Rhode Island
Technical Reference Manual

For Estimating Savings from Energy Efficiency Measures

2019 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 National Grid 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.

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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 National Grid tracking systems,
- Evolution of program and measure cost effectiveness analysis tools,
- Evaluation, Measurement and Verification ("EM&V"),
- Quality control.

Planning and Reporting

National Grid is submitting this version of the RI TRM (the 2019 TRM) to the stakeholders along with its Energy Efficiency Program Plan ("EE Program Plan") for 2019.

The RI TRM provides regulators and stakeholders with documentation of the assumptions and algorithms that National Grid will use in planning and reporting its energy savings for 2019. 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

National Grid 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 National Grid collects.

Evolution of Program and Measure Cost Effectiveness Analysis Tools

The program and measure cost effectiveness analysis tools are Microsoft® Excel® workbooks used by National Grid 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. National Grid 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. National Grid envisions aligning the measure names and the categorization of measures in the TRM

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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 National Grid 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, National Grid 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 National Grid. 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 National Grid provide tracking system details, the reproduction of reported data will be possible using the TRM.

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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:
  - changes in baseline equipment or practices, affecting measure savings
  - changes in efficient equipment or practices, affecting measure savings
  - changes to deemed savings due the revised assumptions for algorithm parameter values (e.g., due to new market research or evaluation studies)
  - 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
National Grid	• Identify and perform needed updates to the TRM • Provide TRM to interested stakeholders
Rhode Island EERMC and Division of Public Utilities and Carriers	• Review; suggest modifications; and accept TRM • Assure coordination with National Grid submissions of program plans and reported savings

Jointly	• Administrative coordination of TRM activities, including:
	  • Assure collaboration and consensus regarding TRM updates
	  • Assure updates are compiled and incorporated into the TRM
	  • Coordinate with related program activities (e.g., evaluation and program reporting processes)

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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 2019 Program Year, compilation of updates continues up through September 2018, for submission in the TRM in October 2018.

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

November (PY-1) prior to program year: The PY TRM is filed with National Grid's PY EE program plan

The PY TRM is submitted to the PUC jointly with National Grid'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: National Grid begins to track savings based on the PY TRM

Beginning in January PY, National Grid will track savings for the PY based on the PY TRM.

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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 2019 TRM are active for the 2019 Program Year: from 1/1/2019 to 12/31/2019

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

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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	Full Program Name
Residential – Electric	Residential New Construction
	EnergyStar® HVAC
	EnergyWise
	EnergyWise Multifamily
	EnergyStar® Lighting
	Home Energy Reports
	EnergyStar® Products
Income Eligible – Electric	Single Family Appliance Management
	Income Eligible Multifamily
Commercial & Industrial – Electric	Commercial New Construction
	Commercial Retrofit
	Direct Install
Residential – Gas	EnergyStar® Heating System
	EnergyWise
	EnergyWise Multifamily
	Home Energy Reports
	Residential New Construction
Income Eligible – Gas	Single Family Appliance Management
	Income Eligible Multifamily
Commercial & Industrial – Gas	Commercial New Construction
	Commercial Retrofit
	Direct Install
	Commercial & Industrial Multifamily

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- **Algorithm Type:** This section describes which of four methods of savings calculation applies to a measure
    - 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 (eg. 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

$$\Delta kWh = \Delta kW \times Hours$$

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

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

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).

ΔkWh	=	gross annual kWh savings from the measure
ΔkW	=	gross annual kW savings from the measure
Hours	=	average hours of use per year
$Watts_{BASE}$	=	baseline connected kW
$Watts_{EE}$	=	energy efficient connected kW

- **Hours:** The operating hours for measures that are either on or off, or equivalent full load hours for 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.
- **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

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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.

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Impact Factors for Calculating Adjusted Gross and Net Savings

National Grid 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.

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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:

- Summer On-Peak: average demand reduction from 1:00-5:00 PM on non-holiday weekdays in June July, and August
- Winter On-Peak: 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 loadshape 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** (SO_P) and **non-participant spillover** (SO_{NP}).

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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 National Grid to track and report gross and net savings for its energy efficiency programs in Rhode Island.

- **Calculation of Net Annual Electric Energy Savings**
  $net_kWh = gross_kWh \times SPF \times ISR \times RR_E \times NTG$

- **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**
  $net_kW_{WP} = gross_kW \times SPF \times ISR \times RR_{WP} \times CF_{WP} \times NTG$

- **Calculation of Net Annual Natural Gas Energy Savings**
  $net_MMBtu = gross_MMBtu \times SPF \times ISR \times RR_G \times NTG$

Where:
Gross_kWh = Gross Annual kWh Savings
net_kWh = Net Annual kWh Savings
$Gross_kW_{SP}$ = Gross Connected kW Savings (summer peak)
$Gross_kW_{WP}$ = Gross Connected kW Savings (winter peak)
net_kW_{SP} = Adjusted Gross Connected kW Savings (winter peak)
net_kW_{WP} = 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_{SP} = Peak Coincidence Factor (summer peak)
CF_{WP} = Peak Coincidence Factor (winter peak)
RR_E = Realization Rate for electric energy (kWh)
RR_G = Realization Rate for gas (MMBtu)
RR_{SP} = Realization Rate for summer peak kW

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RR_{WP} = 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 $(1 – FR + SO_P + SO_{NP})$, or
- NTG is a single value with no distinction of FR, SO_P, SO_{NP}, and/or other factors that cannot be reliably isolated.

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Measure Characterizations

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Commercial electric oven

Sector: C&I | **Fuel:** Electric | **Program Type:** Prescriptive

Measure Category: Food Service | **Measure Type:** Cooking Equipment | **Measure Sub Type:** Oven

Program: 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 standard oven that meets the baseline cooking energy efficiency requirements shown in Table 15 of Appendix A.

Savings principle

The high efficiency case is an oven that meets or exceeds the high efficiency ratings shown in Table 15 of Appendix A.

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: 3756. Hours Source: Technical Assessment of Commercial Ovens <http://www.fishnick.com/equipment/techassessment/7_ovens.pdf>, pg.23 Hours Note: Ovens 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 oven	9688.00	2.58	0.00			0.00	0.00

Electric kWh Source: ENERGY Star Commercial Kitchen Equipment Savings Calculator: Griddle Calculations http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

Electric kW Source: ENERGY Star Commercial Kitchen Equipment Savings Calculator: Griddle Calculations http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Commercial electric oven	12	1.00	1.00		1.00	1.00	1.00	0.90	0.90

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Commercial electric oven	0.32	0.35	0.16	0.17

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 .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 Savings

CFwp Note: Coincidence Factors are .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 oven	0.00	0.00	0.23	

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 oven	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $50/unit

Incentive Unit:

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Unitary AC to 5.4 tons

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: HVAC | **Measure Type:** Unitary AC | **Measure Sub Type:** AC to 5.4 tons

Program: 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

The baseline efficiency case for new installations assumes compliance with the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code. 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: . 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

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Unitary AC to 5.4 tons	20	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Unitary AC to 5.4 tons	0.11	0.11	0.39	0.39

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 $
Unitary AC to 5.4 tons	0.00	0.00	0.00	

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	0.45	0.00	0.00	0.55

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Demand control ventilation

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: HVAC

Measure Type: Ventilation

Measure Sub Type: Demand Control Ventilation

Program: Design 2000plus

Measure Description

The measure is to control quantity of outside air to an air handling system based on detected space CO2 levels. The installed systems monitor the CO2 in the spaces or return air and reduce the outside air use when possible to save energy while meeting indoor air quality standards.

Baseline Description

The baseline efficiency case for this measure assumes the relevant HVAC equipment has no ventilation control.

Savings principle

The high efficiency case is the installation of an outside air intake control based on CO2 sensors.

Savings Method

Custom

Unit

Installed demand control ventilation project.

Savings equation

Gross kWh = deltakWh_custom

Gross Summer kW = deltakW_sp_custom

Gross Winter kW = deltakW_wp_custom

Gross MMBtu Gas = Gross kWh × deltaMMBtu_Gas/kWh

Gross MMBtu Oil = Gross kWh × deltaMMBtu_Oil/kWh

Where:

deltaMMBtu_Gas/kWh = Deemed average natural gas impact per gross electric energy impact

deltaMMBtu_Oil/kWh = Deemed average heating oil impact per gross electric energy impact

Hours: 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
Demand control ventilation	Calc	Calc	Calc			Calc	0.00

Electric kWh Note: Calculated with the National Grid DCV savings Tool

Electric kW Note: Calculated with the National Grid DCV savings Tool

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Demand control ventilation	10	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Demand control ventilation				

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 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 set to 1.00 because coincidence is built into the estimates of Gross kW.

CFwp Note: Coincidence Factors are set to 1.00 because coincidence is built into the estimates of Gross kW.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Demand control ventilation	0.00	0.00	0.00	

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
Demand control ventilation	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Dual enthalpy economizer controls

Sector: C&I | **Fuel:** Electric | **Program Type:** Prescriptive

Measure Category: HVAC | **Measure Type:** Controls | **Measure Sub Type:** Economizer

Program: 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	289.00	0.29	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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dual enthalpy economizer controls				

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	

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	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Custom lighting

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Custom **Measure Type:** Lighting **Measure Sub Type:** Lighting

Program: 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: 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			Calc	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom lighting	mult	1.00	1.00		0.92	1.11	0.79	Custom	Custom

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom lighting	0.30	0.17	0.34	0.18

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 (2013). Impact Evaluation of 2011 Rhode Island Custom Lighting Installations. Prepared for National Grid.

RRsp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Custom Lighting Installations. Prepared for National Grid.

RRwp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Custom Lighting Installations. 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 lighting	0.00	0.00	0.00	

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 lighting	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.28 /kWh

Incentive Unit: $ 0.21 /kWh

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Daylight dimming

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Controls **Measure Sub Type:** Dimming

Program: Design 2000plus

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: 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
Daylight dimming	Calc	Calc	Calc			Calc	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Daylight dimming	10	1.00	1.00		0.38	0.96	0.96	0.15	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Daylight dimming				

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: RLW Analytics (2007). Lighting Controls Impact Evaluation Final Report, 2005 Energy Initiative, Design 2000plus and Small Business Services Program. Prepared for National Grid.

RRsp Source: RLW Analytics (2007). Lighting Controls Impact Evaluation Final Report, 2005 Energy Initiative, Design 2000plus and Small Business Services Program. Prepared for National Grid.

RRwp Source: RLW Analytics (2007). Lighting Controls Impact Evaluation Final Report, 2005 Energy Initiative, Design 2000plus and Small Business Services Program. Prepared for National Grid.

CFsp Source: RLW Analytics (2007). Lighting Controls Impact Evaluation Final Report, 2005 Energy Initiative, Design 2000plus and Small Business Services Program. Prepared for National Grid.

CFwp Source: RLW Analytics (2007). Lighting Controls Impact Evaluation Final Report, 2005 Energy Initiative, Design 2000plus and Small Business Services Program. Prepared for National Grid.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Daylight dimming	0.00	0.00	0.02	

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
Daylight dimming	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.22 /kWh

Incentive Unit: $ 0.16 /kWh

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Occupancy sensors

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Lighting

Measure Type: Controls

Measure Sub Type: Occupancy Sensor

Program: Design 2000plus

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: 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	Calc			Calc	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Occupancy sensors	10	1.00	1.00		0.68	0.96	0.96	0.15	0.18

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Occupancy sensors				

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 (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	0.02	

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
Occupancy sensors	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.22 /kWh

Incentive Unit: $ 0.16 /kWh

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LED Street Lights

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Exterior **Measure Sub Type:** Street Lighting

Program: Design 2000plus

Measure Description

The installation of LED street lights.

Baseline Description

The baseline case is customer owned high-pressure sodium, incandescent, or mercury vapor street lighting.

Savings principle

The high efficiency case is the installation of LED street lighting.

Savings Method

Calculated using site-specific inputs

Unit

Installed LED Streetlight

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: 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 Street Lights	Calc	Calc	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 Street Lights	12	1.00	1.00		1.00	1.00	1.00	Calc	Calc

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Street Lights				

Measure life Note: Based on National Grid Staff estimates

ISR Note: 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 $
LED Street Lights	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Street Lights	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.22 /kWh

Incentive Unit: $ 0.16 /kWh

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LED Performance lighting

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** LEDs **Measure Sub Type:** LED Performance

Program: Design 2000plus

Measure Description

Advanced lighting design refers to the implementation of various lighting design principles aimed at creating a quality and appropriate lighting experience while reducing unnecessary light usage. This is often done by a professional in a new constructionsituation. Advanced lighting design uses techniques like maximizing task lighting and efficient fixtures to create a system of optimal energy efficiency and functionality.

Baseline Description

The baseline efficiency assumes compliance with lighting power density requirements as mandated by Rhode Island State Building Code. Energy efficiency must be met via compliance with the International Energy Conservation Code (IECC) 2012, as described inAppendix A Table 1 and Table 2.

Savings principle

The high efficiency case assumes lighting systems with lighting power densities below those required by Rhode Island State Building Code. Installed lighting wattage should be determined using the installed fixture counts and wattages.

Savings Method

Calculated using site-specific inputs

Unit

Installed lighting fixture project.

Savings equation

Gross kWh = [SUM(LPD_base_i × Area_i × Hours_i) - SUM(QTY_ee_j × Watts_ee_j × Hours_j)] / (Watts per kW)

Gross kW = [SUM(LPD_base_i × Area_i) - SUM(QTY_ee_j × Watts_ee_j)] / (Watts per kW)

Where:

Area_i = Floor area of location i (SQFT)

Hours_base_i = Total annual operating hours for baseline lighting equipment in location i

QTY_ee_j = Quantity of efficient fixtures in location j

Watts_ee_j = Connected wattage of efficient fixtures in location j

Hours_j = Lighting annual hours of operation: site-specific.

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: 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 Performance lighting	Calc	Calc	Calc			Calc	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Performance lighting	15	1.00	1.00		1.07	0.80	0.73	Custo m	Custo m

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Performance lighting	0.30	0.17	0.34	0.18

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 (2009). Sample Design and Impact Evaluation Analysis of the 2008 Custom Program. Prepared for National Grid; Table 19.

RRsp Source: KEMA (2009). Sample Design and Impact Evaluation Analysis of the 2008 Custom Program. Prepared for National Grid; Table 19.

RRwp Source: KEMA (2009). Sample Design and Impact Evaluation Analysis of the 2008 Custom Program. Prepared for National Grid; Table 19.

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 $
LED Performance lighting	0.00	0.00	0.02	

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
LED Performance lighting	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.22 /kWh

Incentive Unit: $ 0.16 /kWh

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LEDs for freezer/cooler cases

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Refrigeration

Measure Type: Refrigeration Lighting

Measure Sub Type: Refrigerator Case LED

Program: Design 2000plus

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 × Watts_base × Hours_base) - SUM(QTY_ee × kW_ee × Hours_ee)] × (1 + EffRefrig × (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: 8760 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
LEDs for freezer/cooler cases	Calc	Calc	0.00			0.00	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LEDs for freezer/cooler cases	13	1.00	1.00		0.94	1.01	1.01	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LEDs for freezer/cooler cases				

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: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

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 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 $
LEDs for freezer/cooler cases	0.00	0.00	0.02	

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 for freezer/cooler cases	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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Commercial Electric Fryer

Sector: C&I **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Food Service **Measure Type:** Cooking Equipment **Measure Sub Type:** Fryer

Program: 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, daily a preheat energy of 2.3 kWh, and an idle energy rate of 1.05 kW

Savings principle

The high efficiency case is a deep-fat fryer with a cooking energy efficiency of 80%, a shortening capacity of up to 65 pounds, a daily preheat energy of 2.3 kWh, and an idle energy rate of 1.05 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: 3756 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	760.00	0.20	0.00			0.00	0.00

Electric kWh Source: ENERGYSTAR Commercial Kitchen Equipment Savings Calculator: Fryer Calculations. www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerRoomAC.xls.

Electric kW Source: ENERGYSTAR Commercial Kitchen Equipment Savings Calculator: Fryer Calculations. www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerRoomAC.xls.

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Commercial Electric Fryer	12	1.00	1.00		1.00	1.00	1.00	0.90	0.90

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Commercial Electric Fryer	0.32	0.35	0.16	0.17

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 .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 Savings

CFwp Note: Coincidence Factors are .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	0.00	0.00	0.23	

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	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $260/unit

Incentive Unit:

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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: 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

Commercial ice machines meeting the ENERGY STAR® specifications are on average 15 percent more energy efficient and 10 percent more water-efficient than standard models.

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: 5634 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	205.00	0.02					

Electric kWh Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Electric kW Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Ice Self Contained				

Measure life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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	

Annual $ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Water/Sewer Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Ice Self Contained	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $140/unit

Incentive Unit:

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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: 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 standard oven that meets the baseline cooking energy efficiency requirements shown in Table 15 of Appendix A.

Savings principle

The high efficiency case is an oven that meets or exceeds the high efficiency ratings shown in Table 15 of Appendix A.

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: 3756. Hours Source: Technical Assessment of Commercial Ovens <http://www.fishnick.com/equipment/techassessment/7_ovens.pdf>, pg.23 Hours Note: Ovens 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 Convection Oven	1364.00	0.44	0.00			0.00	0.00

Electric kWh Source: ENERGY Star Commercial Kitchen Equipment Savings Calculator: Griddle Calculations http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

Electric kW Source: ENERGY Star Commercial Kitchen Equipment Savings Calculator: Griddle Calculations http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Commercial Electric Convection Oven	0.32	0.35	0.16	0.17

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 .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 Savings

CFwp Note: Coincidence Factors are .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	

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	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $50/unit

Incentive Unit:

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Packaged AC to 5.4 tons

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: HVAC | **Measure Type:** Unitary AC | **Measure Sub Type:** AC to 5.4 tons

Program: 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

The baseline efficiency case for new installations assumes compliance with the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code. 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: . 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 5.4 tons	Calc	Calc	0.00			0.00	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Packaged AC to 5.4 tons	20	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Packaged AC to 5.4 tons	0.11	0.11	0.39	0.39

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 5.4 tons	0.00	0.00	0.00	

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 5.4 tons	0.45	0.00	0.00	0.55

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Commercial electric steamer

Sector: C&I | **Fuel:** Electric | **Program Type:** Prescriptive

Measure Category: Food Service | **Measure Type:** Cooking Equipment | **Measure Sub Type:** Steamer

Program: 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 a conventional electric steam cooker with a cooking energy efficiency of 30%, pan production capacity of 23.3 pounds per hour, and an idle energy rate of 1.2 kW.

Savings principle

The high efficiency case is an ENERGY STAR® electric steam cooker with a cooking energy efficiency of 50%, pan production capacity of 16.7 pounds per hour, and an idle energy rate of 0.4 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: 3756. Hours Source: ENERGY Star Commercial Kitchen Equipment Savings Calculator: Griddle Calculations http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls> Hours Note: Steamers are assumed to operate 313 days per year, 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 steamer	8381.00	2.23	0.00			0.00	0.00

Electric kWh Source: ENERGY Star Commercial Kitchen Equipment Savings Calculator: Griddle Calculations http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

Electric kW Source: ENERGY Star Commercial Kitchen Equipment Savings Calculator: Griddle Calculations http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Commercial electric steamer	0.32	0.35	0.16	0.17

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 .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 Savings

CFwp Note: Coincidence Factors are .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	

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	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $1500/unit

Incentive Unit:

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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: 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: 5634 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	4243.00	0.75		153.00			

Electric kWh Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Electric kW Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Gas DHW MMBtu Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dishwasher - High Temperature Single Tank Conveyor				

Measure life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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	

Annual $ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Water/Sewer Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dishwasher - High Temperature Single Tank Conveyor	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $270/unit

Incentive Unit:

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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: 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: 5634 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	13851.00	2.46					

Electric kWh Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Electric kW Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dishwasher - Low Temperature Door Type				

Measure life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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	

Annual $ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Water/Sewer Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dishwasher - Low Temperature Door Type	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $530/unit

Incentive Unit:

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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: 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 1.60 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 × deltakWh / Hours

Where:

Qty = Total number of units.

deltakWh = Deemed average annual kWh reduction per unit.

