	Factor update	MA Comprehensive TRM Review MA19R17-B-TRM DRAFT	9/21/2022
Gas	Res	A03b Residential Retrofit	Weatherization	ML updated to 25	Factor update	MA Assumption	7/10/2022
						Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators	
Gas	Res	A03b Residential Retrofit	Programmable thermostat	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
Gas	ines	AOSD RESIDENTIAL RELIGIT	Trogrammable thermostat	Spinover (Non-participant rate) changed to 470	ractor update	of Wassachusetts, No. 203374, Boulder, Colorado	5/5/2022
Can	Res	A03b Residential Retrofit	Pipe Wrap	Spillover (Non-participant rate) changed to 4%	Factor update	Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
Gas	nes	AOSD RESIDENTIAL RELIGIT	гіре шар	Spinover (Non-participant rate) changed to 4%	ractor upuate	of Massachusetts, No. 203374, Boulder, Colorado	9/9/2022
Gas	Res	A03b Residential Retrofit	Weatherization	Spillover (Non-participant rate) changed to 4%	Factor update	Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
Can	Por.	AO2h Pacidontial Patrofit	Wifi thormostat	Spillower (Man participant cuts) changed to 48	Factor undate	Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators	0/0/2022
Gas	Res	A03b Residential Retrofit	WiFi thermostat	Spillover (Non-participant rate) changed to 4%	Factor update	of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
Gas	Res	A03b Residential Retrofit	Showerhead	Spillover (Non-participant rate) changed to 4%	Factor update	Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
Gas	Res	A03b Residential Retrofit	Aerator	Spillover (Non-participant rate) changed to 4%	Factor update	Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
Gas	Res	A03b Residential Retrofit	Air Sealing Kit, Gas	Spillover (Non-participant rate) changed to 4%	Factor update	Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	9/9/2022
	D.c.	AOOH Basidantial Batasiit	update once add new measure		Factor undete	Guidehouse Inc., Massachusetts Residential Programs Net- to-Gross Research of RCD and Select Products Measures, prepared for the Electric and Gas Program Administrators of Massachusetts, No. 209974, Boulder, Colorado	0/45/2022
Gas	Res Res	A03b Residential Retrofit A02b Residential HVAC	WiFi Enabled Thermostat with Cooling	Spillover (Non-participant rate) changed to 4%  Updated electric kW to 0.030	Factor update Factor update	Navigant Consulting (2018). Baseline Loadshape Study	9/16/2022 7/8/2022
		. ,				Wi-Fi-Thermostat-Impact-Evaluation-Secondary-	11012022
Gas	Res	A02b Residential HVAC	WiFi Enabled Thermostat with Cooling	Updated electric kWh to 18 was 104	Factor update	Literature-Study_FINAL	7/8/2022
Gas	Res	A04b Residential Appliances	Low Flow Showerhead thermo Control (ladybug electric DHW)	Updated Electric kWh to 247	Factor update	MA Comprehensive TRM Review MA19R17-B-TRM DRAFT	7/8/2022
	Pec.	AO2h Daoidential IIVAC	Furnace (forced hot air) 95% AFUE	Hadatad MI to 17 was 12	Contact undate	Cuidebaure (2021). Company Table 2	7/40/2222
Gas	Res	A02b Residential HVAC A02b Residential HVAC	w/ECM	Updated ML to 17 was 12	Factor update	Guidehouse (2021). Comprehensive TRM Review.	7/10/2022
Gas	Res	AUZU RESIDENTIAL TVAC	Furnace (forced hot air) >= 97% AFUE	Updated ML to 17 was 12	Factor update	Guidehouse (2021). Comprehensive TRM Review	7/10/2022
Gas	Res	A03b Residential Retrofit Multifamily	Air Sealing	Updated ML to 20	Factor update	'ComEd Effective Useful Life Research Report', May 2018	7/10/2022
Gas	C&I	C&I Multifamily	Air Sealing	Updated ML to 20	Factor update	'ComEd Effective Useful Life Research Report', May 2018	7/10/2022
Gas	Low Income	B03b Low Income Retrofit Multifamily	Heating System Retrofit, Boiler	Updated ML to 23	Factor update	Guidehouse (2021). Comprehensive TRM Review.	7/10/2022
Gas	Res	A02b Residential HVAC	Integrated water heater/condensing boiler 95	Updated ML to 23 was 17	Factor update	Guidehouse (2021). Comprehensive TRM Revie	7/10/2022
Gas	Low Income	B03b Low Income Retrofit Multifamily	Heating System Retrofit-Boiler	Updated ML to 23 was 17 Updated ML to 23 was 20	Factor update	Guidehouse (2021). Comprehensive TRM Review.	7/10/2022
	-	The second managing	ENERGY STAR STORAGE WATER HEATER			MA C&I HVAC & Water Heater NTG & Market Effects	1,10,2022
Gas	Res	A02b Residential HVAC	.68 UEF (high draw)	Updated NTG to 0.29	Factor update	Measurement	7/72022
Gas	C&I	C02a C&I Lost Opportunity	Advanced Building	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Boiler, Condensing Blend	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Boiler, Condensing Heating	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022

	IC&I	C02a C&I Lost Opportunity	Boiler, Condensing Year round	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	[C&I	CO2a C&I Lost Opportunity CO2a C&I Lost Opportunity	Boiler, Condensing Year round Boiler, Non-Condensing Blend	Updated Non-Electric RR to 83%  Updated Non-Electric RR to 83%	Factor update Factor update	PY2020 Custom Gas Installations in RI PY2020 Custom Gas Installations in RI	9/9/2022