Hours = Deemed average annual operating hours.

Hours: 5634 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	11685.00	2.07					

Electric kWh Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Electric kW Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dishwasher - Low Temperature Single Tank Conveyor				

Measure life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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	

Annual $ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Water/Sewer Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dishwasher - Low Temperature Single Tank Conveyor	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $170/unit

Incentive Unit:

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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: 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: 5634 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	2178.00	0.39					

Electric kWh Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Electric kW Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dishwasher - Low Temperature Under Counter				

Measure life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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	

Annual $ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Water/Sewer Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dishwasher - Low Temperature Under Counter	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $530/unit

Incentive Unit:

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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:** 2-Jan

Program: 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: 4695 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	695.00	0.15					

Electric kWh Source: ENERGY STAR® Commercial Kitchen Equipment Savings Calculator: HFHC Calcs. <http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

Electric kW Source: ENERGY STAR® Commercial Kitchen Equipment Savings Calculator: HFHC Calcs. <http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

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				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Hot Food Holding Cabinet - 1/2				

Measure life Source: ENERGY STAR® Commercial Kitchen Equipment Savings Calculator: HFHC Calcs. <http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

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			0.23	

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	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $1500/unit

Incentive Unit:

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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:** 4-Mar

Program: 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: 4695 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	1042.00	0.22					

Electric kWh Source: ENERGY STAR® Commercial Kitchen Equipment Savings Calculator: HFHC Calcs. <http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

Electric kW Source: ENERGY STAR® Commercial Kitchen Equipment Savings Calculator: HFHC Calcs. <http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

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				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Hot Food Holding Cabinet - 3/4				

Measure life Source: ENERGY STAR® Commercial Kitchen Equipment Savings Calculator: HFHC Calcs. <http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

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			0.23	

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	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $1800/unit

Incentive Unit:

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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: 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: 4695 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	2376.00	0.51					

Electric kWh Source: ENERGY STAR® Commercial Kitchen Equipment Savings Calculator: HFHC Calcs. <http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

Electric kW Source: ENERGY STAR® Commercial Kitchen Equipment Savings Calculator: HFHC Calcs. <http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

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				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Hot Food Holding Cabinet - Full				

Measure life Source: ENERGY STAR® Commercial Kitchen Equipment Savings Calculator: HFHC Calcs. <http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

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			0.23	

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	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $1200/unit

Incentive Unit:

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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: 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

Commercial ice machines meeting the ENERGY STAR® specifications are on average 15 percent more energy efficient and 10 percent more water-efficient than standard models.

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: 5634 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	665.00	0.08					

Electric kWh Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Electric kW Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Ice Making Head				

Measure life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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	

Annual $ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Water/Sewer Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Ice Making Head	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $140/unit

Incentive Unit:

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Ice Remote/Split

Sector: C&I **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Food Service **Measure Type:** Ice Machine **Measure Sub Type:** Ice Remote/Split

Program: 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

Commercial ice machines meeting the ENERGY STAR® specifications are on average 15 percent more energy efficient and 10 percent more water-efficient than standard models.

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: 5634 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/Split	1196.00	0.14					

Electric kWh Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Electric kW Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Ice Remote/Split	8	1.00	1.00		1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Ice Remote/Split				

Measure life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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/Split	0.00	0.00	0.23	

Annual $ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Water/Sewer Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Ice Machine Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Ice Remote/Split	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $140/unit

Incentive Unit:

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Commercial electric griddle

Sector: C&I | **Fuel:** Electric | **Program Type:** Prescriptive

Measure Category: Food Service | **Measure Type:** Cooking Equipment | **Measure Sub Type:** Griddle

Program: 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 standard efficiency (30% efficient) griddle.

Savings principle

The high efficiency case is a griddle with an efficiency of 38%.

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: 3756. Hours Source: Technical Assessment of Commercial Ovens <http://www.fishnick.com/equipment/techassessment/7_ovens.pdf>, 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	2226.00	0.59	0.00			0.00	0.00

Electric kWh Source: ENERGY Star Commercial Kitchen Equipment Savings Calculator: Griddle Calculations http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

Electric kW Source: ENERGY Star Commercial Kitchen Equipment Savings Calculator: Griddle Calculations http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls>

Energy Impact Factors

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Commercial electric griddle	0.32	0.35	0.16	0.17

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 .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 Savings

CFwp Note: Coincidence Factors are .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	

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	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $60/unit

Incentive Unit:

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Custom HVAC

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Custom **Measure Type:** HVAC **Measure Sub Type:** HVAC

Program: 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: 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			Calc	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom HVAC	mult	1.00	1.00		0.78	0.69	0.70	Custom	Custom

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom HVAC				

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: DNV GL (2017) Impact Evaluation of 2014 Custom HVAC Installations

RRsp Source: DNV GL (2017) Impact Evaluation of 2014 Custom HVAC Installations

RRwp Source: DNV GL (2017) Impact Evaluation of 2014 Custom HVAC 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 HVAC	0.00	0.00	0.00	

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	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.28 /kWh

Incentive Unit: $ 0.21 /kWh

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CODES AND STANDARDS

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Codes and Standards

Measure Type: Codes and Standards

Measure Sub Type: Codes and Standards

Program: 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

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:

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

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	1.00	1.00		

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CODES AND STANDARDS				

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				

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%.

Gross Measure TRC unit:

Incentive Unit:

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CAIR Nozzle

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Compressed Air **Measure Type:** CAIR Nozzle **Measure Sub Type:** CAIR Nozzle

Program: 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: 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
CAIR Nozzle	Calc	Calc	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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CAIR Nozzle				

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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			0.04	

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	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Variable compressor up to 25 HP

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: Compressor

Measure Sub Type: Variable compressor up to 25 HP

Program: Design 2000plus

Measure Description

The installation of oil flooded, rotary screw compressors with Variable Displacement 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 Displacement 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: 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
Variable compressor up to 25 HP	Calc	0.19	0.00				

Electric kW Source: KEMA (2016) Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Variable compressor up to 25 HP	15	1.00	1.00		1.41	1.00	1.00	1.05	0.83

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Variable compressor up to 25 HP				

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 $
Variable compressor up to 25 HP			0.04	

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
Variable compressor up to 25 HP	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Variable Displacement (50<=HP<=75)

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: High Efficiency Air Compressors

Measure Sub Type: Variable Displacement

Program: Design 2000plus

Measure Description

The installation of oil flooded, rotary screw compressors with Variable Displacement 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 Displacement 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: 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
Variable Displacement (50<=HP<=75)	Calc	0.19	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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Variable Displacement (50<=HP<=75)	15	1.00	1.00		1.41	1.00	1.00	1.05	0.83

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Variable Displacement (50<=HP<=75)				

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 $
Variable Displacement (50<=HP<=75)			0.04	

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
Variable Displacement (50<=HP<=75)	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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VSD (15<=HP<25)

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: High Efficiency Air Compressors

Measure Sub Type: Variable Speed Drive

Program: 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: 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 (15<=HP<25)	Calc	0.19	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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSD (15<=HP<25)	15	1.00	1.00		1.41	1.00	1.00	1.05	0.83

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
VSD (15<=HP<25)				

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 (15<=HP<25)			0.04	

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 (15<=HP<25)	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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VSD (25<=HP<=75)

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: High Efficiency Air Compressors

Measure Sub Type: Variable Speed Drive

Program: 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: 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 (25<=HP<=75)	Calc	0.19	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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSD (25<=HP<=75)	15	1.00	1.00		1.41	1.00	1.00	1.05	0.83

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
VSD (25<=HP<=75)				

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 (25<=HP<=75)			0.04	

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 (25<=HP<=75)	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Low pressure drop filter

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: Low Pressure Drop Filters

Measure Sub Type: Low Pressure Drop Filter

Program: 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 × HP_compressor × (kW per HP) × %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: 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				

Energy Impact Factors

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low pressure drop filter				

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			0.04	

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	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Dryer (100<=CFM<200)

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: Refrigerated Air Dryers

Measure Sub Type: Refrigerated Air Dryer

Program: 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: 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
Dryer (100<=CFM<200)	Calc	0.01	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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dryer (100<=CFM<200)	15	1.00	1.00		1.56	1.00	1.00	1.05	0.83

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dryer (100<=CFM<200)				

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 $
Dryer (100<=CFM<200)			0.04	

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
Dryer (100<=CFM<200)	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Dryer (200<=CFM<300)

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: Refrigerated Air Dryers

Measure Sub Type: Refrigerated Air Dryer

Program: 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: 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
Dryer (200<=CFM<300)	Calc	0.01	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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dryer (200<=CFM<300)	15	1.00	1.00		1.56	1.00	1.00	1.05	0.83

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dryer (200<=CFM<300)				

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 $
Dryer (200<=CFM<300)			0.04	

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
Dryer (200<=CFM<300)	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Dryer (300<=CFM<400)

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: Refrigerated Air Dryers

Measure Sub Type: Refrigerated Air Dryer

Program: 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: 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
Dryer (300<=CFM<400)	Calc	0.01	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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dryer (300<=CFM<400)	15	1.00	1.00		1.56	1.00	1.00	1.05	0.83

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dryer (300<=CFM<400)				

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 $
Dryer (300<=CFM<400)			0.04	

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
Dryer (300<=CFM<400)	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Dryer (CFM >=400)

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: Refrigerated Air Dryers

Measure Sub Type: Refrigerated Air Dryer

Program: 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: 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
Dryer (CFM >=400)	Calc	0.01	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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dryer (CFM >=400)	15	1.00	1.00		1.56	1.00	1.00	1.05	0.83

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dryer (CFM >=400)				

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 $
Dryer (CFM >=400)			0.04	

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
Dryer (CFM >=400)	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Packaged AC 5.4 to 11.25 tons

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: HVAC | **Measure Type:** Unitary AC | **Measure Sub Type:** 5.4 to 11.25 tons

Program: 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

The baseline efficiency case for new installations assumes compliance with the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code. 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: . 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 5.4 to 11.25 tons	Calc	Calc	0.00			0.00	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Packaged AC 5.4 to 11.25 tons	20	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Packaged AC 5.4 to 11.25 tons	0.11	0.11	0.39	0.39

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 5.4 to 11.25 tons	0.00	0.00	0.00	

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 5.4 to 11.25 tons	0.45	0.00	0.00	0.55

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Zero loss condensate drain

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: Zero Loss Condensate Drains

Measure Sub Type: Zero Loss Condensate Drain

Program: 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: 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				

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Zero loss condensate drain				

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			0.04	

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	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Packaged AC 11.25 to 30 tons

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: HVAC | **Measure Type:** Unitary AC | **Measure Sub Type:** 11.25 to 30 tons

Program: 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

The baseline efficiency case for new installations assumes compliance with the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code. 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: . 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 11.25 to 30 tons	Calc	Calc	0.00			0.00	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Packaged AC 11.25 to 30 tons	20	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Packaged AC 11.25 to 30 tons	0.11	0.11	0.39	0.39

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 11.25 to 30 tons	0.00	0.00	0.00	

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 11.25 to 30 tons	0.45	0.00	0.00	0.55

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Split system AC to 5.4 tons

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: HVAC **Measure Type:** AC **Measure Sub Type:** Split

Program: 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

The baseline efficiency case for new installations assumes compliance with the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code. 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: . 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

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Split system AC to 5.4 tons	0.11	0.11	0.39	0.39

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 $
Split system AC to 5.4 tons	0.00	0.00	0.00	

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	0.45	0.00	0.00	0.55

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Air Cooled AC 11.25 to 20 tons

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: HVAC | **Measure Type:** AC | **Measure Sub Type:** Air cooled

Program: 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

The baseline efficiency case for new installations assumes compliance with the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code. 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: . 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 11.25 to 20 tons	Calc	Calc	0.00			0.00	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Cooled AC 11.25 to 20 tons	20	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Air Cooled AC 11.25 to 20 tons	0.11	0.11	0.39	0.39

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 11.25 to 20 tons	0.00	0.00	0.00	

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 11.25 to 20 tons	0.45	0.00	0.00	0.55

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Air Cooled AC 20 to 63 tons

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: HVAC | **Measure Type:** AC | **Measure Sub Type:** Air cooled

Program: 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

The baseline efficiency case for new installations assumes compliance with the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code. 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: . 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 20 to 63 tons	Calc	Calc	0.00			0.00	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Cooled AC 20 to 63 tons	20	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Air Cooled AC 20 to 63 tons	0.11	0.11	0.39	0.39

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 20 to 63 tons	0.00	0.00	0.00	

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 20 to 63 tons	0.45	0.00	0.00	0.55

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Air Cooled AC 5.4 to 11.25 tons

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: HVAC | **Measure Type:** AC | **Measure Sub Type:** Air cooled

Program: 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

The baseline efficiency case for new installations assumes compliance with the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code. 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: . 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 5.4 to 11.25 tons	Calc	Calc	0.00			0.00	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Cooled AC 5.4 to 11.25 tons	20	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Air Cooled AC 5.4 to 11.25 tons	0.11	0.11	0.39	0.39

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 5.4 to 11.25 tons	0.00	0.00	0.00	

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 5.4 to 11.25 tons	0.45	0.00	0.00	0.55

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Air Cooled AC over 63 tons

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: HVAC | **Measure Type:** AC | **Measure Sub Type:** Air cooled

Program: 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

The baseline efficiency case for new installations assumes compliance with the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code. 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: . 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 over 63 tons	Calc	Calc	0.00			0.00	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Cooled AC over 63 tons	20	1.00	1.00		1.00	1.00	1.00	0.40	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Air Cooled AC over 63 tons	0.11	0.11	0.39	0.39

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 over 63 tons	0.00	0.00	0.00	

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 over 63 tons	0.45	0.00	0.00	0.55

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Ground source (closed loop) heat pump

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: HVAC | **Measure Type:** Heat Pumps | **Measure Sub Type:** Ground Source

Program: 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

The baseline efficiency case for new installations assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code.

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 × (kBtu/hr per ton) × [(1/SEER_base - 1/SEER_ee) × Hours_C + CR × (1/HSPF_base - 1/HSPF_ee) × Hours_H]

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

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: . 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.

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Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Ground source (closed loop) heat pump	Calc	Calc	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 (closed loop) heat pump	15	1.00	1.00		1.05	1.00	1.00	0.40	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Ground source (closed loop) heat pump	0.11	0.11	0.39	0.39

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 $
Ground source (closed loop) heat pump	0.00	0.00	0.00	

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

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Measure	FR	Sop	Sonp	NTG
Ground source (closed loop) heat pump	0.50	0.00	0.00	0.50

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Water source heat pump

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: HVAC | **Measure Type:** Heat Pumps | **Measure Sub Type:** Ground Source

Program: 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

The baseline efficiency case for new installations assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code.

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 × (kBtu/hr per ton) × [(1/SEER_base - 1/SEER_ee) × Hours_C + CR × (1/HSPF_base - 1/HSPF_ee) × Hours_H]

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

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: . 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

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Water source heat pump	15	1.00	1.00		1.05	1.00	1.00	0.40	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Water source heat pump	0.11	0.11	0.39	0.39

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 $
Water source heat pump	0.00	0.00	0.00	

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	0.50	0.00	0.00	0.50

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Groundwater source (open loop) heat pump

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: HVAC

Measure Type: Heat Pumps

Measure Sub Type: Groundwater Source

Program: 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

The baseline efficiency case for new installations assumes compliance with the efficiency requirements as mandated by Rhode Island State Building Code.

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 × (kBtu/hr per ton) × [(1/SEER_base - 1/SEER_ee) × Hours_C + CR × (1/HSPF_base - 1/HSPF_ee) × Hours_H]

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

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: . 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.

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Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Groundwater source (open loop) heat pump	Calc	Calc	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 (open loop) heat pump	15	1.00	1.00		1.05	1.00	1.00	0.40	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Groundwater source (open loop) heat pump	0.11	0.11	0.39	0.39

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 $
Groundwater source (open loop) heat pump	0.00	0.00	0.00	

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

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Measure	FR	Sop	Sonp	NTG
Groundwater source (open loop) heat pump	0.50	0.00	0.00	0.50

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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ECM fan motor for HVAC

Sector: C&I **Fuel:** Electric **Program Type:** Custom

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

Program: 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: . 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

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Energy Impact Factors

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	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ECM fan motor for HVAC				

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	

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	0.50	0.00	0.00	0.50

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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Packaged Terminal Air Conditioner

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: HVAC | **Measure Type:** PTAC | **Measure Sub Type:** PTAC

Program: 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

The baseline efficiency case for new installations assumes compliance with the current version of International Energy Conservation Code (IECC) as mandated by Rhode Island State Building Code. 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: . 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

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Packaged Terminal Air Conditioner	0.11	0.11	0.39	0.39

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	

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: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $ 0.38 /kWh

Incentive Unit: $ 0.29 /kWh

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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: 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: 5634 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	1791.00	0.32		3.90			

Electric kWh Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Electric kW Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Gas DHW MMBtu Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dishwasher - High Temperature Under Counter				

Measure life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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	

Annual $ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Water/Sewer Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dishwasher - High Temperature Under Counter	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $1000/unit

Incentive Unit:

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Dryer (CFM<100)

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: Refrigerated Air Dryers

Measure Sub Type: Refrigerated Air Dryer

Program: 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: 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
Dryer (CFM<100)	Calc	0.01	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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dryer (CFM<100)	15	1.00	1.00		1.56	1.00	1.00	1.05	0.83

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dryer (CFM<100)				

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 $
Dryer (CFM<100)			0.04	

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
Dryer (CFM<100)	0.09	0.03	0.00	0.94

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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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: 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: 5634 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	4151.00	0.74		252.00			

Electric kWh Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Electric kW Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Gas DHW MMBtu Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dishwasher - High Temperature Door Type				

Measure life Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

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	

Annual $ Source: DNV GL (2015) Massachusetts Electric & Gas Program Administrators: C&I New Construction Non-Energy Impacts Study

Water/Sewer Source: Savings Calculator for ENERGY STAR® Certified Commercial Kitchen Equipment: Dishwasher Calcs. <http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dishwasher - High Temperature Door Type	0.29	0.00	0.03	0.74

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $500/unit

Incentive Unit:

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LED stairwell

Sector: C&I **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Lighting **Measure Type:** Upstream **Measure Sub Type:** LED stairwell

Program: 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: 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	6.00	6.00	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	Table 6	0.76	1.00		0.34	0.34	0.34	0.66	0.68

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED stairwell				

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			0.03	

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	0.20	0.00	0.00	0.80

NTG Source: C&I upstream lighting updated based on 8/1 MA NTG concensus group email

Gross Measure TRC unit: $ 0.37 /kWh

Incentive Unit: $ 0.18 /kWh

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Cooler night cover

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Refrigeration **Measure Type:** Temp Maintain **Measure Sub Type:** Night Cover

Program: Energy Initiative

Measure Description

Installation of retractable aluminum woven fabric covers for open-type refrigerated display cases, where the covers are deployed during the facility unoccupied hours in order to reduce refrigeration energy consumption.

Baseline Description

The baseline efficiency case is the annual operation of open-display cooler cases.

Savings principle

The high efficiency case is the use of night covers to protect the exposed area of display cooler cases during unoccupied hours.

Savings Method

Calculated using site-specific inputs

Unit

Linear feet of installed night covers on existing cooler cases.

Savings equation

Gross kWh = Width × deltakW/feet × Hours

Gross kW = Width × deltakW/feet

Where:

Width = Width in feet of the opening that the night covers protect: site-specific

deltakW/feet = Savings factor based on the temperature of the case

Hours = Annual hours thatthe night covers are in use: site-specific

Hours: Hours represent the number of annual hours that the night covers are in use, and should be determined on a case-by-case basis. Hours Note: Hours represent the number of annual hours that the night covers are in use, and should 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
Cooler night cover	Calc	Calc	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
Cooler night cover	10	1.00	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Cooler night cover				

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 $
Cooler night cover	0.00	0.00	0.05	

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
Cooler night cover	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.294 /kWh

Incentive Unit: $ 0.147 /kWh

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Comprehensive Retrofit (CR)

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Whole Building **Measure Type:** Custom **Measure Sub Type:** Whole Building

Program: 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: 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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Comprehensive Retrofit (CR)	mult	1.00	1.00		1.20	0.84	0.50	Custo m	Custo m

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Comprehensive Retrofit (CR)				

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). Impact Evaluation of Custom Comprehensive and HVAC Installations. Prepared for National Grid.

RRsp Source: KEMA (2011). Impact Evaluation of Custom Comprehensive and HVAC Installations. Prepared for National Grid.

RRwp Source: KEMA (2011). Impact Evaluation of Custom Comprehensive and HVAC Installations. 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 $
Comprehensive Retrofit (CR)	0.00	0.00	0.06	

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)	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.48 /kWh

Incentive Unit: $ 0.24 /kWh

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Glass front refrigerated coolers

Sector: C&I **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Refrigeration **Measure Type:** Controls **Measure Sub Type:** Vending Miser

Program: 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 × 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: 8760 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	1208.00	0.14	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.

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Glass front refrigerated coolers				

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	0.05	

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
Glass front refrigerated coolers	0.10	0.04	0.06	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.294 /kWh

Incentive Unit: $ 0.147 /kWh

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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: 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 × 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: 8760 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	343.00	0.04	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.

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Non-refrigerated snack vending machine				

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	0.05	

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
Non-refrigerated snack vending machine	0.10	0.04	0.06	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.294 /kWh

Incentive Unit: $ 0.147 /kWh

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Refrigerated beverage vending machine

Sector: C&I **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Refrigeration **Measure Type:** Controls **Measure Sub Type:** Vending Miser

Program: 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 × 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: 8760 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	1612.00	0.18	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.

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Refrigerated beverage vending machine				

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	0.05	

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
Refrigerated beverage vending machine	0.10	0.04	0.06	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.294 /kWh

Incentive Unit: $ 0.147 /kWh

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Custom CHP

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Custom **Measure Type:** CHP **Measure Sub Type:** CHP

Program: 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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom CHP	mult	1.00	1.00		1.00	1.00	1.00	Custom	Custom

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom CHP				

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%.

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: 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	

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 CHP	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.52 /kWh

Incentive Unit: $ 0.26 /kWh

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Energy management system

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: HVAC

Measure Type: Controls

Measure Sub Type: Energy Management System

Program: 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

Custom

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 = Gross kWh × deltaMMBtu_Gas/kWh

Gross MMBtu Oil = Gross kWh × deltaMMBtu_Oil/kWh

Where:

deltaMMBtu_Gas/kWh = Deemed average natural gas impact per gross electric energy impact

deltaMMBtu_Oil/kWh = Deemed average heating oil impact per gross electric energy impact

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			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		1.04	1.03	1.03	Custom	Custom

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Energy management system				

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 3, Energy Management Control Systems. Prepared for NE Power Service Co.

RRsp Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 3, Energy Management Control Systems. Prepared for NE Power Service Co.

RRwp Source: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 3, Energy Management Control Systems. Prepared for NE Power Service Co.

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 $
Energy management system	0.00	0.00	0.02	

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	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.64 /kWh

Incentive Unit: $ 0.32 /kWh

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LEDs for freezer/cooler cases

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Refrigeration

Measure Type: Refrigeration Lighting

Measure Sub Type: Refrigerator Case LED

Program: Energy Initiative

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 × Watts_base × Hours_base) - SUM(QTY_ee × kW_ee × Hours_ee)] × (1 + EffRefrig × (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: 8760 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
LEDs for freezer/cooler cases	Calc	Calc	0.00			0.00	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LEDs for freezer/cooler cases	13	1.00	1.00		0.94	1.01	1.01	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LEDs for freezer/cooler cases				

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: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

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 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 $
LEDs for freezer/cooler cases	0.00	0.00	0.05	

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 for freezer/cooler cases	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.464 /kWh

Incentive Unit: $ 0.232 /kWh

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LED

Sector: C&I **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Lighting **Measure Type:** Upstream **Measure Sub Type:** LED Screw in

Program: 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: 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	6.00	6.00	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	Table 6	0.76	1.00		0.60	0.60	0.60	0.57	0.58

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED	0.30	0.17	0.34	0.18

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	

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

Gross Measure TRC unit: $ 0.37 /kWh

Incentive Unit: $ 0.18 /kWh

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Occupancy sensors

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Lighting

Measure Type: Controls

Measure Sub Type: Occupancy Sensor

Program: Energy Initiative

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: 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	Calc			Calc	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Occupancy sensors	10	1.00	1.00		0.68	0.96	0.96	0.15	0.18

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Occupancy sensors	0.30	0.17	0.34	0.18

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 (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	0.03	

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
Occupancy sensors	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.464 /kWh

Incentive Unit: $ 0.232 /kWh

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LED Exterior

Sector: C&I **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Lighting **Measure Type:** Upstream **Measure Sub Type:** LED Exterior

Program: 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: 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	6.00	6.00					

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Exterior	Table 6	0.76	1.00		0.76	0.76	0.76	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Exterior				

Measure life Note: Massachusetts Common Assumption

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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			0.03	

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	0.20	0.00	0.00	0.80

NTG Source: C&I upstream lighting updated based on 8/1 MA NTG concensus group email

Gross Measure TRC unit: $ 0.37 /kWh

Incentive Unit: $ 0.18 /kWh

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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: 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: 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 High/Low Bay	6.00	6.00					

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED High/Low Bay	Table 6	0.76	1.00		0.76	0.76	0.76	0.66	0.68

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED High/Low Bay	0.30	0.17	0.34	0.18

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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			0.03	

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	0.20	0.00	0.00	0.80

NTG Source: C&I upstream lighting updated based on 8/1 MA NTG concensus group email

Gross Measure TRC unit: $ 0.37 /kWh

Incentive Unit: $ 0.18 /kWh

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Street Lighting

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Street Lights **Measure Sub Type:** Street lighting

Program: 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 = [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
Street Lighting	Calc	Calc	Calc			Calc	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Street Lighting	20	1.00	1.00		1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Street Lighting				

Measure life Source: NEEP DOE LED Street Lighting Assessment and Strategies for the Northeast and Mid-Atlantic

ISR 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 $
Street Lighting	0.00	0.00	0.06	

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	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.464 /kWh

Incentive Unit: $ 0.232 /kWh

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Street Lighting with controls

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Lighting

Measure Type: Street Lights

Measure Sub Type: Street lighting w/controls

Program: 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 = [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
Street Lighting with controls	Calc	Calc	Calc			Calc	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Street Lighting with controls	20	1.00	1.00		1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Street Lighting with controls				

Measure life Source: NEEP DOE LED Street Lighting Assessment and Strategies for the Northeast and Mid-Atlantic

ISR 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 $
Street Lighting with controls	0.00	0.00	0.06	

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 with controls	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.464 /kWh

Incentive Unit: $ 0.232 /kWh

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Building operator certification

Sector: C&I **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Whole Building **Measure Type:** BOC Training **Measure Sub Type:** Certification

Program: Energy Initiative

Measure Description

The Building Operator Certificaiton (BOC) class improves operators' ability to optimize / minimize gas and electricity use in buildings.

Baseline Description

The basecase 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	0.18	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

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Building operator certification				

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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Building operator certification	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 1695 per measure

Incentive Unit: $ 1250 per measure

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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: Energy Initiative

Measure Description

The Building Operator Certificaiton (BOC) class improves operators' ability to optimize / minimize gas and electricity use in buildings.

Baseline Description

The basecase 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	0.36	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

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Building operator certification + capital improvements				

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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Building operator certification + capital improvements	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 1695 per measure

Incentive Unit: $ 1250 per measure

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Hotel occupancy sensor

Sector: C&I

Fuel: Electric

Program Type: Prescriptive

Measure Category: HVAC

Measure Type: Controls

Measure Sub Type: Occupancy Sensor

Program: 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	438.00	0.09	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.

Energy Impact Factors

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Hotel occupancy sensor				

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	0.10	

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
Hotel occupancy sensor	0.10	0.04	0.06	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.64 /kWh

Incentive Unit: $ 0.32 /kWh

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Custom HVAC

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: Custom | **Measure Type:** HVAC | **Measure Sub Type:** HVAC

Program: 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: 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			Calc	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom HVAC	mult	1.00	1.00		0.78	0.69	0.70	Custom	Custom

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom HVAC				

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: DNV GL (2017) Impact Evaluation of 2014 Custom HVAC Installations

RRsp Source: DNV GL (2017) Impact Evaluation of 2014 Custom HVAC Installations

RRwp Source: DNV GL (2017) Impact Evaluation of 2014 Custom HVAC 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 HVAC	0.00	0.00	0.02	

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	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.33 /kWh

Incentive Unit: $ 0.16 /kWh

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Linear LED

Sector: C&I **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Lighting **Measure Type:** Upstream **Measure Sub Type:** LED Linear

Program: 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: 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	6.00	6.00	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	Table 6	0.76	1.00		1.71	1.71	1.71	0.80	0.59

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Linear LED	0.30	0.17	0.34	0.18

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			0.03	

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	0.20	0.00	0.00	0.80

NTG Source: C&I upstream lighting updated based on 8/1 MA NTG concensus group email

Gross Measure TRC unit: $ 0.37 /kWh

Incentive Unit: $ 0.18 /kWh

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ECM Evaporator fan Motors for Walk-in coolers

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Refrigeration **Measure Type:** Motors **Measure Sub Type:** ECM

Program: Energy Initiative

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: 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. See section: Refrigeration – Evaporator Fan Controls for %OFF valu 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. See section: Refrigeration – Evaporator Fan Controls for %OFF valu

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 for Walk-in coolers	Calc	Calc	0.00			0.00	0.00

Electric kWh Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
ECM Evaporator fan Motors for Walk-in coolers	15	1.00	1.00		1.00	1.00	1.00	0.87	0.51

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ECM Evaporator fan Motors for Walk-in coolers				

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: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

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). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

CFwp Source: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
ECM Evaporator fan Motors for Walk-in coolers	0.00	0.00	0.05	

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
ECM Evaporator fan Motors for Walk-in coolers	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.294 /kWh

Incentive Unit: $ 0.147 /kWh

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Variable compressor up to 75 HP

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: Compressor

Measure Sub Type: Variable compressor up to 75 HP

Program: Energy Initiative

Measure Description

The installation of oil flooded, rotary screw compressors with Variable Displacement 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 Displacement 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: 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
Variable compressor up to 75 HP	Calc	Calc					

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

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Variable compressor up to 75 HP	13	1.00	1.00		1.41	1.00	1.00	1.05	0.83

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Variable compressor up to 75 HP				

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 $
Variable compressor up to 75 HP			0.06	

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
Variable compressor up to 75 HP	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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VSD compressor up to 75 HP

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: Compressor

Measure Sub Type: VSD compressor up to 75 HP

Program: 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: 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					

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

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
VSD compressor up to 75 HP				

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			0.06	

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	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Zero Loss Drain

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Compressed Air **Measure Type:** Drain **Measure Sub Type:** Zero Loss Drain

Program: 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: 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					

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Zero Loss Drain				

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			0.06	

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	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Custom Compressed Air

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Custom **Measure Type:** Compressed Air **Measure Sub Type:** Compressed Air

Program: 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			Calc	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom Compressed Air	mult	1.00	1.00		0.93	1.00	1.04	Custom	Custom

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom Compressed Air				

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 (2010). Sample Design and Impact Evaluation Analysis of 2009 Custom Program. Prepared for National Grid; Table 17.

RRsp Source: KEMA (2010). Sample Design and Impact Evaluation Analysis of 2009 Custom Program. Prepared for National Grid; Table 17.

RRwp Source: KEMA (2010). Sample Design and Impact Evaluation Analysis of 2009 Custom Program. Prepared for National Grid; Table 17.

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	

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	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.33 /kWh

Incentive Unit: $ 0.16 /kWh

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Variable compressor up to 25 HP

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: Compressor

Measure Sub Type: Variable compressor up to 25 HP

Program: Energy Initiative

Measure Description

The installation of oil flooded, rotary screw compressors with Variable Displacement 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 Displacement 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: 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
Variable compressor up to 25 HP	Calc	Calc					

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

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Variable compressor up to 25 HP	13	1.00	1.00		1.41	1.00	1.00	1.05	0.83

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Variable compressor up to 25 HP				

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 $
Variable compressor up to 25 HP			0.06	

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
Variable compressor up to 25 HP	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Custom lighting

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Custom **Measure Type:** Lighting **Measure Sub Type:** Lighting

Program: 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: 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			Calc	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom lighting	mult	1.00	1.00		0.92	1.11	0.79	Custom	Custom

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom lighting				

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 (2013). Impact Evaluation of 2011 Rhode Island Custom Lighting Installations. Prepared for National Grid.

RRsp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Custom Lighting Installations. Prepared for National Grid.

RRwp Source: KEMA (2013). Impact Evaluation of 2011 Rhode Island Custom Lighting Installations. 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 lighting	0.00	0.00	0.06	

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	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.33 /kWh

Incentive Unit: $ 0.16 /kWh

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Novelty cooler shutoff

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Refrigeration

Measure Type: Controls

Measure Sub Type: Novelty Cooler Control

Program: Energy Initiative

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: 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 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

Electric kWh Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

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Energy Impact Factors

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		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Novelty cooler shutoff				

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 $
Novelty cooler shutoff	0.00	0.00	0.05	

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
Novelty cooler shutoff	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.294 /kWh

Incentive Unit: $ 0.147 /kWh

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Case ECMs

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: Refrigeration | **Measure Type:** Motors | **Measure Sub Type:** ECM

Program: Energy Initiative

Measure Description

Installation of various sizes of electronically commutated motors (ECMs) in walk-in coolers and freezers to replace existing evaporator fan motors.

Baseline Description

The baseline efficiency case is an existing case motor.

Savings principle

The high efficiency case is the replacement of an existing case 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_motor × LRF × Hours × (1 + RefrigEff × (Btu/hr per kW) / (Btu/hr per ton))

Gross kW = Gross kWh / Hours

Where:

kW_motor = Metered load of existing case motor: site-specific

LRF = Load reduction factor: 53% when shaded pole motors are replaced, 29% when PSC motors are replaced

Hours = Average runtime of case motors; Estimate based on NRM field experience.

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: Hours are the annual operating hours of the case motors. Hours Note: Hours are the annual operating hours of the case motors.

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Case ECMs	Calc	Calc	0.00			0.00	0.00

Electric kWh Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Case ECMs	15	1.00	1.00		1.00	1.00	1.00	0.87	0.51

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Case ECMs				

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: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

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). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

CFwp Source: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Case ECMs	0.00	0.00	0.05	

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
Case ECMs	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.294 /kWh

Incentive Unit: $ 0.147 /kWh

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Low pressure drop filter

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Compressed Air

Measure Type: Filter

Measure Sub Type: Low pressure drop filter

Program: 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 × HP_compressor × (kW per HP) × %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: 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					

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

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low pressure drop filter				

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			0.06	

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	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.23 /kWh

Incentive Unit: $ 0.17 /kWh

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Custom Refrigeration

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Refrigeration **Measure Type:** Custom **Measure Sub Type:** Refrigeration

Program: 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			Calc	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom Refrigeration	mult	1.00	1.00		1.00	1.14	1.17	Custom	Custom

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom Refrigeration				

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: DNV GL (2014) impact Evaluation of Rhode Island Custom Refrigeration, Motor, and Other Measures

RRsp Source: DNV GL (2014) impact Evaluation of Rhode Island Custom Refrigeration, Motor, and Other Measures

RRwp Source: DNV GL (2014) impact Evaluation of Rhode Island Custom Refrigeration, Motor, and Other Measures

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	

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	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.48 /kWh

Incentive Unit: $ 0.24 /kWh

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Custom Motor

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Custom **Measure Type:** Motor **Measure Sub Type:** Motor

Program: 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			Calc	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom Motor	mult	1.00	1.00		1.00	1.14	1.17	Custom	Custom

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom Motor				

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: DNV GL (2014) impact Evaluation of Rhode Island Custom Refrigeration, Motor, and Other Measures

RRsp Source: DNV GL (2014) impact Evaluation of Rhode Island Custom Refrigeration, Motor, and Other Measures

RRwp Source: DNV GL (2014) impact Evaluation of Rhode Island Custom Refrigeration, Motor, and Other Measures

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	

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 Motor	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.33 /kWh

Incentive Unit: $ 0.16 /kWh

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Evaporator fan control

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: Refrigeration | **Measure Type:** Controls | **Measure Sub Type:** Fan Control

Program: Energy Initiative

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. Electronic controls allow less fluctuation in temperature, thereby creating savings.

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 × %OFF × (Hours per year) × (1 + RefrigEff × (Btu/hr per kW) / (Btu/hr per ton)) + [kW_cp × Hours_cp + kW_fan × (Hours per year) × (1-%OFF)] × %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: 4072 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
Evaporator fan control	Calc	Calc	0.00			0.00	0.00

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Electric kWh Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Evaporator fan control	10	1.00	1.00		0.58	1.00	1.00	0.23	0.84

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Evaporator fan control				

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: HEC, Inc. (1996). Analysis of Savings from Walk-In Cooler Air Economizers and Evaporator Fan Controls. Prepared for NEPSCo.

RRsp Source: HEC, Inc. (1996). Analysis of Savings from Walk-In Cooler Air Economizers and Evaporator Fan Controls. Prepared for NEPSCo.

RRwp Source: HEC, Inc. (1996). Analysis of Savings from Walk-In 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 $
Evaporator fan control	0.00	0.00	0.05	

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
Evaporator fan control	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

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Gross Measure TRC unit: $ 0.294 /kWh

Incentive Unit: $ 0.147 /kWh

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Door heater control

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Refrigeration

Measure Type: Controls

Measure Sub Type: Door Heater Control

Program: Energy Initiative

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 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 measuring the ambient humidity and temperature of the store, calculating the dew point, and using pulse width modulation (PWM) to control the anti-sweat heater based on specific algorithms for freezer and cooler doors. Door temperature is typically maintained about 5 degrees Fahrenheit above the store air dew point temperature with the heaters operating at 80% (adjustable).

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: 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). 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

Electric kWh Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

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Energy Impact Factors

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		1.00	1.00	1.00	0.50	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Door heater control				

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 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 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 $
Door heater control	0.00	0.00	0.05	

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
Door heater control	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.294 /kWh

Incentive Unit: $ 0.147 /kWh

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Defrost control

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Refrigeration **Measure Type:** Controls **Measure Sub Type:** Defrost Control

Program: Energy Initiative

Measure Description

A control mechanism to skip defrost cycles when defrost is unnecessary.

Baseline Description

The baseline efficiency case is an evaporator fan electric defrost system that uses a time clock mechanism to initiate defrost.

Savings principle

The high efficiency case is an evaporator fan defrost system with electric defrost controls.

Savings Method

Calculated using site-specific inputs

Unit

Installed defrost controls in existing cooler/freezer.