	C&I	CO2a C&I Lost Opportunity CO2a C&I Lost Opportunity	Boiler, Non-Condensing Biend  Boiler, Non-Condensing Heating	Updated Non-Electric RR to 83% Updated Non-Electric RR to 83%	Factor update Factor update	PY2020 Custom Gas Installations in RI PY2020 Custom Gas Installations in RI	
Gas	C&I		,				9/9/2022
Gas		C02a C&I Lost Opportunity	Boiler, Non-Condensing Year round	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Building Shell	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Domestic Hot Water	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Energy Management System (building)	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Food Service	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Furnace, Blend	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Furnace, Heating	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Furnace, Year-round	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Gas driven cooling	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Heat Pump	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Heat Recovery, Blend	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Heat Recovery, Heating	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
Gas	C&I	C02a C&I Lost Opportunity	Heat Recovery, Year Round	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C02a C&I Lost Opportunity	HVAC	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
ias	C&I	C02a C&I Lost Opportunity	HVAC insulation	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
ias	C&I	C02a C&I Lost Opportunity	Kitchen Equipment	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
ias	C&I	C02a C&I Lost Opportunity	Other Blend	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C02a C&I Lost Opportunity	Other Heating	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C02a C&I Lost Opportunity	Other Year Round	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C02a C&I Lost Opportunity	Process	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C02a C&I Lost Opportunity	Solar Heat Blend	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C02a C&I Lost Opportunity	Solar Heat Year Round (DHW)	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
25	C&I	C02a C&I Lost Opportunity	Solar Heating	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as as	[C&I		-	Updated Non-Electric RR to 83%			
dS	****	CO2a C&I Lost Opportunity	Steam boiler		Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C02a C&I Lost Opportunity	Steam Trap	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C02a C&I Lost Opportunity	Ventilation Reduction	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C02a C&I Lost Opportunity	VSDs on HVAC	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C02a C&I Lost Opportunity	VSDs on non-HVAC	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Boiler, Condensing Blend	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Boiler, Condensing Heating	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Boiler, Condensing Year round	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Boiler, Non-Condensing Blend	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Boiler, Non-Condensing Heating	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
ias	C&I	C03a Large C&I Retrofit	Boiler, Non-Condensing Year round	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
ias	C&I	C03a Large C&I Retrofit	Building Shell	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
ias	C&I	C03a Large C&I Retrofit	Comprehensive Design - CD	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
ias	C&I	C03a Large C&I Retrofit	Comprehensive Design - CDA	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Comprehensive Retrofit	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
ias		-			· · · · · · · · · · · · · · · · · · ·		
as	C&I	C03a Large C&I Retrofit	Custom Other	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Domestic Hot Water	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Energy Management System (building)	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Food Service	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Furnace, Blend	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Furnace, Heating	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as as	C&I	C03a Large C&I Retrofit	Furnace, Year-round	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Heat Pump	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	
	C&I						9/9/2022
as		C03a Large C&I Retrofit	Heat Recovery, Blend	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Heat Recovery, Heating	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Heat Recovery, Year Round	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
		[	Not in TRM - custom small business is		L .		
as	C&I	C03b Small C&I Retrofit	limited in TRM	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	HVAC	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	HVAC insulation	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Operation & Maintenance	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Other, Blend	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Other, Heating	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Other, Year round	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Process	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Solar Heat Blend	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Solar Heat Year Round (DHW)	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	Solar Heating	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as as	C&I	C03a Large C&I Retrofit	Ventilation Reduction	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
23	C&I				<u> </u>		
as		C03a Large C&I Retrofit	Verified Savings	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	VSDs on HVAC	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C03a Large C&I Retrofit	VSDs on non-HVAC	Updated Non-Electric RR to 83%	Factor update	PY2020 Custom Gas Installations in RI	9/9/2022
as	C&I	C02a C&I Lost Opportunity	Comprehensive Design	Updated Non-Electric RR to 97%	Factor update	InDemand - assume path 1 and path 2	9/9/2022
	C&I	C02a C&I Lost Opportunity	Comprehensive Design Assistance	Updated Non-Electric RR to 97%	Factor update	InDemand - assume path 1 and path 3	9/9/2022
ias		1	· ·		1 -	MA O&M and Non-O&M NEI Study - C&I Motors/Drives -	
Sas							
	C&I	C03b Small C&I Retrofit	Fan control	NEI annual per kWh updated to 0.003	NEI Update	Prescriptive	9/21/2022
lectric	C&I	C03b Small C&I Retrofit C03a Large C&I Retrofit	Fan control Custom CHP	NEI annual per kWh updated to 0.003 NEI annual per kWh updated to -0.0147	NEI Update NEI Update		9/21/2022 9/21/2022

						MA O&M and Non-O&M NEI Study - C&I Motors/Drives -	
Electric	C&I	CO3b Small C&I Retrofit	ECM evaporater fan motors (walk-in)	NEI annual per kWh updated to 0.018	NEI Update	Custom	9/21/2022
Electric	C&I	CO3a Large C&I Retrofit	Custom Motor	NEI annual per kWh updated to 0.018	NEI Update	MA O&M and Non-O&M NEI Study - C&I Motors/Drives - Custom	9/21/2022
	C&I	CO2a C&I Lost Opportunity	Motor	NEI annual per kWh updated to 0.018	NEI Update	MA O&M and Non-O&M NEI Study - C&I Motors/Drives - Custom	
Electric	C&I	COZA CAN LOST OPPORTUNITY	Wiotoi	NEI allitual pei kwii upuateu to 0.018	NEI Opuate	MA O&M and Non-O&M NEI Study - C&I Motors/Drives -	9/21/2022
Electric	C&I	C03a Large C&I Retrofit	VSD-HVAC	NEI annual per kWh updated to 0.018	NEI Update	Custom  MA O&M and Non-O&M NEI Study - C&I Motors/Drives -	9/21/2022
Electric	C&I	C03a Large C&I Retrofit	VSD-NON HVAC	NEI annual per kWh updated to 0.018	NEI Update	Custom	9/21/2022
Electric	C&I	C02a C&I Lost Opportunity	VSD-HVAC	NEI annual per kWh updated to 0.018	NEI Update	MA O&M and Non-O&M NEI Study - C&I Motors/Drives - Custom	9/21/2022
Licetiic						MA O&M and Non-O&M NEI Study - C&I Motors/Drives -	
Electric	C&I	C02a C&I Lost Opportunity	VSD-NON HVAC	NEI annual per kWh updated to 0.018	NEI Update	Custom  MA O&M and Non-O&M NEI Study - C&I NC Envelope -	9/21/2022
Electric	C&I	C02a C&I Lost Opportunity	Building Shell	NEI annual per kWh updated to 0.036	NEI Update	Custom	9/21/2022
Electric	C&I	C02a C&I Lost Opportunity	EMS	NEI annual per kWh updated to 0.037	NEI Update	MA O&M and Non-O&M NEI Study - C&I NC EMS - Custom	9/21/2022
						MA O&M and Non-O&M NEI Study - C&I Retro Lighting	
Electric	C&I	C03b Small C&I Retrofit	OCCUPANCY SENSORS	NEI annual per kWh updated to 0.084	NEI Update	Controls - Prescriptive  MA O&M and Non-O&M NEI Study - C&I Retro Lighting	9/21/2022
Electric	C&I	C03b Small C&I Retrofit	PHOTOCELLS	NEI annual per kWh updated to 0.084	NEI Update	Controls - Prescriptive	9/21/2022
Electric	C&I	C03b Small C&I Retrofit	TIMECLOCKS	NEI annual per kWh updated to 0.084	NEI Update	MA O&M and Non-O&M NEI Study - C&I Retro Lighting Controls - Prescriptive	9/21/2022
	C&I					MA O&M and Non-O&M NEI Study - C&I NC Lighting	
Electric	C&I	C02a C&I Lost Opportunity	Lighting Controls	NEI annual per kWh updated to 0.087	NEI Update	Controls - Custom  MA O&M and Non-O&M NEI Study - C&I Retro Lighting	9/21/2022