Savings equation

Gross kWh = kW_Defrost × DRF × Hours × (1 + RefrigEff × (Btu/hr per kW) / (Btu/hr per ton))

Gross kW = Gross kWh / Hours

Where:

kW_Defrost = Load of electric defrost: site-specific

DRF = Defrost reduction factor- percent reduction in defrosts required peryear: 35%

Hours = Number of hours defrost occurs over a year without the defrost controls

1.6 RefrigEff = Efficiency of typical refrigeration system (kW/ton); Estimate based on NRM field experience.

3413 Btu/hr per kW = Conversion factor

12 kBtu/hr per ton = Conversion factor

Hours: The number of defrost cycles is estimated to decrease by 35% from an average number of defrost cycles of 1460 defrosts/year at 40 minutes each for a total of 973 hours/year. The number of defrost cycles with the defrost controls is 949 cycles/year, or 633 Hours Note: The number of defrost cycles is estimated to decrease by 35% from an average number of defrost cycles of 1460 defrosts/year at 40 minutes each for a total of 973 hours/year. The number of defrost cycles with the defrost controls is 949 cycles/year, or 633, 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
Defrost control	Calc	Calc	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
Defrost control	10	1.00	1.00		1.00	1.00	1.00	1.00	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Defrost control				

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 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 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 $
Defrost control	0.00	0.00	0.05	

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
Defrost control	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.294 /kWh

Incentive Unit: $ 0.147 /kWh

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Custom process

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Custom **Measure Type:** Process **Measure Sub Type:** Process

Program: 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: 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			Calc	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom process	mult	1.00	1.00		0.75	1.00	1.04	Custom	Custom

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom process				

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: DNV GL 2017, Impact Evaluation of 2013 Custom Process Installations

RRsp Source: KEMA (2010). Sample Design and Impact Evaluation Analysis of 2009 Custom Program. Prepared for National Grid; Table 17.

RRwp Source: KEMA (2010). Sample Design and Impact Evaluation Analysis of 2009 Custom Program. Prepared for National Grid; Table 17.

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	

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	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.33 /kWh

Incentive Unit: $ 0.16 /kWh

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Custom Other

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Custom **Measure Type:** Other **Measure Sub Type:** Other

Program: 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			Calc	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom Other	mult	1.00	1.00		1.00	1.14	1.17	Custom	Custom

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom Other				

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: DNV GL (2014) impact Evaluation of Rhode Island Custom Refrigeration, Motor, and Other Measures

RRsp Source: DNV GL (2014) impact Evaluation of Rhode Island Custom Refrigeration, Motor, and Other Measures

RRwp Source: DNV GL (2014) impact Evaluation of Rhode Island Custom Refrigeration, Motor, and Other Measures

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	

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	0.16	0.00	0.00	0.84

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.33 /kWh

Incentive Unit: $ 0.16 /kWh

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Door heater control

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Refrigeration

Measure Type: Controls

Measure Sub Type: Door Heater Control

Program: 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 andcooler 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: 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

Electric kWh Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

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Energy Impact Factors

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		1.00	1.00	1.00	0.50	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Door heater control				

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 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 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 $
Door heater control	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Door heater control	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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VENDING MACHINES

Sector: C&I | **Fuel:** Electric | **Program Type:** Prescriptive

Measure Category: Refrigeration | **Measure Type:** Controls | **Measure Sub Type:** Vending Miser

Program: 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: 8760 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	1612.00	0.18	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.

Energy Impact Factors

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
VENDING MACHINES			0.33	0.33

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
VENDING MACHINES	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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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: 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	1185.00	0.20	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	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low-Flow Showerhead			0.33	0.33

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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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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Water Heating measures - Prescriptive

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Water Heating **Measure Type:** Flow Control **Measure Sub Type:** DHW

Program: 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 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
Water Heating measures - Prescriptive	Calc	Calc	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 Heating measures - Prescriptive	7	1.00	1.00		1.00	1.00	1.00	0.52	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Water Heating measures - Prescriptive			0.33	0.33

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 $
Water Heating measures - Prescriptive	calc	calc		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Water Heating measures - Prescriptive	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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LED CASE REFRIG - PRESCRIPTIVE

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Refrigeration

Measure Type: Refrigeration Lighting

Measure Sub Type: Refrigerator Case LED

Program: 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 × Watts_base × Hours_base) - SUM(QTY_ee × kW_ee × Hours_ee)] × (1 + EffRefrig × (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: 8760 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
LED CASE REFRIG - PRESCRIPTIVE	Calc	Calc	0.00			0.00	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED CASE REFRIG - PRESCRIPTIVE	7	1.00	1.00		0.94	1.07	1.15	0.99	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED CASE REFRIG - PRESCRIPTIVE			0.33	0.33

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: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

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 $
LED CASE REFRIG - PRESCRIPTIVE	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED CASE REFRIG - PRESCRIPTIVE	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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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: 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: 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

Electric kWh Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

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Energy Impact Factors

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		1.00	1.00	1.00	0.87	0.51

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ECM evaporator fan motors (walk–in coolers/ freezers)				

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: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
ECM evaporator fan motors (walk–in coolers/ freezers)	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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Novelty cooler shutoff

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Refrigeration

Measure Type: Controls

Measure Sub Type: Novelty Cooler Control

Program: 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: 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

Electric kWh Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

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Energy Impact Factors

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		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Novelty cooler shutoff				

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 $
Novelty cooler shutoff	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Novelty cooler shutoff	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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Fan Control

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: Refrigeration | **Measure Type:** Controls | **Measure Sub Type:** Fan Control

Program: 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 × %OFF × (Hours per year) × (1 + RefrigEff × (Btu/hr per kW) / (Btu/hr per ton)) + [kW_cp × Hours_cp + kW_fan × (Hours per year) × (1-%OFF)] × %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: 4072 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

Electric kWh Note: Calculation assumptions based off of NRM field experience and data

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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		0.58	1.00	1.00	0.23	0.84

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Fan Control				

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: HEC, Inc. (1996). Analysis of Savings from Walkiin Cooler Air Economizers and Evaporator Fan Controls. Prepared for NEPSco.

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Fan Control	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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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: 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 andcooler 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: 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

Electric kWh Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

Electric kW Note: Algorith Inputs are based field experience and evaluation from National Resource Management. Supported by Select Energy (2004). Cooler Control Spreadsheet

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Energy Impact Factors

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		1.00	1.00	1.00	0.50	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Freezer Door Heater Controls				

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 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 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 $
Freezer Door Heater Controls	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Freezer Door Heater Controls	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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Glass front refrigerated coolers

Sector: C&I | **Fuel:** Electric | **Program Type:** Prescriptive

Measure Category: Refrigeration | **Measure Type:** Controls | **Measure Sub Type:** Vending Miser

Program: Small Customers under 200kW

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 × 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: 8760 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	1208.00	0.14	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.

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Glass front refrigerated coolers				

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Glass front refrigerated coolers	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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Custom other

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: Custom | **Measure Type:** Other | **Measure Sub Type:** Other

Program: 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: 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			Calc	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom other	mult	1.00	1.00		0.81	0.77	0.53	Custom	Custom

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom other				

ISR Note: 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: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

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 other	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Custom other	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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LED Exit Signs

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Signage **Measure Sub Type:** Exit Sign LED

Program: 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: 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

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Exit Signs	13	1.00	1.00		1.03	0.98	0.98	0.62	0.44

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Exit Signs			0.33	0.33

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: 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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Exit Signs	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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Lighting systems

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Efficient Lighting

Program: 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: 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			Calc	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Lighting systems	11	1.00	1.00		1.05	0.92	0.98	0.49	0.60

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Lighting systems				

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Lighting systems	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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LED EXTERIOR - HW

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Exterior **Measure Sub Type:** LED Fixture

Program: 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: 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

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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED EXTERIOR - HW	13	1.00	1.00		1.05	0.92	0.98	0.11	0.91

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED EXTERIOR - HW			0.33	0.33

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 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: DNV GL (2015) RI Small Business EE Program Prescriptive Lighting Study

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED EXTERIOR - HW	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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OCCUPANCY SENSORS

Sector: C&I

Fuel: Electric

Program Type: Custom

Measure Category: Lighting

Measure Type: Controls

Measure Sub Type: Occupancy Sensor

Program: 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: 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	0.00			0.00	0.00

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
OCCUPANCY SENSORS			0.33	0.33

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 (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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
OCCUPANCY SENSORS	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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PROGRAMMABLE THERMOSTATS

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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

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		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
PROGRAMMABLE THERMOSTATS			0.33	0.33

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 $
PROGRAMMABLE THERMOSTATS	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
PROGRAMMABLE THERMOSTATS	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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CUSTOM REFRIGERATION

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: Custom | **Measure Type:** Refrigeration | **Measure Sub Type:** Refrigeration

Program: 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: 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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CUSTOM REFRIGERATION	13	1.00	1.00		1.60	1.49	0.69	1.49	0.69

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CUSTOM REFRIGERATION			0.33	0.33

ISR Note: 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: RLW Analytics (2007). Small Business Services Custom Measure Impact Evaluation. Prepared for National Grid.

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
CUSTOM REFRIGERATION	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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TIMECLOCKS

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Controls **Measure Sub Type:** Timeclocks

Program: 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	0.00			0.00	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
TIMECLOCKS	9	1.00	1.00		1.00	0.94	0.94	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
TIMECLOCKS			0.33	0.33

ISR Note: 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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
TIMECLOCKS	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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PHOTOCELLS

Sector: C&I **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Controls **Measure Sub Type:** Photocells

Program: 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

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
PHOTOCELLS	Calc	Calc	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
PHOTOCELLS	9	1.00	1.00		1.00	0.94	0.94	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
PHOTOCELLS			0.33	0.33

ISR Note: 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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
PHOTOCELLS	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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Faucet Aerator

Sector: C&I **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** Flow Control **Measure Sub Type:** Faucet Aerator

Program: 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	387.40	0.07	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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Faucet Aerator			0.33	0.33

Measure life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

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ISR Note: 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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Faucet Aerator	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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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: 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	2598.00	0.68	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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Pre-Rinse Spray Valve			0.33	0.33

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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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pre-Rinse Spray Valve	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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CUSTOM LIGHTING

Sector: C&I | **Fuel:** Electric | **Program Type:** Custom

Measure Category: Custom | **Measure Type:** Lighting | **Measure Sub Type:** Lighting

Program: 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: 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

Energy Impact Factors

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	0.92	0.98	0.49	0.60

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CUSTOM LIGHTING			0.33	0.33

ISR Note: 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 $
CUSTOM LIGHTING	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
CUSTOM LIGHTING	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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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: Small Customers under 200kW

Measure Description

Controls significantly reduce the energy consumption of vending machine lighting by powering down lighting during periods of inactivity. This measure applies to non-refrigerated snack vending machines. This measure does not apply to ENERGY STAR® qualifiedvending machines, as they already have built-in controls.

Baseline Description

The baseline efficiency case is a standard efficiency non-refrigerated snack vending machine without a control system capable of powering down lighting during periods of inactivity.

Savings principle

The high efficiency case is a standard efficiency non-refrigerated snack vending machine with a control system capable of powering down lighting 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: 8760 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	343.00	0.04	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.

Energy Impact Factors

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Non-refrigerated snack vending machine			0.33	0.33

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Non-refrigerated snack vending machine	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.74 /kWh

Incentive Unit: $ 0.52 /kWh

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AERATOR Elec

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** Flow Control **Measure Sub Type:** Faucet Aerator

Program: 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

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	97.00	0.02					

Electric kWh Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. Prepared for Massachusetts Program Administrators.

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
AERATOR Elec	7	1.00	1.00		0.86	1.00	1.00	0.58	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
AERATOR Elec	0.40	0.33	0.15	0.13

ISR Note: 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 $
AERATOR Elec	332.00		0.01	0.01

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.

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
AERATOR Elec	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Dwelling Int Reflector

Sector: Income Eligible

Fuel: Electric

Program Type: Custom

Measure Category: Lighting

Measure Type: Interior

Measure Sub Type: Dwelling Reflector

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int Reflector	6	0.88	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dwelling Int Reflector	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Dwelling Int Reflector	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dwelling Int Reflector	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Common Int Reflector

Sector: Income Eligible

Fuel: Electric

Program Type: Custom

Measure Category: Lighting

Measure Type: Interior

Measure Sub Type: Common Reflector

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Int Reflector	6	1.00	1.00		1.00	1.00	1.00	0.17	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Int Reflector	0.36	0.36	0.13	0.15

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Common Int Reflector	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Int Reflector	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Dwelling Int LED Fixture

Sector: Income Eligible **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Dwelling LED

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int LED Fixture	5	0.88	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dwelling Int LED Fixture	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Dwelling Int LED Fixture	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dwelling Int LED Fixture	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Common Int LED Fixture

Sector: Income Eligible **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Common LED

Program: 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 halgoen 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					

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.

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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	5	1.00	1.00		1.00	1.00	1.00	0.17	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Int LED Fixture	0.36	0.36	0.13	0.15

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Common Int LED Fixture	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Int LED Fixture	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Common Int LED Bulbs

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Common LED

Program: 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	304.20		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
Common Int LED Bulbs	5	1.00	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Int LED Bulbs	0.43	0.24	0.21	0.12

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Common Int LED Bulbs	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Int LED Bulbs	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Participant (NEB)

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Participant **Measure Type:** NEI **Measure Sub Type:** Low Income

Program: 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

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)							

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	0.77	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Participant (NEB)	0.34	0.33	0.16	0.17

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 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.

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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 $
Participant (NEB)			7.70	0.01

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.

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.

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Participant (NEB)	0.00	0.00	0.00	1.00

Gross Measure TRC unit: $758/participant

Incentive Unit: $758/participant

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Smart Strips

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Plug Load **Measure Type:** Smart Strips **Measure Sub Type:** Smart Strip

Program: 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: 8760 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	75.10	0.00	0.00			0.00	0.00

Electric kWh Source: NEEP (2012). Advanced Power Strips Deemed Savings Methodology.

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
Smart Strips	6	1.00	1.00		0.86	1.00	1.00	0.77	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Smart Strips	0.34	0.33	0.16	0.17

Measure life Source: Nexus Market Research and RLW Analytics (2008). Residential Lighting Measure Life Study. Prepared for New England Residential Lighting Program Sponsors.

ISR Note: 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: 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		0.01	0.01

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.

Annual $ Note: NEI per kWh

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%.

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Vending Miser

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Vending Miser **Measure Type:** Vending Miser **Measure Sub Type:** Vending Miser

Program: 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: 8760 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	1612.00	0.18	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.

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	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Vending Miser	0.17	0.50	0.08	0.25

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 Miser	0.00		0.01	0.01

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.

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Vending Miser	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Common Int EISA Exempt

Sector: Income Eligible **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Common EISA

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Int EISA Exempt	9	1.00	1.00		1.00	1.00	1.00	0.17	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Int EISA Exempt	0.36	0.36	0.13	0.15

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Common Int EISA Exempt	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Int EISA Exempt	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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: 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		0.00				1.07	

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
SHOWERHEAD Oil	7	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
SHOWERHEAD Oil	0.00	0.00	0.00	0.00

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Measure life Source: Massachusetts common assumption

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 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	2165.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
SHOWERHEAD Oil	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Common Ext LED Fixture

Sector: Income Eligible **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Common LED

Program: 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 is the existing lighting hours of use.

Savings principle

The high efficiency case is lights thaare 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Ext LED Fixture	5	1.00	1.00		1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Ext LED Fixture	0.20	0.54	0.06	0.20

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Common Ext LED Fixture	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Ext LED Fixture	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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: 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	217.00	0.04				0.00	

Electric kWh Source: The Cadmus Group (2015). Massachusetts Low-Income Multifamily Initiative Impact Evaluation. Prepared for the Massachusetts Electric and Gas Program Administrators.

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

Oil MMBtu Source: The Cadmus Group (2015). Massachusetts Low-Income Multifamily Initiative Impact Evaluation. Prepared for the Massachusetts Electric and Gas Program Administrators.

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
SHOWERHEAD Elec	7	1.00	1.00		0.86	1.00	1.00	0.58	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
SHOWERHEAD Elec	0.40	0.33	0.15	0.13

Measure life Source: Massachusetts common assumption

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 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 Elec	2165.00		0.01	0.01

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.

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
SHOWERHEAD Elec	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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: 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

Calculated using site-specific inputs

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	335.00	0.06					

Electric kWh Source: National Grid (2014). Review of ShowerStart evolve.

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
TSV Showerhead Elec	7	1.00	1.00		0.86	1.00	1.00	0.58	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
TSV Showerhead Elec	0.40	0.33	0.15	0.13

Measure life Source: Massachusetts common assumption

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 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 Elec	2165.00		0.58	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
TSV Showerhead Elec	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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: 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

Calculated using site-specific inputs

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	129.00	0.02				0.10	

Electric kWh Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. Prepared for Massachusetts Program Administrators.

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
Pipe Wrap DHW Elec	15	1.00	1.00		0.86	1.00	1.00	0.58	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Pipe Wrap DHW Elec	0.40	0.33	0.14	0.13

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 Note: 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 Elec	0.00		6.61	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pipe Wrap DHW Elec	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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: 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

Calculated using site-specific inputs

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						1.14	

Oil MMBtu Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. 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
Pipe Wrap DHW Oil	15	1.00	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak 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 Note: 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		6.61	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pipe Wrap DHW Oil	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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: 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				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
Tankless WH Oil	20	1.00	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak 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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Tankless WH Oil	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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: 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				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 Oil	13	1.00	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak 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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Standalone WH Oil	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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: 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				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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak 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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Standalone WH Other	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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AERATOR Oil

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** Flow Control **Measure Sub Type:** Faucet Aerator

Program: 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 Oil		0.00				0.28	

Oil MMBtu Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. 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
AERATOR Oil	7	1.00	1.00		0.86	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
AERATOR 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 $
AERATOR Oil	332.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
AERATOR Oil	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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: 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: 4644. 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					

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.

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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	0.41	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
INSULATION ELEC WITH AC	0.45	0.44	0.06	0.05

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 ELEC WITH AC	0.00		52.47	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
INSULATION ELEC WITH AC	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Refrigerator

Sector: Income Eligible **Fuel:** Electric **Program Type:** Custom

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

Program: 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: 8760 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

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.

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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		0.86	1.00	1.00	1.00	0.86

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Refrigerator				

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: 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 $
Refrigerator	0.00		0.01	0.01

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.

Annual $ Note: NEI per kWh

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%.

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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AIR SEALING OIL

Sector: Income Eligible **Fuel:** Electric **Program Type:** Custom

Measure Category: Building Shell **Measure Type:** Air Sealing **Measure Sub Type:** Oil

Program: 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 air-tightness 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: 4644. 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				3.02	

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.

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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 OIL	15	1.00	1.00		1.00	1.00	1.00	1.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
AIR SEALING OIL	0.01	0.04	0.53	0.42

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 $
AIR SEALING OIL	0.00		66.94	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
AIR SEALING OIL	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Dwelling Int LED Bulbs

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Dwelling LED

Program: 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	41.00		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
Dwelling Int LED Bulbs	5	0.88	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dwelling Int LED Bulbs	0.43	0.24	0.21	0.12

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Dwelling Int LED Bulbs	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dwelling Int LED Bulbs	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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INSULATION OIL

Sector: Income Eligible **Fuel:** Electric **Program Type:** Custom

Measure Category: Building Shell **Measure Type:** Insulation **Measure Sub Type:** Oil

Program: 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: 4644. 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				7.17	

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.

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
INSULATION OIL	0.01	0.04	0.53	0.42

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		52.47	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
INSULATION OIL	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Dwelling Int EISA Exempt

Sector: Income Eligible **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Dwelling EISA

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int EISA Exempt	9	0.88	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dwelling Int EISA Exempt	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Dwelling Int EISA Exempt	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dwelling Int EISA Exempt	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Custom

Sector: Income Eligible **Fuel:** Electric **Program Type:** Custom

Measure Category: Custom **Measure Type:** Multi-family **Measure Sub Type:** Low Income

Program: Low Income Retrofit Multifamily

Measure Description

Vendors install a variety of measures at multifamily facilities. Measures include

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		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.

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom	mult	1.00	1.00		0.86	1.00	1.00	Custo m	Custo m

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom				

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ISR Note: 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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Custom			0.01	0.01

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.

Annual $ Note: NEI per kWh

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Custom	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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THERMOSTAT Elec with AC

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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	257.00	0.13					

Electric kWh Source: The Cadmus Group (2015). Massachusetts Low-Income Multifamily Initiative Impact Evaluation. Prepared for the Massachusetts Electric and Gas Program Administrators.

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
THERMOSTAT Elec with AC	10	1.00	1.00		0.86	1.00	1.00	0.41	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
THERMOSTAT Elec with AC	0.45	0.44	0.06	0.05

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 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 $
THERMOSTAT Elec with AC	0.00		16.02	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
THERMOSTAT Elec with AC	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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THERMOSTAT AC Only

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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	25.00	0.06					

Electric kWh Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. Prepared for Massachusetts Program Administrators.

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
THERMOSTAT AC Only	10	1.00	1.00		0.86	1.00	1.00	1.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
THERMOSTAT AC Only	0.01	0.04	0.53	0.42

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 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 $
THERMOSTAT AC Only	0.00		16.02	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
THERMOSTAT AC Only	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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THERMOSTAT Heat Pump

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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	241.00	0.10					

Electric kWh Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. Prepared for Massachusetts Program Administrators.

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
THERMOSTAT Heat Pump	10	1.00	1.00		0.86	1.00	1.00	0.01	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
THERMOSTAT Heat Pump	0.41	0.55	0.01	0.03

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 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 $
THERMOSTAT Heat Pump	0.00		16.02	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
THERMOSTAT Heat Pump	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Common Ext Reflector

Sector: Income Eligible

Fuel: Electric

Program Type: Custom

Measure Category: Lighting

Measure Type: Exterior

Measure Sub Type: Common Reflector

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Ext Reflector	6	1.00	1.00		1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Ext Reflector	0.20	0.54	0.06	0.20

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Common Ext Reflector	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Ext Reflector	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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: 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 air-tightness 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: 4644. 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					

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.

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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	15	1.00	1.00		1.00	1.00	1.00	0.41	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
AIR SEALING ELEC WITH AC	0.45	0.44	0.06	0.05

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 $
AIR SEALING ELEC WITH AC	0.00		66.94	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
AIR SEALING ELEC WITH AC	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

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Incentive Unit: LI MF Bundled costs (see Participant listing)

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THERMOSTAT OIL

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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		0.00				2.26	

Oil MMBtu Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. 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
THERMOSTAT OIL	10	1.00	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
THERMOSTAT OIL	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 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 $
THERMOSTAT OIL	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
THERMOSTAT OIL	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Dwelling Ext LED Fixture

Sector: Income Eligible **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Exterior **Measure Sub Type:** Dwelling LED

Program: 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 halgoen 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					

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.

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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	5	0.88	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dwelling Ext LED Fixture	0.20	0.54	0.06	0.20

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Dwelling Ext LED Fixture	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dwelling Ext LED Fixture	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Dwelling Ext Reflector

Sector: Income Eligible

Fuel: Electric

Program Type: Custom

Measure Category: Lighting

Measure Type: Exterior

Measure Sub Type: Dwelling Reflector

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Ext Reflector	6	0.88	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dwelling Ext Reflector	0.20	0.54	0.06	0.20

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Dwelling Ext Reflector	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dwelling Ext Reflector	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Pipe Wrap Heating Oil

Sector: Income Eligible **Fuel:** Electric **Program Type:** Custom

Measure Category: HVAC **Measure Type:** Insulation **Measure Sub Type:** Pipe Insulation

Program: 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

Calculated using site-specific inputs

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	Calc	Calc				0.16	

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
Pipe Wrap Heating Oil	15	1.00	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak 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		6.61	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pipe Wrap Heating Oil	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Heating System Retrofit-Boiler

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heating **Measure Sub Type:** Retrofit Boiler

Program: 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		0.00				20.40	

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	20	1.00	1.00		0.86	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating System Retrofit-Boiler	0.00	0.00	0.00	0.00

Measure life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR Qualified Boilers.

ISR Note: 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		123.91	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating System Retrofit-Boiler	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Heating System Retrofit-Furnace

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

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

Program: 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	132.00	0.07				14.30	

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	18	1.00	1.00		0.86	1.00	1.00	0.00	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating System Retrofit-Furnace	0.38	0.62	0.00	0.00

Measure life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR 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 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		123.91	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating System Retrofit-Furnace	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Common Ext LED Bulbs

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Lighting **Measure Type:** Exterior **Measure Sub Type:** Common LED

Program: 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	115.00		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
Common Ext LED Bulbs	5	1.00	1.00		1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Ext LED Bulbs	0.20	0.54	0.06	0.20

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Common Ext LED Bulbs	0.00			

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Ext LED Bulbs	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Weatherization (oil)

Sector: Income Eligible

Fuel: Electric

Program Type: Prescriptive

Measure Category: Building Shell

Measure Type: Insulation & Air sealing

Measure Sub Type: Weatherization

Program: 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 includes increased weatherization insulation levels.

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 × 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)	95.00	0.08	0.00			13.00	

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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

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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	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Weatherization (oil)	0.38	0.62	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: 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 $
Weatherization (oil)			558.21	

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%.

Gross Measure TRC unit: $ 4500 per job

Incentive Unit: $ 4500 per job

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ER propane DHW washer & ele 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: Single Family - Appliance Management

Measure Description

This measure covers the early retirement of an existing inefficient washer & dryer with new energy efficient models.

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

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 annualoperating 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
ER propane DHW washer & ele dryer	327.00	0.05	0.00				1.28

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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

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
ER propane DHW washer & ele dryer	12	1.00	1.00		1.00	1.00	1.00	1.00	0.90

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ER propane DHW washer & ele dryer	0.35	0.31	0.17	0.16

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: 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 $
ER propane DHW washer & ele dryer	4777.00			

Water/Sewer Source: Washer & Dryer savings references

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
ER propane DHW washer & ele dryer	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 725 per measure

Incentive Unit: $ 725 per measure

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Programmable thermostat

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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 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 × 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	251.70	0.18	0.00				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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

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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	1.00	1.00	0.03	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable thermostat	0.38	0.62	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.

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: 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 $
Programmable thermostat			44.53	

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	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 125 per measure

Incentive Unit: $ 125 per measure

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HP Water Heaters

Sector: Income Eligible

Fuel: Electric

Program Type: Prescriptive

Measure Category: Appliances

Measure Type: Heat Pump Water Heaters

Measure Sub Type: Heat Pump Water Heaters

Program: 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	814.00	0.37	0.00			0.00	0.00

Electric kWh 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
HP Water Heaters	10	1.00	1.00		1.00	1.00	1.00	0.47	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
HP Water Heaters	0.36	0.31	0.17	0.16

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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: 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 $
HP Water Heaters			4.64	1.65

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.

One-Time $ 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%.

Gross Measure TRC unit: $ 2300 per measure

Incentive Unit: $ 2300 per measure

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Weatherization (electric)

Sector: Income Eligible

Fuel: Electric

Program Type: Prescriptive

Measure Category: Building Shell

Measure Type: Insulation & Air sealing

Measure Sub Type: Weatherization

Program: 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 includes increased weatherization insulation levels.

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 × 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)	3187.00	1.70	0.00				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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

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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	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Weatherization (electric)	0.38	0.62	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: 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 $
Weatherization (electric)			558.21	

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%.

Gross Measure TRC unit: $ 4500 per job

Incentive Unit: $ 4500 per job

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Replacement Refrigerator

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

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

Program: Single Family - Appliance Management

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

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 annualoperating hours.

Hours: 8760 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	467.00	0.06	0.00				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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
Replacement Refrigerator	19	1.00	1.00		1.00	1.00	1.00	1.00	0.93

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Replacement Refrigerator	0.31	0.34	0.16	0.19

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: 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 $
Replacement Refrigerator			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.

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.

Annual $ 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%.

Gross Measure TRC unit: $ 1100 per measure

Incentive Unit: $ 1100 per measure

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Appliance Removal

Sector: Income Eligible

Fuel: Electric

Program Type: Prescriptive

Measure Category: Appliances

Measure Type: Recycling

Measure Sub Type: Refrigerator Recycling

Program: Single Family - Appliance Management

Measure Description

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

Baseline Description

For Top Ten® and Most Efficient® refrigerators, the baseline is a 50% mix of available Energy Star® and Federal standard compliant refrigerators. For Energy Star® refrigerators, the baseline is a refrigerator that meets Federal standards.

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 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	1036.00	0.13	0.00			0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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
Appliance Removal	5	1.00	1.00		1.00	1.00	1.00	1.00	0.93

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Appliance Removal	0.31	0.34	0.16	0.19

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: 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 $
Appliance Removal				

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%.

Gross Measure TRC unit: $ 55 per measure

Incentive Unit: $ 55 per measure

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Replacement Freezer

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Appliances **Measure Type:** Freezers **Measure Sub Type:** Freezer

Program: 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 annualoperating 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	333.00	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: 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
Replacement Freezer	19	1.00	1.00		1.00	1.00	1.00	1.00	0.93

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Replacement Freezer	0.31	0.34	0.16	0.19

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: 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 $
Replacement Freezer		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.

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.

Annual $ 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%.

Gross Measure TRC unit: $ 550 per measure

Incentive Unit: $ 550 per measure

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Dehumidifier Rebate

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Appliances **Measure Type:** Dehumidifiers **Measure Sub Type:** Dehumidifier

Program: Single Family - Appliance Management

Measure Description

The Installation of high efficiency dehumidifiers and the turn-in of existing inefficienct dehumidifyers.

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 dehumidifer

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	1106.00	0.26	0.00			0.00	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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
Dehumidifier Rebate	12	1.00	1.00		1.00	1.00	1.00	0.85	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dehumidifier Rebate	0.02	0.03	0.59	0.36

Measure life Source: Environmental Protection Agency (2002). Life Cycle Cost Estimate for ENERGY STAR Dehumidifiers.

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

CFwp Source: Nexus Market Research and RLW Analytics (2009). Residential Lighting Markdown Impact Evaluation. Prepared for Markdown and Buydown Program Sponsors in CT, MA, RI, and VT.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Dehumidifier Rebate		0.00		

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%.

Gross Measure TRC unit: $ 250 per measure

Incentive Unit: $ 250 per measure

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Programmable Thermostat, Other

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Appliances **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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 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 × 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	11.20	0.00	0.00			0.00	3.38

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Propane MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat, Other	15	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable Thermostat, Other	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: 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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Programmable Thermostat, Other		0.00	44.53	

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%.

Gross Measure TRC unit: $ 125 per measure

Incentive Unit: $ 125 per measure

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Programmable Thermostat, Gas

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Appliances **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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 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 × 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	11.20	0.00	3.38				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Gas Heat MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat, Gas	15	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable Thermostat, Gas	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: 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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Programmable Thermostat, Gas		0.00	44.53	

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%.

Gross Measure TRC unit: $ 125 per measure

Incentive Unit: $ 125 per measure

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LED Bulbs LI

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

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

Program: 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 existing bulbs in the home.

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: 1022. 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 LI	18.00	0.02	0.00				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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
LED Bulbs LI	5	1.00	1.00		1.00	1.00	1.00	0.13	0.16

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Bulbs LI	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

ISR Note: 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: Nexus Market Research and RLW Analytics (2009). Residential Lighting Markdown Impact Evaluation. Prepared for Markdown and Buydown Program Sponsors in CT, MA, RI, and VT.

CFwp Source: Nexus Market Research and RLW Analytics (2009). Residential Lighting Markdown Impact Evaluation. Prepared for Markdown and Buydown Program Sponsors in CT, MA, RI, and VT.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
LED Bulbs LI				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.

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.

Annual $ Note: NEI per unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Bulbs LI	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 9 per measure

Incentive Unit: $ 9 per measure

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Heating system replacement (oil)

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heating **Measure Sub Type:** Efficient Heating

Program: 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 × 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)	10.00	0.01	0.00			8.00	

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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

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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
Heating system replacement (oil)	18	1.00	1.00		1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating system replacement (oil)	0.38	0.62	0.00	0.00

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: 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 replacement (oil)			310.82	

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%.

Gross Measure TRC unit: 5000 per measure

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Incentive Unit: 5000 per measure

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Programmable Thermostat, Oil

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Appliances **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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 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 × 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	8.70	0.00	0.00			3.40	0.00

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Oil MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat, Oil	15	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable Thermostat, Oil	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: 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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Programmable Thermostat, Oil		0.00	44.53	

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%.

Gross Measure TRC unit: $ 125 per measure

Incentive Unit: $ 125 per measure

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Basic Educational Measures

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Whole Home **Measure Type:** Audit **Measure Sub Type:** Educational Kit

Program: 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	21.00	0.03	0.00				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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
Basic Educational Measures	5	1.00	1.00		1.00	1.00	1.00	0.73	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Basic Educational Measures	0.36	0.32	0.16	0.16

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: 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 $
Basic Educational Measures			10.37	

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%.

Gross Measure TRC unit: $ 178 per kit

Incentive Unit: $ 178 per kit

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Minisplit Heat Pumps - Electric Resistance

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Appliances **Measure Type:** Heat Pumps **Measure Sub Type:** Ductless

Program: 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-efficiecny air-source heat pump system for heating and cooling.

Savings equation

Cooling Gross kWh = Qty*deltakWh_cooling

Cooling Gross kW = Qty*deltakW_cooling

Heating Gross MMBtu = Qty * deltaMMBtu_oil

Where:

Qty = Total number of units.

deltakWh_cooling = Average annual cooling kWh reduction per unit.

deltakW_cooling = Average annual cooling kW reduction per unit.

deltaMMBTu_oil = Average annual oil 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	2748.00	0.50	0.00				

Electric kWh Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

Electric kW Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

Energy Impact Factors

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	0.25	0.50

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Minisplit Heat Pumps - Electric Resistance	0.29	0.49	0.12	0.10

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

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	Sewer: Gallons	Annual $	One-time $
Minisplit Heat Pumps - Electric Resistance			310.82	

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%.

Gross Measure TRC unit: $ 4000 per measure

Incentive Unit: $ 4000 per measure

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ER gas DHW washer & 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: Single Family - Appliance Management

Measure Description

This measure covers the early retirement of an existing inefficient washer & dryer with new energy efficient models.

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

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 annualoperating 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
ER gas DHW washer & gas dryer	46.00	0.01	0.00	2.24			

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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

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
ER gas DHW washer & gas dryer	12	1.00	1.00		1.00	1.00	1.00	1.00	0.90

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ER gas DHW washer & gas dryer	0.35	0.31	0.17	0.16

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: 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 $
ER gas DHW washer & gas dryer	4777.00			

Water/Sewer Source: Washer & Dryer savings references

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
ER gas DHW washer & gas dryer	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 725 per measure

Incentive Unit: $ 725 per measure

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ER oil DHW washer & ele 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: Single Family - Appliance Management

Measure Description

This measure covers the early retirement of an existing inefficient washer & dryer with new energy efficient models.

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

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 annualoperating 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
ER oil DHW washer & ele dryer	327.00	0.05	0.00			1.28	

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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

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
ER oil DHW washer & ele dryer	12	1.00	1.00		1.00	1.00	1.00	1.00	0.90

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ER oil DHW washer & ele dryer	0.35	0.31	0.17	0.16

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: 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 $
ER oil DHW washer & ele dryer	4777.00			

Water/Sewer Source: Washer & Dryer savings references

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
ER oil DHW washer & ele dryer	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 725 per measure

Incentive Unit: $ 725 per measure

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Window AC Replacements

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Cooling **Measure Sub Type:** Window AC

Program: 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: . 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	71.00	0.29	0.00				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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
Window AC Replacements	12	1.00	1.00		1.00	1.00	1.00	1.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Window AC Replacements	0.01	0.05	0.60	0.34

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: 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 $
Window AC Replacements			49.50	

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%.

Gross Measure TRC unit: $ 330 per measure

Incentive Unit: $ 330 per measure

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ER ele DHW washer & 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: Single Family - Appliance Management

Measure Description

This measure covers the early retirement of an existing inefficient washer & dryer with new energy efficient models.

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

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 annualoperating 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
ER ele DHW washer & gas dryer	307.00	0.05	0.00	0.96			

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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

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
ER ele DHW washer & gas dryer	12	1.00	1.00		1.00	1.00	1.00	1.00	0.90

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ER ele DHW washer & gas dryer	0.35	0.31	0.17	0.16

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: 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 $
ER ele DHW washer & gas dryer	4777.00			

Water/Sewer Source: Washer & Dryer savings references

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
ER ele DHW washer & gas dryer	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 725 per measure

Incentive Unit: $ 725 per measure

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ER ele DHW washer & ele 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: Single Family - Appliance Management

Measure Description

This measure covers the early retirement of an existing inefficient washer & dryer with new energy efficient models.

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

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 annualoperating 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
ER ele DHW washer & ele dryer	588.00	0.09	0.00				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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
ER ele DHW washer & ele dryer	12	1.00	1.00		1.00	1.00	1.00	1.00	0.90

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ER ele DHW washer & ele dryer	0.35	0.31	0.17	0.16

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: 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 $
ER ele DHW washer & ele dryer	4777.00			

Water/Sewer Source: Washer & Dryer savings references

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
ER ele DHW washer & ele dryer	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 725 per measure

Incentive Unit: $ 725 per measure

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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: 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	872.00	0.19	0.00				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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
Waterbed mattress replacement	10	1.00	1.00		1.00	1.00	1.00	0.73	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Waterbed mattress replacement	0.36	0.32	0.16	0.16

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: 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 $
Waterbed mattress replacement				

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%.

Gross Measure TRC unit: $ 600 per measure

Incentive Unit: $ 600 per measure

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DHWater Measure (oil)

Sector: Income Eligible

Fuel: Electric

Program Type: Prescriptive

Measure Category: Water Heating

Measure Type: Flow Control

Measure Sub Type: Flow Control Measures

Program: Single Family - Appliance Management

Measure Description

DHW measures include 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

Gross kWh = Qty × 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
DHWater Measure (oil)	0.00	0.00	0.00			0.90	

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Oil MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
DHWater Measure (oil)	7	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
DHWater Measure (oil)				

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: 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 $
DHWater Measure (oil)	4028.00			1.72

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.

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.

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.

Annual $ Note: NEI per unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
DHWater Measure (oil)	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 10 per measure

Incentive Unit: $ 10 per measure

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DHWater 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: Single Family - Appliance Management

Measure Description

DHW measures include 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

Gross kWh = Qty × 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
DHWater Measure (gas)	0.00	0.00	0.83				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Gas Heat MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
DHWater Measure (gas)	7	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
DHWater Measure (gas)				

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: 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 $
DHWater Measure (gas)	4028.00			1.72

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.

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.

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.

Annual $ Note: NEI per unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
DHWater Measure (gas)	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 10 per measure

Incentive Unit: $ 10 per measure

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DHWater 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: Single Family - Appliance Management

Measure Description

DHW measures include 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

Gross kWh = Qty × 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
DHWater Measure (electric)	160.00	0.02	0.00				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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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
DHWater Measure (electric)	7	1.00	1.00		1.00	1.00	1.00	1.00	0.94

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
DHWater Measure (electric)	0.36	0.31	0.17	0.16

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: 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 $
DHWater Measure (electric)	4028.00			1.72

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.