Electric	C&I	C03a Large C&I Retrofit	Lighting Controls	NEI annual per kWh updated to 0.101	NEI Update	Controls - Custom	9/21/2022
Electric	C&I	C03a Large C&I Retrofit	Street Lighting with controls	NEI annual per kWh updated to 0.101	NEI Update	MA O&M and Non-O&M NEI Study - C&I Retro Lighting Controls - Custom	9/21/2022
	C&I					MA O&M and Non-O&M NEI Study - C&I Retro HVAC -	
Electric	C&I	C03a Large C&I Retrofit	Glass front refridgerated coolers	NEI annual per kWh updated to 0.111	NEI Update	Prescriptive  MA O&M and Non-O&M NEI Study - C&I Retro HVAC -	9/21/2022
Electric	C&I	C03a Large C&I Retrofit	Hotel occupancy sensor	NEI annual per kWh updated to 0.111	NEI Update	Prescriptive	9/21/2022
Electric	C&I	C03a Large C&I Retrofit	Non-refridgerated snack vending machine	NEI annual per kWh updated to 0.111	NEI Update	MA O&M and Non-O&M NEI Study - C&I Retro HVAC - Prescriptive	9/21/2022
Florida	C&I	C03a Large C&I Retrofit	Refridgerated vending machine	NEI annual per kWh updated to 0.111	NELLIndote	MA O&M and Non-O&M NEI Study - C&I Retro HVAC - Prescriptive	0/24/2022
Electric	Cai	COSA Large C&I RELIGIT	Remagerated vending machine	NEI annuai per kwii upuateu to 0.111	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	Energy Management System (building)	NEI annual per therm updated to 0.041	NEI Update	Custom - EMS  MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Energy Management System (building)	NEI annual per therm updated to 0.041	NEI Update	Custom - EMS	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	Steam Trap	NEI annual per therm updated to -0.045	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - Process	9/21/2022
GdS		COZA CAN LOST OPPORTUNITY	эсеані пар	NEI aimuai per trieriri upuateu to -0.043	NEI Opuate	MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Boiler, Condensing Blend	NEI annual per therm updated to -0.045	NEI Update	Custom - Process  MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Furnace, Blend	NEI annual per therm updated to -0.045	NEI Update	Custom - Process	9/21/2022
Gas	C&I	CO3a Large C&I Retrofit	Heat Recovery, Blend	NEI annual per therm updated to -0.045	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - Process	9/21/2022
Gas						MA O&M and Non-O&M NEI Study - C&I - Existing -	
Gas	C&I	C03a Large C&I Retrofit	Boiler, Non-Condensing Blend	NEI annual per therm updated to -0.045	NEI Update	Custom - Process  MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	CO3a Large C&I Retrofit	Process	NEI annual per therm updated to -0.045	NEI Update	Custom - Process	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Solar Heat Blend	NEI annual per therm updated to -0.045	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - Process	9/21/2022
						MA O&M and Non-O&M NEI Study - C&I - Existing -	
Gas	C&I	C03a Large C&I Retrofit	Boiler, Condensing Heating	NEI annual per therm updated to -0.067	NEI Update	Custom - HVAC  MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Furnace, Heating	NEI annual per therm updated to -0.067	NEI Update	Custom - HVAC	9/21/2022
	COL	cosa carge carrietrone					
Gas	C&I		Heat Pump	NEI annual per therm updated to -0.067	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - HVAC	9/21/2022
	C&I	C03a Large C&I Retrofit	Heat Pump	NEI annual per therm updated to -0.067	NEI Update	Custom - HVAC  MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I		Heat Pump Heat Recovery, Heating	NEI annual per therm updated to -0.067  NEI annual per therm updated to -0.067	NEI Update	Custom - HVAC	9/21/2022
	C&I	C03a Large C&I Retrofit				Custom - HVAC  MA Q&M and Non-Q&M NEI Study - C&I - Existing - Custom - HVAC  MA Q&M and Non-Q&M NEI Study - C&I - Existing - Custom - HVAC	
Gas	C&I	C03a Large C&I Retrofit C03a Large C&I Retrofit	Heat Recovery, Heating	NEI annual per therm updated to -0.067	NEI Update	Custom - HVAC  MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - HVAC  MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas Gas	C&I C&I C&I	C03a Large C&I Retrofit  C03a Large C&I Retrofit  C03a Large C&I Retrofit  C03a Large C&I Retrofit	Heat Recovery, Heating HVAC Boiler, Non-Condensing Heating	NEI annual per therm updated to -0.067  NEI annual per therm updated to -0.067  NEI annual per therm updated to -0.067	NEI Update  NEI Update  NEI Update	Custom - HVAC  MA Q&M and Non-Q&M NEI Study - C&I - Existing - Custom - HVAC  MA Q&M and Non-Q&M NEI Study - C&I - Existing - Custom - HVAC  MA Q&M and Non-Q&M NEI Study - C&I - Existing - Custom - HVAC  MA Q&M and Non-Q&M NEI Study - C&I - Existing - Custom - HVAC  MA Q&M and Non-Q&M NEI Study - C&I - Existing -	9/21/2022 9/21/2022 9/21/2022