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.

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.

Annual $ Note: NEI per unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
DHWater Measure (electric)	0.00	0.00	0.00	1.00

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

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Gross Measure TRC unit: $ 10 per measure

Incentive Unit: $ 10 per measure

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Minisplit Heat Pumps - Oil Fuel Switching

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Appliances **Measure Type:** Heat Pumps **Measure Sub Type:** Ductless

Program: Single Family - Appliance Management

Measure Description

The purchase and installation of high efficiency mini-split heat pump system rather than the purchase of a standard efficiency oil boiler or to replace a standard efficiency oil boiler.

Baseline Description

The baseline efficiency case for heating is a residential oil boiler with 82 AFUE.

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-efficiecny 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 - Oil Fuel Switching	126.00	0.50	0.00			17.43	

Electric kWh Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

Electric kW Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

Oil MMBtu Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Minisplit Heat Pumps - Oil Fuel Switching	18	1.00	1.00		1.00	1.00	1.00	0.25	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Minisplit Heat Pumps - Oil Fuel Switching	0.00	0.00	0.55	0.45

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

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	Sewer: Gallons	Annual $	One-time $
Minisplit Heat Pumps - Oil Fuel Switching				-1960.96

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Minisplit Heat Pumps - Oil Fuel Switching	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 4000 per measure

Incentive Unit: $ 4000 per measure

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Smart Strips

Sector: Income Eligible **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Plug Load **Measure Type:** Smart Strips **Measure Sub Type:** Smart Strip

Program: 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

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: 8760 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	75.00	0.02	0.00				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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
Smart Strips	5	1.00	1.00		1.00	1.00	1.00	0.73	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Smart Strips	0.36	0.32	0.16	0.16

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 rate is 100% since gross savings values are based on evaluation results.

CFsp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Smart Strips				

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%.

Gross Measure TRC unit: $ 20 per measure

Incentive Unit: $ 20 per measure

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ER gas DHW washer & ele 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: Single Family - Appliance Management

Measure Description

This measure covers the early retirement of an existing inefficient washer & dryer with new energy efficient models.

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

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 annualoperating 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
ER gas DHW washer & ele dryer	327.00	0.05	0.00	1.28			

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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

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
ER gas DHW washer & ele dryer	12	1.00	1.00		1.00	1.00	1.00	1.00	0.90

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ER gas DHW washer & ele dryer	0.35	0.31	0.17	0.16

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: 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 $
ER gas DHW washer & ele dryer	4777.00			

Water/Sewer Source: Washer & Dryer savings references

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
ER gas DHW washer & ele dryer	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 725 per measure

Incentive Unit: $ 725 per measure

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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: 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

A control group of homes that does not receive Home Energy Reports

Savings principle

A home that receives Home Energy Reports.

Savings Method

Calculated as average per household savings

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
New Movers dual fuel	Calc	Calc				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
New Movers dual fuel	1	1.00	1.00		0.88	0.88	0.88	0.73	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
New Movers dual fuel	0.36	0.32	0.16	0.16

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

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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: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

RRsp Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

RRwp Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

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 $
New Movers dual fuel	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
New Movers dual fuel	0.00	0.00	0.00	1.00

NTG Note: Free-ridership and spillover are not applicable as customers cannot participate without the utility program.

Gross Measure TRC unit: $ 8.68 per participant

Incentive Unit: $ 8.68 per participant

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Refills

Sector: Residential

Fuel: Electric

Program Type: Custom

Measure Category: Whole Home

Measure Type: Behavior

Measure Sub Type: Home Energy Reports

Program: 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

A control group of homes that does not receive Home Energy Reports

Savings principle

A home that receives Home Energy Reports.

Savings Method

Calculated as average per household savings

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
Refills	Calc	Calc				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
Refills	1	1.00	1.00		0.88	0.88	0.88	0.73	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Refills	0.36	0.32	0.16	0.16

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

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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: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

RRsp Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

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

RRwp Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

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 $
Refills				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Refills	0.00	0.00	0.00	1.00

NTG Note: Free-ridership and spillover are not applicable as customers cannot participate without the utility program.

Gross Measure TRC unit: $ 8.68 per participant

Incentive Unit: $ 8.68 per participant

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New Movers

Sector: Residential

Fuel: Electric

Program Type: Custom

Measure Category: Whole Home

Measure Type: Behavior

Measure Sub Type: Home Energy Reports

Program: 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

A control group of homes that does not receive Home Energy Reports

Savings principle

A home that receives Home Energy Reports.

Savings Method

Calculated as average per household savings

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
New Movers	Calc	Calc				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
New Movers	1	1.00	1.00		0.88	0.88	0.88	0.73	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
New Movers	0.36	0.32	0.16	0.16

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

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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: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

RRsp Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

RRwp Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

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 $
New Movers	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
New Movers	0.00	0.00	0.00	1.00

NTG Note: Free-ridership and spillover are not applicable as customers cannot participate without the utility program.

Gross Measure TRC unit: $ 8.68 per participant

Incentive Unit: $ 8.68 per participant

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Opt-out dual fuel

Sector: Residential

Fuel: Electric

Program Type: Custom

Measure Category: Whole Home

Measure Type: Behavior

Measure Sub Type: Home Energy Reports

Program: 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 as average per household savings

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
Opt-out dual fuel	Calc	Calc				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
Opt-out dual fuel	1	1.00	1.00		0.88	0.88	0.88	0.73	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Opt-out dual fuel	0.36	0.32	0.16	0.16

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

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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: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

RRsp Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

RRwp Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

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 $
Opt-out dual fuel				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Opt-out dual fuel	0.00	0.00	0.00	1.00

NTG Note: Free-ridership and spillover are not applicable as customers cannot participate without the utility program.

Gross Measure TRC unit: $ 8.68 per participant

Incentive Unit: $ 8.68 per participant

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Opt-Out electric

Sector: Residential

Fuel: Electric

Program Type: Custom

Measure Category: Whole Home

Measure Type: Behavior

Measure Sub Type: Home Energy Reports

Program: 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 as average per household savings

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
Opt-Out electric	Calc	Calc				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
Opt-Out electric	1	1.00	1.00		0.88	0.88	0.88	0.73	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Opt-Out electric	0.36	0.32	0.16	0.16

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

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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: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

RRsp Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

RRwp Source: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

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 $
Opt-Out electric				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Opt-Out electric	0.00	0.00	0.00	1.00

NTG Note: Free-ridership and spillover are not applicable as customers cannot participate without the utility program.

Gross Measure TRC unit: $ 8.68 per participant

Incentive Unit: $ 8.68 per participant

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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: 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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Domestic Hot Water_tier3	0.36	0.31	0.17	0.16

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.

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	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_tier3	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $14107/home

Incentive Unit: $2643/home

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DISHWASH

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: 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 × 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
DISHWASH	40.00	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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
DISHWASH	0.26	0.40	0.14	0.20

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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 $
DISHWASH	0.00	0.00	0.00	

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%.

Gross Measure TRC unit: Assumed to equal incentive amount. per housing Unit

Incentive Unit:

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Renovation Rehab Cooling_tier4

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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_tier4	Calc	Calc	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_tier4	25	1.00	1.00		1.00	1.00	1.00	1.00	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Cooling_tier4	0.01	0.04	0.54	0.41

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.

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 Cooling_tier4	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Cooling_tier4	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $18,438/home

Incentive Unit: $6974/home

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Renovation Rehab Heating_tier4

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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_tier4	Calc	Calc	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_tier4	25	1.00	1.00		1.00	1.00	1.00	1.00	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier4	0.38	0.62	0.00	0.00

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.

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_tier4	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier4	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $18,438/home

Incentive Unit: $6974/home

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Renovation Rehab Domestic Hot Water_tier4

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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_tier4	Calc	Calc	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_tier4	15	1.00	1.00		1.00	1.00	1.00	1.00	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Domestic Hot Water_tier4	0.36	0.31	0.17	0.16

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.

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_tier4	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_tier4	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $18,438/home

Incentive Unit: $6974/home

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Heating_tier4

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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_tier4	Calc	Calc	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_tier4	25	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating_tier4	0.38	0.62	0.00	0.00

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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.

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_tier4	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating_tier4	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $12,012/home

Incentive Unit: $6794/home

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Cooling_tier1

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Cooling_tier1	0.01	0.04	0.54	0.41

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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.

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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Cooling_tier1	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $1445/home

Incentive Unit: $885/home

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DHW_tier4

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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_tier4	Calc	Calc	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_tier4	15	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
DHW_tier4	0.36	0.31	0.17	0.16

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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.

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

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
DHW_tier4	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
DHW_tier4	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $12,012/home

Incentive Unit: $6794/home

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Cooling_tier2

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Cooling_tier2	0.01	0.04	0.54	0.41

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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.

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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Cooling_tier2	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $4860/home

Incentive Unit: $1525/home

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Heating_tier2

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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			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	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating_tier2	0.38	0.62	0.00	0.00

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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.

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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating_tier2	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $4860/home

Incentive Unit: $1525/home

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Cooling_tier3

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Cooling_tier3	0.01	0.04	0.54	0.41

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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.

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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Cooling_tier3	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $7688/home

Incentive Unit: $2650/home

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DHW_tier3

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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			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	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
DHW_tier3	0.36	0.31	0.17	0.16

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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.

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

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
DHW_tier3	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
DHW_tier3	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $7688/home

Incentive Unit: $2650/home

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Heating_tier3

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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			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	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating_tier3	0.38	0.62	0.00	0.00

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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.

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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating_tier3	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $7688/home

Incentive Unit: $2650/home

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Cooling_tier4

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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_tier4	Calc	Calc	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_tier4	25	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Cooling_tier4	0.01	0.04	0.54	0.41

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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.

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_tier4	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Cooling_tier4	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $12,012/home

Incentive Unit: $6794/home

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Renovation Rehab Heating_tier3

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier3	0.38	0.62	0.00	0.00

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.

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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier3	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $14107/home

Incentive Unit: $2643/home

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Renovation Rehab Domestic Hot WaterCP

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Domestic Hot WaterCP	0.36	0.31	0.17	0.16

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot WaterCP	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $787/home

Incentive Unit: $345/home

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DHW_tier1

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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			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	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
DHW_tier1	0.36	0.31	0.17	0.16

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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.

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

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
DHW_tier1	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
DHW_tier1	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $1445/home

Incentive Unit: $885/home

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HEATINGCP

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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			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	0.24	0.89

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
HEATINGCP	0.38	0.62	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%.

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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 $
HEATINGCP	0.00	0.00	0.00	117.00

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%.

Gross Measure TRC unit: $787/home

Incentive Unit: $345/home

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Adaptive Reuse

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Adaptive Reuse	0.01	0.04	0.54	0.41

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%.

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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 $
Adaptive Reuse	0.00	0.00	0.00	117.00

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%.

Gross Measure TRC unit: $1142/home

Incentive Unit: $700/home

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Refrigerators

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: 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	104.00	0.01	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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Refrigerators	0.26	0.40	0.14	0.20

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ISR Note: 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 assumed 100% because energy savings are custom calculated.

Non Energy Impact Factors

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

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Refrigerators	0.54			0.46

Gross Measure TRC unit: ESH Bundled costs

Incentive Unit: ESH Bundled costs

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LED Fixture

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

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

Program: 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 incandescents, 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	68.90	0.06	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	5	0.95	1.00		1.00	1.00	1.00	0.13	0.16

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Fixture	0.26	0.40	0.14	0.20

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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	0.00	3.50

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Fixture	0.08	0.04	0.00	0.96

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

Gross Measure TRC unit:

Incentive Unit:

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LEDs

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

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

Program: 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 incandescents, 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 × (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: 985.5. 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
LEDs	36.90	0.04	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
LEDs	5	1.00	1.00		1.00	1.00	1.00	0.13	0.16

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LEDs	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

ISR Note: 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: 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 $
LEDs	0.00	0.00	0.00	3.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LEDs	0.20	0.00	0.00	0.80

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

Gross Measure TRC unit:

Incentive Unit:

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Showerheads

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: Water Heating

Measure Type: Flow Control

Measure Sub Type: Low Flow Showerhead

Program: 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	129.00	0.02	0.00			0.00	0.00

Electric kWh Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

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
Showerheads	7	1.00	1.00		1.00	1.00	1.00	0.58	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Showerheads	0.40	0.33	0.15	0.13

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	0.00	

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

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

Gross Measure TRC unit:

Incentive Unit:

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CWASHER

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: Energy Star Homes

Measure Description

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

Baseline Description

A standard non-Energy Star clotheswasher.

Savings principle

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

Savings Method

Deemed

Unit

Installed clothes washer.

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
CWASHER	47.52	0.02	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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CWASHER	0.26	0.40	0.14	0.20

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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 $
CWASHER	0.00	0.00	0.00	

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%.

Gross Measure TRC unit: Assumed to equal incentive amount. per housing Unit

Incentive Unit:

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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: 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

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

Electric kWh 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	12	1.00	1.00		1.00	1.00	1.00	0.24	0.89

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CODES AND STANDARDS	0.34	0.51	0.08	0.07

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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 $
CODES AND STANDARDS	0.00	0.00	0.00	

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%.

Gross Measure TRC unit:

Incentive Unit:

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Renovation Rehab HeatingCP

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab HeatingCP	0.38	0.62	0.00	0.00

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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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab HeatingCP	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $787/home

Incentive Unit: $345/home

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DHWCP

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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			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	0.24	0.89

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
DHWCP	0.26	0.40	0.14	0.20

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%.

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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 $
DHWCP	0.00	0.00	0.00	117.00

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%.

Gross Measure TRC unit: $787/home

Incentive Unit: $345/home

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Renovation Rehab Cooling_tier3

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Cooling_tier3	0.01	0.04	0.54	0.41

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.

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 Cooling_tier3	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Cooling_tier3	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $14107/home

Incentive Unit: $2643/home

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DHW_tier2

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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			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	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
DHW_tier2	0.36	0.31	0.17	0.16

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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.

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

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
DHW_tier2	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
DHW_tier2	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $4860/home

Incentive Unit: $1525/home

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Renovation Rehab CoolingCP

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab CoolingCP	0.01	0.04	0.54	0.41

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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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab CoolingCP	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $787/home

Incentive Unit: $345/home

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Renovation Rehab Cooling_tier1

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Cooling_tier1	0.01	0.04	0.54	0.41

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.

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 Cooling_tier1	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Cooling_tier1	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $1874/home

Incentive Unit: $900/home

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Renovation Rehab Heating_tier1

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier1	0.38	0.62	0.00	0.00

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.

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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier1	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $1874/home

Incentive Unit: $900/home

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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: 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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Domestic Hot Water_tier1	0.36	0.31	0.17	0.16

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.

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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_tier1	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $1874/home

Incentive Unit: $900/home

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Renovation Rehab Cooling_tier2

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Cooling_tier2	0.01	0.04	0.54	0.41

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.

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 Cooling_tier2	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Cooling_tier2	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $2767/home

Incentive Unit: $1520/home

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Renovation Rehab Heating_tier2

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier2	0.38	0.62	0.00	0.00

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.

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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier2	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $2767/home

Incentive Unit: $1520/home

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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: 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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Domestic Hot Water_tier2	0.36	0.31	0.17	0.16

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.

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	0.00	0.00	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_tier2	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $2767/home

Incentive Unit: $1520/home

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COOLINGCP

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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			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	0.24	0.89

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COOLINGCP	0.01	0.04	0.54	0.41

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%.

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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 $
COOLINGCP	0.00	0.00	0.00	117.00

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%.

Gross Measure TRC unit: $787/home

Incentive Unit: $345/home

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Heating_tier1

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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			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	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating_tier1	0.38	0.62	0.00	0.00

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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.

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	0.00	117.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating_tier1	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $1445/home

Incentive Unit: $885/home

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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: 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 × (kBtu/hr per ton) × max[(1/EER),(1/HSPF)] × %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: . 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	255.60	0.17	0.00			0.00	0.00

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

Electric kWh Note: Updated based on historic measure mix

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

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Electric kW Note: Updated based on historic measure mix

Gas Heat MMBtu Source: KEMA (2013). Project 25 Prescriptive Gas Program Final Evaluation Report. Prepared for Massachusetts Energy Efficiency Program Administrators; Page 1-5

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	0.21	0.50

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CoolSmart HP Digital Check	0.62	0.21	0.12	0.05

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 Note: Massachusetts Common Assumption

CFwp 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	7.44

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

Gross Measure TRC unit: $ 742 per measure

Incentive Unit: $ 500 per measure

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CoolSmart AC Digital Check

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

Measure Category: HVAC | **Measure Type:** HVAC O&M | **Measure Sub Type:** HVAC Tune Up

Program: Energy Star HVAC

Measure Description

Tune-up of an existing central AC system.

Baseline Description

The baseline efficiency case is a standard central air-conditioning system that does not operate 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 AC system

Savings equation

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

Gross kW = Tons × (kBtu/hr per ton) × 1/EER × %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: 360. Hours Source: ADM Associated, Inc. (2009). Residential Central AC Regional Evaluation. Prepared for NSTAR, National Grid, Connecticut Light & Power and United Illuminating. 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 Digital Check	43.00	0.15	0.00			0.00	0.00

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

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

Gas Heat MMBtu Source: NYSERDA Deemed Savings Database (Rev 11).

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CoolSmart AC Digital Check	5	1.00	1.00		1.00	1.00	1.00	0.25	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CoolSmart AC Digital Check	0.00	0.00	0.70	0.30

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 Note: Massachusetts Common Assumption

CFwp Note: Massachusetts Common Assumption

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
CoolSmart AC Digital Check	0.00	0.00	0.00	0.00

Net to Gross Factors

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

NTG Note: Massachusetts Common Assumption

Gross Measure TRC unit: $ 175 per measure

Incentive Unit: $ 175 per measure

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ECM Pumps

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

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

Program: 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	142.00	0.08	0.00			0.00	0.00

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

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
ECM Pumps	15	1.00	1.00		1.00	1.00	1.00	0.00	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ECM Pumps	0.34	0.52	0.09	0.05

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.

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 $
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%.

Gross Measure TRC unit: $ 120 per measure

Incentive Unit: $ 100 per measure

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Oil Fuel Switching

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: HVAC

Measure Type: Heating

Measure Sub Type: Heat Pump Electrification

Program: Energy Star HVAC

Measure Description

The purchase and installation of high efficiency mini-split heat pump system rather than the purchase of a standard efficiency oil boiler or to replace a standard efficiency oil boiler.

Baseline Description

The baseline efficiency case for heating is a residential oil boiler with 82 AFUE.

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-efficiecny air-source heat pump system for heating and cooling.

Savings equation

Cooling Gross kWh = Qty*deltakWh_cooling

Cooling Gross kW = Qty*deltakW_cooling

Heating Gross MMBtu = Qty * deltaMMBtu_oil

Where:

Qty = Total number of units.

deltakWh_cooling = Average annual cooling kWh reduction per unit.

deltakW_cooling = Average annual cooling kW reduction per unit.

deltaMMBTu_oil = Average annual oil 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
Oil Fuel Switching	126.00	0.50	0.00			17.43	0.00

Electric kWh Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

Electric kW Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

Oil MMBtu Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Oil Fuel Switching	18	1.00	1.00		1.00			0.25	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Oil Fuel Switching	0.00	0.00	0.55	0.45

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.

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

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	Sewer: Gallons	Annual $	One-time $
Oil Fuel Switching	0.00	0.00	0.00	-1960.96

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Oil Fuel Switching	0.00	0.00	0.00	1.00

Gross Measure TRC unit: $ 15700 per measure

Incentive Unit: $ 2400 per measure

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Oil Fuel Switching ROF

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: HVAC

Measure Type: Heating

Measure Sub Type: Heat Pump Electrification

Program: Energy Star HVAC

Measure Description

The purchase and installation of high efficiency mini-split heat pump system rather than the purchase of a standard efficiency oil boiler or to replace a standard efficiency oil boiler.