Gas	C&I C&I C&I C&I C&I	CO3a Large C&I Retrofit CO3a Large C&I Retrofit CO3a Large C&I Retrofit	Heat Recovery, Heating	NEI annual per therm updated to -0.067  NEI annual per therm updated to -0.067	NEI Update	Custom - HVAC  MA O &M and Non-O&M NEI Study - C&I - Existing - Custom - HVAC  MA O &M and Non-O&M NEI Study - C&I - Existing - Custom - HVAC  MA O &M and Non-O&M NEI Study - C&I - Existing - Custom - HVAC  Custom - HVAC	9/21/2022 9/21/2022
Gas Gas	C&I C&I C&I	C03a Large C&I Retrofit  C03a Large C&I Retrofit  C03a Large C&I Retrofit  C03a Large C&I Retrofit	Heat Recovery, Heating HVAC Boiler, Non-Condensing Heating	NEI annual per therm updated to -0.067  NEI annual per therm updated to -0.067  NEI annual per therm updated to -0.067	NEI Update  NEI Update  NEI Update	Custom - HVAC  MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - HVAC  MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - HVAC  MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - HVAC  MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - HVAC  MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - HVAC  MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - HVAC	9/21/2022 9/21/2022 9/21/2022
Gas Gas Gas	C&I C&I C&I C&I C&I	CO3a Large C&I Retrofit  CO3a Large C&I Retrofit  CO3a Large C&I Retrofit  CO3a Large C&I Retrofit  CO3a Large C&I Retrofit	Heat Recovery, Heating  HVAC  Boiler, Non-Condensing Heating  Other, Heating	NEI annual per therm updated to -0.067  NEI annual per therm updated to -0.067  NEI annual per therm updated to -0.067  NEI annual per therm updated to -0.067	NEI Update  NEI Update  NEI Update  NEI Update	Custom - HVAC  MA O &M and Non-O &M NEI Study - C&I - Existing - Custom - HVAC  MA O &M and Non-O &M NEI Study - C&I - Existing - Custom - HVAC  MA O &M and Non-O &M NEI Study - C&I - Existing - Custom - HVAC  MA O &M and Non-O &M NEI Study - C&I - Existing - Custom - HVAC  MA O &M and Non-O &M NEI Study - C&I - Existing - Custom - HVAC  MA O &M and Non-O &M NEI Study - C&I - Existing -	9/21/2022 9/21/2022 9/21/2022 9/21/2022

Gas	C&I	C02a C&I Lost Opportunity	Furnace, Heating	NEI annual per therm updated to -0.067	NEI Update	MA O&M and Non-O&M NEI Study - C&I - New Bldg - Custom - HVAC	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	Heat Recovery, Heating	NEI annual per therm updated to -0.067	NEI Update	MA O&M and Non-O&M NEI Study - C&I - New Bldg - Custom - HVAC	9/21/2022
						MA O&M and Non-O&M NEI Study - C&I - New Bldg -	
Gas	C&I	C02a C&I Lost Opportunity	HVAC	NEI annual per therm updated to -0.067	NEI Update	Custom - HVAC  MA O&M and Non-O&M NEI Study - C&I - New Bldg -	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	Other Heating	NEI annual per therm updated to -0.067	NEI Update	Custom - HVAC  MA O&M and Non-O&M NEI Study - C&I - New Bldg -	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	HVAC insulation	NEI annual per therm updated to -0.067	NEI Update	Custom - HVAC	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	Solar Heating	NEI annual per therm updated to -0.067	NEI Update	MA O&M and Non-O&M NEI Study - C&I - New Bldg - Custom - HVAC	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	Ventilation Reduction	NEI annual per therm updated to -0.067	NEI Update	MA O&M and Non-O&M NEI Study - C&I - New Bidg - Custom - HVAC	9/21/2022
GdS						MA O&M and Non-O&M NEI Study - C&I - New Bldg -	
Gas	C&I	C02a C&I Lost Opportunity	Solar Heat Year Round (DHW)	NEI annual per therm updated to 0.079	NEI Update	Prescriptive - Hot Water  MA O&M and Non-O&M NEI Study - C&I - New Bldg -	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	WATER HEATER - INDIRECT	NEI annual per therm updated to 0.079	NEI Update	Prescriptive - Hot Water	9/21/2022
Gas	C&I	C03b Small C&I Retrofit	NA - custom measure	NEI annual per therm updated to 0.08	NEI Update	C&I - Existing - Prescriptive - Hot Water  MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	CO3a Large C&I Retrofit	Faucet Aerator	NEI annual per therm updated to 0.08	NEI Update	Prescriptive - Hot Water	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Low-Flow Showerhead	NEI annual per therm updated to 0.08	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Prescriptive - Hot Water	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Pre- rinse Spray Valve	NEI annual per therm updated to 0.08	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Prescriptive - Hot Water	9/21/2022
Gas				Neramidal per trieffi apaated to 0.00		MA O&M and Non-O&M NEI Study - C&I - Existing -	5/21/2022
Gas	C&I	C03b Small C&I Retrofit	DEMAND CIRCULATOR	NEI annual per therm updated to 0.08	NEI Update	Prescriptive - Hot Water  MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	C03b Small C&I Retrofit	Faucet aerator	NEI annual per therm updated to 0.08	NEI Update	Prescriptive - Hot Water	9/21/2022
Gas	C&I	C03b Small C&I Retrofit	Pre-rinse spray valve	NEI annual per therm updated to 0.08	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Prescriptive - Hot Water	9/21/2022
						MA O&M and Non-O&M NEI Study - C&I - Existing -	
Gas Gas	C&I	C03b Small C&I Retrofit C02a C&I Lost Opportunity	Low-flow showerhead Building Shell	NEI annual per therm updated to 0.08  NEI annual per therm updated to 0.322	NEI Update NEI Update	Prescriptive - Hot Water  MA O&M and Non-O&M NEI Study -C&I - Envelope	9/21/2022 9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Building Shell	NEI annual per therm updated to 0.322	NEI Update	MA O&M and Non-O&M NEI Study -C&I - Envelope	9/21/2022
003	Cui	cosa zarge car netrone	Saliding Sites	The difficulty of the first appared to 0.522	iver opaute	MA O&M and Non-O&M NEI Study - C&I - New Bldg -	3/21/2022
Gas	C&I	C02a C&I Lost Opportunity	Steam boiler	NEI annual per therm updated to 0.349	NEI Update	Custom - Hot Water	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	Domestic Hot Water	NEI annual per therm updated to 0.349	NEI Update	MA O&M and Non-O&M NEI Study - C&I - New Bldg - Custom - Hot Water	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	Furnace, Year-round	NEI annual per therm updated to 0.349	NEI Update	MA O&M and Non-O&M NEI Study - C&I - New Bldg - Custom - Hot Water	9/21/2022
						MA O&M and Non-O&M NEI Study - C&I - New Bldg -	
Gas	C&I	C02a C&I Lost Opportunity	Heat Recovery, Year Round	NEI annual per therm updated to 0.349	NEI Update	Custom - Hot Water  MA O&M and Non-O&M NEI Study - C&I - New Bldg -	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	Other Year Round	NEI annual per therm updated to 0.349	NEI Update	Custom - Hot Water MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	WATER HEATER - ON-DEMAND 94	NEI annual per therm updated to 0.35	NEI Update	Custom - Hot Water	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Boiler, Condensing Year round	NEI annual per therm updated to 0.35	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - Hot Water	9/21/2022
_				NET		MA O&M and Non-O&M NEI Study - C&I - Existing -	
Gas	C&I	C03a Large C&I Retrofit	Domestic Hot Water	NEI annual per therm updated to 0.35	NEI Update	Custom - Hot Water  MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Furnace, Year-round	NEI annual per therm updated to 0.35	NEI Update	Custom - Hot Water	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Heat Recovery, Year Round	NEI annual per therm updated to 0.35	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - Hot Water	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Boiler, Non-Condensing Year Round	NEI annual per therm updated to 0.35	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Custom - Hot Water	9/21/2022
das						MA O&M and Non-O&M NEI Study - C&I - Existing -	
Gas	C&I	C03a Large C&I Retrofit	Other, Year-round	NEI annual per therm updated to 0.35	NEI Update	Custom - Hot Water  MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Solar Heat Year Round (DHW)	NEI annual per therm updated to 0.35	NEI Update	Custom - Hot Water	9/21/2022
Gas	C&I	CO3a Large C&I Retrofit	BOILER RESET 1 STAGE	NEI annual per therm updated to 0.592	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Prescriptive - HVAC	9/21/2022
Gas	C&I	C03a Large C&I Retrofit	Boiler reset control (multi	NEI annual per therm updated to 0.592	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Prescriptive - HVAC	9/21/2022
						MA O&M and Non-O&M NEI Study - C&I - Existing -	