Baseline Description

The baseline efficiency case for heating is a residential oil boiler with 82 AFUE.

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-efficiecny air-source heat pump system for heating and cooling.

Savings equation

Cooling Gross kWh = Qty*deltakWh_cooling

Cooling Gross kW = Qty*deltakW_cooling

Heating Gross MMBtu = Qty * deltaMMBtu_oil

Where:

Qty = Total number of units.

deltakWh_cooling = Average annual cooling kWh reduction per unit.

deltakW_cooling = Average annual cooling kW reduction per unit.

deltaMMBTu_oil = Average annual oil 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
Oil Fuel Switching ROF	126.00	0.50	0.00			17.43	0.00

Electric kWh Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

Electric kW Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

Oil MMBtu Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Oil Fuel Switching ROF	18	1.00	1.00		1.00			0.25	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Oil Fuel Switching ROF	0.00	0.00	0.55	0.45

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.

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

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	Sewer: Gallons	Annual $	One-time $
Oil Fuel Switching ROF	0.00	0.00	0.00	-1960.96

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Oil Fuel Switching ROF	0.00	0.00	0.00	1.00

Gross Measure TRC unit: $ 6700 per measure

Incentive Unit: $ 2400 per measure

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Electric Resistance Fuel Switching

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: HVAC

Measure Type: Heating

Measure Sub Type: Heat Pump Electrification

Program: 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-efficiecny 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
Electric Resistance Fuel Switching	2748.00	0.50	0.00			0.00	0.00

Electric kWh Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

Electric kW Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

Oil MMBtu Source: The Cadmus Group, Inc (2016) Ductless Mini-Split Heat Pump Impact Evaluation

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Electric Resistance Fuel Switching	18	1.00	1.00		1.00			0.25	0.50

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Electric Resistance Fuel Switching	0.29	0.49	0.12	0.10

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.

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

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	Sewer: Gallons	Annual $	One-time $
Electric Resistance Fuel Switching	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Electric Resistance Fuel Switching	0.00	0.00	0.00	1.00

Gross Measure TRC unit: $ 15700 per measure

Incentive Unit: $ 2400 per measure

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Mini Split HP SEER 18.0 HSPF 9.6

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heat Pumps **Measure Sub Type:** Ductless

Program: Energy Star HVAC

Measure Description

The installation of a more efficient ENERGY STAR® rated Ductless MiniSplit system.

Baseline Description

The baseline efficiency case is a non- ENERGY STAR® rated ductless mini split heat pump with SEER 14, EER 8.5 and HSPF 8.2.

Savings principle

The high efficiency case is a high-efficiency Ductless Mini Split System.

Savings Method

Calculated using deemed inputs

Unit

Installed high-efficiency ductless minisplit system.

Savings equation

Gross kWh = Tons × (12 kBtu/hr per ton) × [(1/SEER_base - 1/SEER_EE) × Hours_c + (1/HSPF_base - 1/HSPF_EE) × Hours_h)]

Gross kW = Tons × (12 kBtu/hr per ton) × max[(1/SEER_base - 1/SEER_ee),(1/HSPF_base - 1/HSPF_ee)]

Where:

Tons = Deemed average equipmentcapacity: 1.8 tons for 18 SEER unit / 1.1 tons for 20 SEER unit

SEER_base = Seasonal Energy Efficiency Ratio of baseline equipment

SEER_ee = Seasonal Energy Efficiency Ratio of new equipment

HSPF_base = Heating Season Performance Factor of baseline equipment

HSPF_ee = Heating Season Performance Factor of new equipment

Hours_c = Equivalent full load cooling hours

Hours_h = Equivalent full load heating hours

Hours: . 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 447 hours/year for heating and 218 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
Mini Split HP SEER 18.0 HSPF 9.6	874.70	0.51	0.00			0.00	0.00

Electric kWh Note: Updated based on historic measure mix

Electric kW Note: Updated based on historic measure mix

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Mini Split HP SEER 18.0 HSPF 9.6	18	1.00	1.00		1.00	1.00	1.00	0.25	0.50

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Mini Split HP SEER 18.0 HSPF 9.6	0.29	0.49	0.12	0.10

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

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	Sewer: Gallons	Annual $	One-time $
Mini Split HP SEER 18.0 HSPF 9.6	0.00	0.00	5.15	

Annual $ Note: MA values

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Mini Split HP SEER 18.0 HSPF 9.6	0.40	0.00	0.00	0.60

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

Gross Measure TRC unit: $ 2089 per measure

Incentive Unit: $ 300 per measure

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Early Replacement HP - SEER 18 (Retire)

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: HVAC

Measure Type: Heat Pumps

Measure Sub Type: Early replacement

Program: Energy Star HVAC

Measure Description

Early replacement of a Central Air Conditioning or Heat Pump Unit. This measure accounts for the additional savings achieved for the early replacement of existing inefficient AC or heat pump units over the remaining life of the existing equipment.

Baseline Description

The baseline efficiency case is assumed to be a typical 10-12 year-old central air-conditioning or heat pump unit with SEER 10, EER 8.5, and HSPF 7.0

Savings principle

For the retirement savings over the remaining life of the existing AC unit, the efficient case is a SEER 13, EER 11, HSPF 7.6 unit. For the high efficiency savings over the lifetime of the new AC unit, the efficient case is a new high efficiency EER 14.5,EER 12, 8.2 HSPF unit.

Savings Method

Calculated using deemed inputs

Unit

Installation of a new efficient air conditioner.

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: . 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
Early Replacement HP - SEER 18 (Retire)	933.80	0.28	0.00			0.00	0.00

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

Electric kWh Note: Updated based on historic measure mix

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

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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
Early Replacement HP - SEER 18 (Retire)	7	1.00	1.00		1.00	1.00	1.00	0.25	0.50

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Early Replacement HP - SEER 18 (Retire)	0.29	0.49	0.12	0.10

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

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	Sewer: Gallons	Annual $	One-time $
Early Replacement HP - SEER 18 (Retire)	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Early Replacement HP - SEER 18 (Retire)	0.15	0.00	0.00	0.85

NTG Note: Massachusetts Common Assumption

Gross Measure TRC unit: $ 1570 per measure

Incentive Unit: $ 1000 per measure

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Early Replacement HP - SEER 18 (EE)

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: HVAC

Measure Type: Heat Pumps

Measure Sub Type: Early replacement

Program: Energy Star HVAC

Measure Description

Early replacement of a Central Air Conditioning or Heat Pump Unit. This measure accounts for the additional savings achieved for the early replacement of existing inefficient AC or heat pump units over the remaining life of the existing equipment.

Baseline Description

The baseline efficiency case is assumed to be a typical 10-12 year-old central air-conditioning or heat pump unit with SEER 10, EER 8.5, and HSPF 7.0

Savings principle

For the retirement savings over the remaining life of the existing AC unit, the efficient case is a SEER 13, EER 11, HSPF 7.6 unit. For the high efficiency savings over the lifetime of the new AC unit, the efficient case is a new high efficiency EER 14.5,EER 12, 8.2 HSPF unit.

Savings Method

Calculated using deemed inputs

Unit

Installation of a new efficient air conditioner.

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: . 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
Early Replacement HP - SEER 18 (EE)	742.00	0.47	0.00			0.00	0.00

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

Electric kWh Note: Updated based on historic measure mix

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

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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
Early Replacement HP - SEER 18 (EE)	18	1.00	1.00		1.00	1.00	1.00	0.25	0.50

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Early Replacement HP - SEER 18 (EE)	0.29	0.49	0.12	0.10

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

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	Sewer: Gallons	Annual $	One-time $
Early Replacement HP - SEER 18 (EE)	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Early Replacement HP - SEER 18 (EE)	0.15	0.00	0.00	0.85

NTG Note: Massachusetts Common Assumption

Gross Measure TRC unit: $ 1570 per measure

Incentive Unit: $ 1000 per measure

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Early Replacement HP - SEER 16 (Retire)

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: HVAC

Measure Type: Heat Pumps

Measure Sub Type: Early replacement

Program: Energy Star HVAC

Measure Description

Early replacement of a Central Air Conditioning or Heat Pump Unit. This measure accounts for the additional savings achieved for the early replacement of existing inefficient AC or heat pump units over the remaining life of the existing equipment.

Baseline Description

The baseline efficiency case is assumed to be a typical 10-12 year-old central air-conditioning or heat pump unit with SEER 10, EER 8.5, and HSPF 7.0

Savings principle

For the retirement savings over the remaining life of the existing AC unit, the efficient case is a SEER 13, EER 11, HSPF 7.6 unit. For the high efficiency savings over the lifetime of the new AC unit, the efficient case is a new high efficiency EER 14.5,EER 12, 8.2 HSPF unit.

Savings Method

Calculated using deemed inputs

Unit

Installation of a new efficient air conditioner.

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: . 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
Early Replacement HP - SEER 16 (Retire)	933.80	0.28	0.00			0.00	0.00

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

Electric kWh Note: Updated based on historic measure mix

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

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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
Early Replacement HP - SEER 16 (Retire)	7	1.00	1.00		1.00	1.00	1.00	0.25	0.50

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Early Replacement HP - SEER 16 (Retire)	0.29	0.49	0.12	0.10

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

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	Sewer: Gallons	Annual $	One-time $
Early Replacement HP - SEER 16 (Retire)	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Early Replacement HP - SEER 16 (Retire)	0.15	0.00	0.00	0.85

NTG Note: Massachusetts Common Assumption

Gross Measure TRC unit: $ 900 per measure

Incentive Unit: $ 750 per measure

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Energy Star QI with Duct Modifications

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: Energy Star HVAC

Measure Description

50% reduction in duct leakage from 20% to 10%. This measure may also include duct modifications.

Baseline Description

The baseline efficiency case is a system with an installation that is inconsistent with manufacturer specifications and may include leaky ducts.

Savings principle

The high efficiency case is a system with an installation that is consistent with manufacturer specifications and may have reduced duct leakage.

Savings Method

Deemed

Unit

Completed job

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
Energy Star QI with Duct Modifications	513.00	0.85	0.00			0.00	0.00

Electric kWh Source: RLW Analytics (2002). Market Research for the Rhode Island, Massachusetts, and Connecticut Residential HVAC Market. Prepared for National Grid, Northeast Utilities, NSTAR, Fitchburg Gas and Electric Light Company and United Illuminating;

Electric kW Source: RLW Analytics (2002). Market Research for the Rhode Island, Massachusetts, and Connecticut Residential HVAC Market. Prepared for National Grid, Northeast Utilities, NSTAR, Fitchburg Gas and Electric Light Company and United Illuminating;

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Energy Star QI with Duct Modifications	18	1.00	1.00		1.00	1.00	1.00	0.26	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Energy Star QI with Duct Modifications	0.00	0.00	0.70	0.30

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

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	Sewer: Gallons	Annual $	One-time $
Energy Star QI with Duct Modifications	0.00	0.00	1.53	7.44

Annual $ Note: MA values

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Energy Star QI with Duct Modifications	0.25	0.16	0.00	0.91

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

Gross Measure TRC unit: $ 1000 per measure

Incentive Unit: $ 525 per measure

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Duct Sealing - 100 CFM redcution 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: 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 redcution in leaks 15% of flow to 5%	212.00	0.30	0.00			0.00	0.00

Electric kWh Source: RLW Analytics (2002). Market Research for the Rhode Island, Massachusetts, and Connecticut Residential HVAC Market. Prepared for National Grid, Northeast Utilities, NSTAR, Fitchburg Gas and Electric Light Company and United Illuminating;

Electric kW Source: RLW Analytics (2002). Market Research for the Rhode Island, Massachusetts, and Connecticut Residential HVAC Market. Prepared for National Grid, Northeast Utilities, NSTAR, Fitchburg Gas and Electric Light Company and United Illuminating;

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Duct Sealing - 100 CFM redcution in leaks 15% of flow to 5%	20	1.00	1.00		1.00	1.00	1.00	0.26	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Duct Sealing - 100 CFM redcution in leaks 15% of flow to 5%	0.00	0.00	0.70	0.30

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

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	Sewer: Gallons	Annual $	One-time $
Duct Sealing - 100 CFM redcution in leaks 15% of flow to 5%	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Duct Sealing - 100 CFM redcution in leaks 15% of flow to 5%	0.15	0.00	0.00	0.85

NTG Note: Massachusetts Common Assumption

Gross Measure TRC unit: $ 600 per measure

Incentive Unit: $ 100 per measure

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Early Replacement AC - SEER 16 (Retire)

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: Energy Star HVAC

Measure Description

Early replacement of a Central Air Conditioning or Heat Pump Unit. This measure accounts for the additional savings achieved for the early replacement of existing inefficient AC or heat pump units over the remaining life of the existing equipment.

Baseline Description

The baseline efficiency case is assumed to be a typical 10-12 year-old central air-conditioning or heat pump unit with SEER 10, EER 8.5, and HSPF 7.0

Savings principle

For the retirement savings over the remaining life of the existing AC unit, the efficient case is a SEER 13, EER 11, HSPF 7.6 unit. For the high efficiency savings over the lifetime of the new AC unit, the efficient case is a new high efficiency EER 14.5,EER 12, 8.2 HSPF unit.

Savings Method

Calculated using deemed inputs

Unit

Installation of a new efficient air conditioner.

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: . 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
Early Replacement AC - SEER 16 (Retire)	269.20	0.87	0.00			0.00	0.00

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

Electric kWh Note: Updated based on historic measure mix

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

Electric kW Note: Updated based on historic measure mix

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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
Early Replacement AC - SEER 16 (Retire)	7	1.00	1.00		1.00	1.00	1.00	0.25	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Early Replacement AC - SEER 16 (Retire)	0.00	0.00	0.70	0.30

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

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	Sewer: Gallons	Annual $	One-time $
Early Replacement AC - SEER 16 (Retire)	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Early Replacement AC - SEER 16 (Retire)	0.15	0.00	0.00	0.85

NTG Note: Massachusetts Common Assumption

Gross Measure TRC unit: $ 900 per measure

Incentive Unit: $ 750 per measure

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Early Replacement AC - SEER 16 (EE)

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: Energy Star HVAC

Measure Description

Early replacement of a Central Air Conditioning or Heat Pump Unit. This measure accounts for the additional savings achieved for the early replacement of existing inefficient AC or heat pump units over the remaining life of the existing equipment.

Baseline Description

The baseline efficiency case is assumed to be a typical 10-12 year-old central air-conditioning or heat pump unit with SEER 10, EER 8.5, and HSPF 7.0

Savings principle

For the retirement savings over the remaining life of the existing AC unit, the efficient case is a SEER 13, EER 11, HSPF 7.6 unit. For the high efficiency savings over the lifetime of the new AC unit, the efficient case is a new high efficiency EER 14.5,EER 12, 8.2 HSPF unit.

Savings Method

Calculated using deemed inputs

Unit

Installation of a new efficient air conditioner.

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: . 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
Early Replacement AC - SEER 16 (EE)	181.60	0.51	0.00			0.00	0.00

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

Electric kWh Note: Updated based on historic measure mix

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

Electric kW Note: Updated based on historic measure mix

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Early Replacement AC - SEER 16 (EE)	18	1.00	1.00		1.00	1.00	1.00	0.25	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Early Replacement AC - SEER 16 (EE)	0.00	0.00	0.70	0.30

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

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	Sewer: Gallons	Annual $	One-time $
Early Replacement AC - SEER 16 (EE)	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Early Replacement AC - SEER 16 (EE)	0.15	0.00	0.00	0.85

NTG Note: Massachusetts Common Assumption

Gross Measure TRC unit: $ 900 per measure

Incentive Unit: $ 750 per measure

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Mini Split HP SEER 16.0 HSPF 8.5

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heat Pumps **Measure Sub Type:** Ductless

Program: Energy Star HVAC

Measure Description

The installation of a more efficient ENERGY STAR® rated Ductless MiniSplit system.

Baseline Description

The baseline efficiency case is a non- ENERGY STAR® rated ductless mini split heat pump with SEER 14, EER 8.5 and HSPF 8.2.

Savings principle

The high efficiency case is a high-efficiency Ductless Mini Split System.

Savings Method

Calculated using deemed inputs

Unit

Installed high-efficiency ductless minisplit system.

Savings equation

Gross kWh = Tons × (12 kBtu/hr per ton) × [(1/SEER_base - 1/SEER_EE) × Hours_c + (1/HSPF_base - 1/HSPF_EE) × Hours_h)]

Gross kW = Tons × (12 kBtu/hr per ton) × max[(1/SEER_base - 1/SEER_ee),(1/HSPF_base - 1/HSPF_ee)]

Where:

Tons = Deemed average equipmentcapacity: 1.8 tons for 18 SEER unit / 1.1 tons for 20 SEER unit

SEER_base = Seasonal Energy Efficiency Ratio of baseline equipment

SEER_ee = Seasonal Energy Efficiency Ratio of new equipment

HSPF_base = Heating Season Performance Factor of baseline equipment

HSPF_ee = Heating Season Performance Factor of new equipment

Hours_c = Equivalent full load cooling hours

Hours_h = Equivalent full load heating hours

Hours: . 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 447 hours/year for heating and 218 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
Mini Split HP SEER 16.0 HSPF 8.5	812.50	0.51	0.00			0.00	0.00

Electric kWh Note: Updated based on historic measure mix

Electric kW Note: Updated based on historic measure mix

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Mini Split HP SEER 16.0 HSPF 8.5	18	1.00	1.00		1.00	1.00	1.00	0.25	0.50

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Mini Split HP SEER 16.0 HSPF 8.5	0.29	0.49	0.12	0.10

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

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	Sewer: Gallons	Annual $	One-time $
Mini Split HP SEER 16.0 HSPF 8.5	0.00	0.00	3.26	40.35

Annual $ Note: MA values

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Mini Split HP SEER 16.0 HSPF 8.5	0.40	0.00	0.00	0.60

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

Gross Measure TRC unit: $ 698 per measure

Incentive Unit: $ 250 per measure

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CoolSmart AC SEER 16.0 EER 13

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: 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 = 13 and EER = 11. For early replacement installations, the baseline is a 10-12 year old HVAC unit with SEER = 10 and EER = 8.5.

Savings principle

The high efficiency case is an ENERGY STAR® qualified Central AC system.

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: 360. Hours Source: ADM Associated, Inc. (2009). Residential Central AC Regional Evaluation. Prepared for NSTAR, National Grid, Connecticut Light & Power and United Illuminating. 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 SEER 16.0 EER 13	219.90	0.63	0.00			0.00	0.00

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

Electric kWh Note: Updated based on historic measure mix

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

Electric kW Note: Updated based on historic measure mix

Gas Heat MMBtu Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CoolSmart AC SEER 16.0 EER 13	16	1.00	1.00		1.00	1.00	1.00	0.25	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CoolSmart AC SEER 16.0 EER 13	0.00	0.00	0.70	0.30

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

ISR Note: 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: The Cadmus Group (2013). 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing.