Gas	C&I	C03a Large C&I Retrofit	Programmable thermostat	NEI annual per therm updated to 0.592	NEI Update	Prescriptive - HVAC  MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	CO3a Large C&I Retrofit	WiFi Thermostat - cooling and htg	NEI annual per therm updated to 0.592	NEI Update	Prescriptive - HVAC  MA O&M and Non-O&M NEI Study - C&I - Existing -	9/21/2022
Gas	C&I	CO3a Large C&I Retrofit	WiFi Tstat-heat only	NEI annual per therm updated to 0.592	NEI Update	Prescriptive - HVAC	9/21/2022
Gas	C&I	C03b Small C&I Retrofit	WiFi Thermostat - cooling and htg	NEI annual per therm updated to 0.592	NEI Update	MA O&M and Non-O&M NEI Study - C&I - Existing - Prescriptive - HVAC	9/21/2022
						MA O&M and Non-O&M NEI Study - C&I - Existing -	
Gas	C&I	C03b Small C&I Retrofit	WiFi Tstat-heat only	NEI annual per therm updated to 0.592	NEI Update	Prescriptive - HVAC	9/21/2022

	COL	502- 5011	High Perf Contact Conveyor Toaster	Added		MA 2022 BC Model, C&I Existing Buildings Retrofit,	
Electric	C&I	C02a C&I Lost Opportunity	UPSTR  Vending Miser - Refrigerated Beverage	Added new measure	New measure	Vending Miser, calculated- look at email  MA 2022 BC Model, C&I Existing Buildings Retrofit,	9/13/2022
Electric	C&I	C02a C&I Lost Opportunity	Vending Machines UPSTR	Added new measure	New measure	Vending Miser, calculated- look at email	9/16/2022
Liectric		coza car zost opportant,	Vending Machines of STR	Added Hew Heddare	Trew measure	MA 2022 BC Model, C&I Existing Buildings Retrofit,	3/10/2022
			Vending Miser - Non-Refrigerated Snack			Vending Miser, calculated- look at email -pg 249 in MA	
Electric	C&I	C02a C&I Lost Opportunity	Vending Machines UPSTR	Added new measure	New measure	TRM	9/16/2022
			Vending Miser - Glass Front Refrigerated				
Electric	C&I	C02a C&I Lost Opportunity	Coolers UPSTR	Added new measure	New measure	2022 BC Model, calculated - check email	9/16/2022
						IE SF 2022 MA Impact Factors, check MA TRM to see how	
Electric	Income Eligible	B03b Low Income Retrofit Multifamily	Window - Electric Resistance	Added new measure	New measure	calculated - pg 58 of MA TRM	9/16/2022
L				l		IE SF 2022 MA Impact Factors, check MA TRM to see how	
Electric	Income Eligible	B03b Low Income Retrofit Multifamily	Window - Heat Pump	Added new measure	New measure	calculated	9/16/2022
Flootrie	Income Eligible	B03b Low Income Retrofit Multifamily	Window - Oil	Added new measure	New measure	IE SF 2022 MA Impact Factors, check MA TRM to see how calculated	0/16/2022
Electric	IIICOITIE Eligible	BOSD LOW IIICOME RELIGITE WHITEMANNY	Willdow - Oil	Added flew fileasure	ivew ineasure	IE SF 2022 MA Impact Factors, check MA TRM to see how	9/16/2022
Electric	Income Eligible	B03b Low Income Retrofit Multifamily	Window - Propane	Added new measure	New measure	calculated	9/16/2022
	0 1 1	,				IE SF 2022 MA Impact Factors, check MA TRM to see how	3, 3, 3, 3
Electric	Income Eligible	B03a Low Income Retrofit 1-4	Window - Electric Resistance	Added new measure	New measure	calculated	9/16/2022
						IE SF 2022 MA Impact Factors, check MA TRM to see how	
Electric	Income Eligible	B03a Low Income Retrofit 1-4	Window - Heat Pump	Added new measure	New measure	calculated	9/16/2022
						IE SF 2022 MA Impact Factors, check MA TRM to see how	
Electric	Income Eligible	B03a Low Income Retrofit 1-4	Window - Oil	Added new measure	New measure	calculated	9/16/2022
	Lancas Electric	B03a Low Income Retrofit 1-4	Western Brown	Added		IE SF 2022 MA Impact Factors, check MA TRM to see how calculated	
Electric	Income Eligible Res	A03b Residential Retrofit	Window - Propane Electric Resistance to MSHP	Added new measure  Added new measure	New measure New measure	2022 BC Model	9/16/2022 6/22/2022
Electric	nes	AOSD RESIDENTIAL RELIGIT	Electric Resistance to Wishir	Added flew fileasure	ivew illeasure	MA BC Model. calculated check MA TRM to see how	6/22/2022
Electric	Res	A03b Residential Retrofit	Window - Electric Resistance	Added new measure	New measure	calculate	9/16/2022
Licetife						MA BC Model, calculated check MA TRM to see how	3/10/2022
Electric	Res	A03b Residential Retrofit	Window - Heat Pump	Added new measure	New measure	calculate	9/16/2022
						MA BC Model, calculated check MA TRM to see how	
Electric	Res	A03b Residential Retrofit	Window - Oil	Added new measure	New measure	calculate	9/16/2022
						MA BC Model, calculated check MA TRM to see how	
Electric	Res	A03b Residential Retrofit	Window - Propane	Added new measure	New measure	calculate	9/16/2022
		A03h Davidaratial UNAC	Windows Should Building	Added		MA BC Model, calculated check MA TRM to see how	
Electric	Res	A02b Residential HVAC	Window - Electric Resistance	Added new measure	New measure	MA BC Model, calculated check MA TRM to see how	9/16/2022
Electric	Res	A02b Residential HVAC	Window - Heat Pump	Added new measure	New measure	calculate	9/16/2022
Electric	nes	AUZU RESIDENTIAL TIVAC	willdow - Heat Fullip	Added flew fileasure	ivew illeasure	MA BC Model, calculated check MA TRM to see how	9/16/2022
Electric	Res	A02b Residential HVAC	Window - Oil	Added new measure	New measure	calculate	9/16/2022
						MA BC Model, calculated check MA TRM to see how	5,15,155
Electric	Res	A02b Residential HVAC	Window - Propane	Added new measure	New measure	calculate	9/16/2022
						Added based on solar inverters, new in 2022 BC Model,	
Electric	Res	Residential Demand Management	Solar Inverters, Existing	Added new measure	New measure	add as deemed check EMV of elec model	9/16/2022
	_					Based on smart strip - RI BC Model, check with Jen Castor,	
Electric	Res	A04b Residential Appliances	Tricklestar Keyboard	Added new measure	New measure	deemed saving	9/16/2022
Electric	Income Eligible	B03a Low Income Retrofit 1-4	need to add condensing boiler <= 300 mbh with 95%	Added new measure	New measure	MA BC Model	16/2022 - need to check TRC/incent
Gas	C&I	C02a C&I Lost Opportunity	AFUE	Added measure to TRM	New measure	Included as a program offering and is in InDemand	9/21/2022
Gas	C&I	C02a C&I Lost Opportunity	ERV - Rotary Wheel UPSTR	Added new measure	New measure	MA BC Model/MA 2019-2021 Plan TRM, calculated	9/16/2022
Gas	C&I	C02a C&I Lost Opportunity	ERV - Fixed Plate UPSTR	Added new measure	New measure	MA BC Model/MA 2019-2021 Plan TRM, calculated	9/16/2022
Gas	C&I	C03a Large C&I Retrofit	ERV - Rotary Wheel UPSTR	Added new measure	New measure	MA BC Model/MA 2019-2021 Plan TRM, calculated	9/16/2022
Gas	C&I	C03a Large C&I Retrofit	ERV - Fixed Plate UPSTR	Added new measure	New measure	MA BC Model/MA 2019-2021 Plan TRM, calculated	9/16/2022
Gas	Income Eligible	Bo3b Low Income Retofit Multifamily	Triple Pane Windows	Added new measure	New measure	MA BC Model (Windows - Gas. IE SF)	9/16/2022
Gas	Income Eligible	B03a Low Income Retrofit 1-4	Programmable Thermostat, Gas	Added new measure	New measure	MA Gas BC Model 3 Yr Plan	9/16/2022
Gas	Income Eligible	B03a Low Income Retrofit 1-4	Wi-Fi Thermostat, Gas	Added new measure	New measure	MA Gas BC Model 3 Yr Plan	9/16/2022
Gas	Income Eligible	B03a Low Income Retrofit 1-4	Triple Pane Windows	Added new measure	New measure	MA BC Model (Windows - Gas. IE SF)	9/16/2022
Gas	Res	A03b Residential Retrofit	Triple Pane Windows	Added new measure	New measure	MA BC Model MA BC Model	9/16/2022
Gas	Res	A02b Residential HVAC	Triple Pane Windows	Added new measure	New measure	C&I Prescriptive and Custom NTG Omnibus Study	9/16/2022
Gas	C&I	C02a C&I Lost Opportunity	condensing boiler <= 300 mbh	updated source in TRM	Source update	(MA20X07-B-CIOMNINTG)	9/21/2022
G03		сода сал возг оррогили	condensing boiler 4- 500 mbil	apareca source in this	Source apartic	C&I Prescriptive and Custom NTG Omnibus Study	3/21/2022
Gas	C&I	C02a C&I Lost Opportunity	Condensing boiler 1000-1700 mbh	updated source in TRM	Source update	(MA20X07-B-CIOMNINTG)	9/21/2022
1						C&I Prescriptive and Custom NTG Omnibus Study	-,,2022
Gas	C&I	C02a C&I Lost Opportunity	Condensing boiler 1701+ MBH	updated source in TRM	Source update	(MA20X07-B-CIOMNINTG)	9/21/2022
						C&I Prescriptive and Custom NTG Omnibus Study	
Gas	C&I	C02a C&I Lost Opportunity	Condensing boiler 300-499 mbh	updated source in TRM	Source update	(MA20X07-B-CIOMNINTG)	9/21/2022
						C&I Prescriptive and Custom NTG Omnibus Study	
Gas	C&I	C02a C&I Lost Opportunity	Condensing boiler 500-999 mbh	updated source in TRM	Source update	(MA20X07-B-CIOMNINTG)	9/21/2022
	C&I	502- 5011	WATER UEATER TANK O CT EE	Under description of NTC to 6200	Cdata	MA C&I HVAC & Water Heater NTG & Market Effects	
Gas	IUNI	C02a C&I Lost Opportunity	WATER HEATER TANK 0.67 EF	Updated source of NTG to S299	Source update	Measurement	9/16/2022
		,			·	MA CRI HVAC R Water Heater NTC R Market Effects	
Gas	C&I	C02a C&I Lost Opportunity	COND WATER HEATER 90%MIN 75-800	Updated source of NTG to S299	Source update	MA C&I HVAC & Water Heater NTG & Market Effects Measurement	9/16/2022