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

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
CoolSmart AC SEER 16.0 EER 13	0.00	0.00	6.06	35.77

Annual $ Note: MA values

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
CoolSmart AC SEER 16.0 EER 13	0.33	0.00	0.00	0.67

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

Gross Measure TRC unit: $ 1208 per measure

Incentive Unit: $ 250 per measure

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Down Size 1/2 ton

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: 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 × 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
Down Size 1/2 ton	203.00	0.30	0.00			0.00	0.00

Electric kWh Source: RLW Analytics (2002). Market Research for the Rhode Island, Massachusetts, and Connecticut Residential HVAC Market. Prepared for National Grid, Northeast Utilities, NSTAR, Fitchburg Gas and Electric Light Company and United Illuminating;

Electric kW Source: RLW Analytics (2002). Market Research for the Rhode Island, Massachusetts, and Connecticut Residential HVAC Market. Prepared for National Grid, Northeast Utilities, NSTAR, Fitchburg Gas and Electric Light Company and United Illuminating;

Electric kW Note: Updated based on historic measure mix

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Down Size 1/2 ton	18	1.00	1.00		1.00	1.00	1.00	0.26	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Down Size 1/2 ton	0.00	0.00	0.70	0.30

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

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	Sewer: Gallons	Annual $	One-time $
Down Size 1/2 ton	0.00	0.00	0.64	3.01

Annual $ Note: MA values

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Down Size 1/2 ton	0.15	0.00	0.00	0.85

NTG Note: Massachusetts Common Assumption

Gross Measure TRC unit: $ 120 per measure

Incentive Unit: $ 100 per measure

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CoolSmart AC SEER 18.0 EER 13

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

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

Program: 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 = 13 and EER = 11. For early replacement installations, the baseline is a 10-12 year old HVAC unit with SEER = 10 and EER = 8.5.

Savings principle

The high efficiency case is an ENERGY STAR® qualified Central AC system.

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: 360. Hours Source: ADM Associated, Inc. (2009). Residential Central AC Regional Evaluation. Prepared for NSTAR, National Grid, Connecticut Light & Power and United Illuminating. 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 SEER 18.0 EER 13	334.20	0.67	0.00			0.00	0.00

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

Electric kWh Note: Updated based on historic measure mix

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

Electric kW Note: Updated based on historic measure mix

Gas Heat MMBtu Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
CoolSmart AC SEER 18.0 EER 13	16	1.00	1.00		1.00	1.00	1.00	0.25	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CoolSmart AC SEER 18.0 EER 13	0.00	0.00	0.70	0.30

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

ISR Note: 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: The Cadmus Group (2013). 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing.

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

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
CoolSmart AC SEER 18.0 EER 13	0.00	0.00	6.06	35.77

Annual $ Note: MA values

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
CoolSmart AC SEER 18.0 EER 13	0.33	0.00	0.00	0.67

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

Gross Measure TRC unit: $1208 per measure

Incentive Unit: $ 250 per measure

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WiFi programmable thermostat with cooling (oil)

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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 × 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)	104.00	0.23	0.00			6.60	0.00

Electric kWh Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis. Prepared for Keith Miller and Whitney Domigan, National Grid.

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Electric kW Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis. Prepared for Keith Miller and Whitney Domigan, National Grid.

Oil 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
WiFi programmable thermostat with cooling (oil)	15	1.00	1.00		1.00	1.00	1.00	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WiFi programmable thermostat with cooling (oil)	0.00	0.00	0.70	0.30

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: 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 $
WiFi programmable thermostat with cooling (oil)	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
WiFi programmable thermostat with cooling (oil)	0.00	0.00	0.00	1.00

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

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Gross Measure TRC unit: $ 265 per measure

Incentive Unit: $ 75 per measure

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Mini Split HP SEER 18.0 HSPF 9

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heat Pumps **Measure Sub Type:** Ductless

Program: Energy Star HVAC

Measure Description

The installation of a more efficient ENERGY STAR® rated Ductless MiniSplit system.

Baseline Description

The baseline efficiency case is a non- ENERGY STAR® rated ductless mini split heat pump with SEER 14, EER 8.5 and HSPF 8.2.

Savings principle

The high efficiency case is a high-efficiency Ductless Mini Split System.

Savings Method

Calculated using deemed inputs

Unit

Installed high-efficiency ductless minisplit system.

Savings equation

Gross kWh = Tons × (12 kBtu/hr per ton) × [(1/SEER_base - 1/SEER_EE) × Hours_c + (1/HSPF_base - 1/HSPF_EE) × Hours_h)]

Gross kW = Tons × (12 kBtu/hr per ton) × max[(1/SEER_base - 1/SEER_ee),(1/HSPF_base - 1/HSPF_ee)]

Where:

Tons = Deemed average equipmentcapacity: 1.8 tons for 18 SEER unit / 1.1 tons for 20 SEER unit

SEER_base = Seasonal Energy Efficiency Ratio of baseline equipment

SEER_ee = Seasonal Energy Efficiency Ratio of new equipment

HSPF_base = Heating Season Performance Factor of baseline equipment

HSPF_ee = Heating Season Performance Factor of new equipment

Hours_c = Equivalent full load cooling hours

Hours_h = Equivalent full load heating hours

Hours: . 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 447 hours/year for heating and 218 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
Mini Split HP SEER 18.0 HSPF 9	387.20	0.66	0.00			0.00	0.00

Electric kWh Note: Updated based on historic measure mix

Electric kW Note: Updated based on historic measure mix

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Mini Split HP SEER 18.0 HSPF 9	18	1.00	1.00		1.00	1.00	1.00	0.25	0.50

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Mini Split HP SEER 18.0 HSPF 9	0.29	0.49	0.12	0.10

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

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	Sewer: Gallons	Annual $	One-time $
Mini Split HP SEER 18.0 HSPF 9	0.00	0.00	3.26	40.35

Annual $ Note: MA values

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Mini Split HP SEER 18.0 HSPF 9	0.30	0.07	0.00	0.77

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

Gross Measure TRC unit: $ 353 per measure

Incentive Unit: $ 250 per measure

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MiniSplit HP SEER 20, HSPF 11

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heat Pumps **Measure Sub Type:** Ductless

Program: Energy Star HVAC

Measure Description

The installation of a more efficient ENERGY STAR® rated Ductless MiniSplit system.

Baseline Description

The baseline efficiency case is a non- ENERGY STAR® rated ductless mini split heat pump with SEER 14, EER 8.5 and HSPF 8.2.

Savings principle

The high efficiency case is a high-efficiency Ductless Mini Split System.

Savings Method

Calculated using deemed inputs

Unit

Installed high-efficiency ductless minisplit system.

Savings equation

Gross kWh = Tons × (12 kBtu/hr per ton) × [(1/SEER_base - 1/SEER_EE) × Hours_c + (1/HSPF_base - 1/HSPF_EE) × Hours_h)]

Gross kW = Tons × (12 kBtu/hr per ton) × max[(1/SEER_base - 1/SEER_ee),(1/HSPF_base - 1/HSPF_ee)]

Where:

Tons = Deemed average equipmentcapacity: 1.8 tons for 18 SEER unit / 1.1 tons for 20 SEER unit

SEER_base = Seasonal Energy Efficiency Ratio of baseline equipment

SEER_ee = Seasonal Energy Efficiency Ratio of new equipment

HSPF_base = Heating Season Performance Factor of baseline equipment

HSPF_ee = Heating Season Performance Factor of new equipment

Hours_c = Equivalent full load cooling hours

Hours_h = Equivalent full load heating hours

Hours: . 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 447 hours/year for heating and 218 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
MiniSplit HP SEER 20, HSPF 11	502.90	0.82	0.00			0.00	0.00

Electric kWh Note: Updated based on historic measure mix

Electric kW Note: Updated based on historic measure mix

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
MiniSplit HP SEER 20, HSPF 11	18	1.00	1.00		1.00	1.00	1.00	0.25	0.50

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
MiniSplit HP SEER 20, HSPF 11	0.29	0.49	0.12	0.10

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

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	Sewer: Gallons	Annual $	One-time $
MiniSplit HP SEER 20, HSPF 11	0.00	0.00	3.26	40.35

Annual $ Note: MA values

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
MiniSplit HP SEER 20, HSPF 11	0.30	0.07	0.00	0.77

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

Gross Measure TRC unit: $ 689 per measure

Incentive Unit: $ 500 per measure

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CoolSmart AC QIV ES

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: HVAC

Measure Type: HVAC O&M

Measure Sub Type: Central AC Quality Install

Program: 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 with SEER = 14.5 and EER = 12 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 × (kBtu/hr per ton) × 1/EER × %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: 360. Hours Source: ADM Associated, Inc. (2009). Residential Central AC Regional Evaluation. Prepared for NSTAR, National Grid, Connecticut Light & Power and United Illuminating. 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	34.50	0.12	0.00			0.00	0.00

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

Electric kWh Note: Updated based on historic measure mix

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

Gas Heat MMBtu Source: The Cadmus Group (2013). 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing.

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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	0.26	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CoolSmart AC QIV ES	0.00	0.00	0.70	0.30

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

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	Sewer: Gallons	Annual $	One-time $
CoolSmart AC QIV ES	0.00	0.00	1.53	7.44

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: Net-to-Gross, Market Effects, and Equipment Replacement Timing.

Gross Measure TRC unit: $ 175 per measure

Incentive Unit: $ 175 per measure

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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: 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 with SEER = 14.5, EER = 12 and HSPF = 8.2) 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 × (kBtu/hr per ton) × max[(1/EER),(1/HSPF)] × %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: 360. 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 QIV ES	193.10	0.14	0.00			0.00	0.00

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

Electric kWh Note: Updated based on historic measure mix

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

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Electric kW Note: Updated based on historic measure mix

Gas Heat MMBtu Source: The Cadmus Group (2013). 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing.

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	0.26	0.26

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CoolSmart HP QIV ES	0.62	0.21	0.12	0.05

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

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	Sewer: Gallons	Annual $	One-time $
CoolSmart HP QIV ES	0.00	0.00	1.53	7.44

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: Net-to-Gross, Market Effects, and Equipment Replacement Timing.

Gross Measure TRC unit: $ 175 per measure

Incentive Unit: $ 175 per measure

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Mini Split Heat Pump QIV

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: HVAC

Measure Type: HVAC O&M

Measure Sub Type: Central AC Quality Install

Program: 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 with SEER = 14.5 and EER = 12 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 × (kBtu/hr per ton) × 1/EER × %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: 360. Hours Source: ADM Associated, Inc. (2009). Residential Central AC Regional Evaluation. Prepared for NSTAR, National Grid, Connecticut Light & Power and United Illuminating. Hours Note: The equivalent full load cooling hours are 218 hours/year.

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	60.90	0.13	0.00			0.00	0.00

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

Electric kWh Note: Updated based on historic measure mix

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

Electric kW Note: Updated based on historic measure mix

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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		

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Mini Split Heat Pump QIV	0.29	0.49	0.12	0.10

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 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 $
Mini Split Heat Pump QIV	0.00	0.00	1.53	7.44

Annual $ Note: MA values

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Mini Split Heat Pump QIV				1.00

Gross Measure TRC unit: $ 175 per measure

Incentive Unit: $ 175 per measure

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WiFi programmable thermostat with cooling (gas)

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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 × 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)	104.00	0.23	6.60			0.00	0.00

Electric kWh Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis. Prepared for Keith Miller and Whitney Domigan, National Grid.

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Electric kW Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis. Prepared for Keith Miller and Whitney Domigan, National Grid.

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	1.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WiFi programmable thermostat with cooling (gas)	0.00	0.00	0.70	0.30

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: 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 $
WiFi programmable thermostat with cooling (gas)	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
WiFi programmable thermostat with cooling (gas)	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 265 per measure

Incentive Unit: $ 75 per measure

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Furnace ECM

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: Energy Star HVAC

Measure Description

Installation of high efficiency motors on residential furnace fans, including electronically commutated motors (ECMs) or steady state brushless furnace fan motors.

Baseline Description

The baseline efficiency case is the installation of a furnace with a standard efficiency steady state motor.

Savings principle

The high efficiency case is the installation an electronically commutated motor or brushless fan motor on a residential furnace.

Savings Method

Deemed

Unit

Installed high-efficiency furnace fan motor.

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 × 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
Furnace ECM	168.00	0.12	0.00			7.22	0.00

Electric kWh Source: Energy & Resource Solutions (2011). BFM Impact Evaluation Report. Prepared for the Electric and Gas Program Administrators of Massachusetts.

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Electric kW Source: Energy & Resource Solutions (2011). BFM Impact Evaluation Report. 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
Furnace ECM	18	1.00	1.00		1.00	1.00	1.00	0.00	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Furnace ECM	0.38	0.62	0.00	0.00

Measure life Source: Sachs, Harvey (2003). Energy Savings from Efficient Furnace Air Handlers in Massachusetts.

ISR Note: 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: Energy & Resource Solutions (2011). BFM Impact Evaluation Report. Prepared for the Electric and Gas Program Administrators of Massachusetts.

CFwp Source: Energy & Resource Solutions (2011). BFM Impact Evaluation Report. Prepared for the Electric and Gas Program Administrators of Massachusetts.

Non Energy Impact Factors

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

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Furnace ECM	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2015) 2013-14 Rhode Island C&I Natural Gas Free Ridership and Spillover Study (Memorandum), August 2015

Gross Measure TRC unit: $200/unit

Incentive Unit: $100/unit

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ECM Gas Rebate

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: Energy Star HVAC

Measure Description

Installation of high efficiency motors on residential furnace fans, including electronically commutated motors (ECMs) or steady state brushless furnace fan motors.

Baseline Description

The baseline efficiency case is the installation of a furnace with a standard efficiency steady state motor.

Savings principle

The high efficiency case is the installation an electronically commutated motor or brushless fan motor on a residential furnace.

Savings Method

Deemed

Unit

Installed high-efficiency furnace fan motor.

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 × 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
ECM Gas Rebate	168.00	0.12	-0.72				0.00

Electric kWh Source: Energy & Resource Solutions (2011). BFM Impact Evaluation Report. Prepared for the Electric and Gas Program Administrators of Massachusetts.

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Electric kW Source: Energy & Resource Solutions (2011). BFM Impact Evaluation Report. 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
ECM Gas Rebate	18	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ECM Gas Rebate	0.00	0.00	0.70	0.30

Measure life Source: Sachs, Harvey (2003). Energy Savings from Efficient Furnace Air Handlers in Massachusetts.

ISR Note: 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: Energy & Resource Solutions (2011). BFM Impact Evaluation Report. Prepared for the Electric and Gas Program Administrators of Massachusetts.

CFwp Source: Energy & Resource Solutions (2011). BFM Impact Evaluation Report. Prepared for the Electric and Gas Program Administrators of Massachusetts.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
ECM Gas Rebate	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
ECM Gas Rebate	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2015) 2013-14 Rhode Island C&I Natural Gas Free Ridership and Spillover Study (Memorandum), August 2015

Gross Measure TRC unit: N/A

Incentive Unit: N/A

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Early Replacement HP - SEER 16 (EE)

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: HVAC

Measure Type: Heat Pumps

Measure Sub Type: Early replacement

Program: Energy Star HVAC

Measure Description

Early replacement of a Central Air Conditioning or Heat Pump Unit. This measure accounts for the additional savings achieved for the early replacement of existing inefficient AC or heat pump units over the remaining life of the existing equipment.

Baseline Description

The baseline efficiency case is assumed to be a typical 10-12 year-old central air-conditioning or heat pump unit with SEER 10, EER 8.5, and HSPF 7.0

Savings principle

For the retirement savings over the remaining life of the existing AC unit, the efficient case is a SEER 13, EER 11, HSPF 7.6 unit. For the high efficiency savings over the lifetime of the new AC unit, the efficient case is a new high efficiency EER 14.5,EER 12, 8.2 HSPF unit.

Savings Method

Calculated using deemed inputs

Unit

Installation of a new efficient air conditioner.

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: . 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
Early Replacement HP - SEER 16 (EE)	679.90	0.47	0.00			0.00	0.00

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

Electric kWh Note: Updated based on historic measure mix

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

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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
Early Replacement HP - SEER 16 (EE)	18	1.00	1.00		1.00	1.00	1.00	0.25	0.50

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Early Replacement HP - SEER 16 (EE)	0.29	0.49	0.12	0.10

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

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	Sewer: Gallons	Annual $	One-time $
Early Replacement HP - SEER 16 (EE)	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Early Replacement HP - SEER 16 (EE)	0.15	0.00	0.00	0.85

NTG Note: Massachusetts Common Assumption

Gross Measure TRC unit: $ 900 per measure

Incentive Unit: $ 750 per measure

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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: 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)	2009.00	0.34	0.00			0.00	0.00

Electric kWh Source: Steven Winter Associates, Inc (2012). Heat Pump Water Heaters Evaluation of Field Installed Performance. Sponsored by National Grid and NSTAR

Electric kW Source: Steven Winter Associates, Inc (2012). Heat Pump Water Heaters Evaluation of Field Installed Performance. Sponsored by National Grid and NSTAR

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
HPWH <55 gallon (electric)	13	1.00	1.00		1.00	1.00	1.00	0.47	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
HPWH <55 gallon (electric)	0.36	0.31	0.17	0.16

Measure life Note: Based on warranty of equipment

ISR Note: 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: Steven Winter Associates, Inc (2012). Heat Pump Water Heaters Evaluation of Field Installed Performance. Sponsored by National Grid and NSTAR

CFwp Source: Steven Winter Associates, Inc (2012). Heat Pump Water Heaters Evaluation of Field Installed Performance. Sponsored by National Grid and NSTAR

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)	0.22	0.04	0.01	0.83

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

Gross Measure TRC unit: $ 750 per measure

Incentive Unit: $ 500 per measure

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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: 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, UEF 2.70 (electric)	418.00	0.34	0.00			0.00	0.00

Electric kWh Source: Not used

Electric kW Source: Not used

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
HPWH >55 gallon, UEF 2.70 (electric)	13	1.00	1.00		1.00	1.00	1.00	0.47	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
HPWH >55 gallon, UEF 2.70 (electric)				

Measure life Note: Based on warranty of equipment

ISR Note: 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: Not used

CFwp Source: Not used

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
HPWH >55 gallon, UEF 2.70 (electric)	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
HPWH >55 gallon, UEF 2.70 (electric)	0.22	0.04	0.01	0.83

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

Gross Measure TRC unit: $ 750 per measure

Incentive Unit: $ 500 per measure

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School Program LED Bulbs

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

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

Program: Energy Star Lighting

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

Existing lighting mix.

Savings principle

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

Savings Method

Calculated using deemed inputs

Unit

Installed lamp

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: 1059. Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014 Hours Note: The average annual operating hours are 1,058.5 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
School Program LED Bulbs	37.50	0.03	-0.04			-0.02	-0.01

Electric kWh Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Electric kW Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
School Program LED Bulbs	5	0.50	1.00		1.01	1.20	0.93	0.14	0.18

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
School Program LED Bulbs	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

SPF Note: All PAs use 100% savings persistence factors.

RRe Note: The realization rate accounts for heating/cooling interactive effects

RRsp Note: The realization rate accounts for heating/cooling interactive effects

RRwp Note: The realization rate accounts for heating/cooling interactive effects

CFsp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

CFwp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
School Program LED Bulbs	0.00	0.00		3.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
School Program LED Bulbs	0.65	0.00	0.00	0.35

NTG Source: RLPNC 17-11 LED NTG Consensus Process

Gross Measure TRC unit: $ 6 per bulb

Incentive Unit: $ 6 per bulb

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LED Bulbs (linear)

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: Energy Star Lighting

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 incandescents, 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 × (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: 1059. Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014 Hours Note: The average annual operating hours are 1,058.5 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 (linear)	11.90	0.01					-0.01

Electric kWh Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Electric kW Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Bulbs (linear)	16	1.00	1.00		1.01	1.20	0.93	0.14	0.18

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Bulbs (linear)	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

SPF Note: All PAs use 100% savings persistence factors.

RRe Note: The realization rate accounts for heating/cooling interactive effects

RRsp Note: The realization rate accounts for heating/cooling interactive effects

RRwp Note: The realization rate accounts for heating/cooling interactive effects

CFsp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

CFwp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
LED Bulbs (linear)	0.00	0.00	0.00	3.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Bulbs (linear)	0.55	0.00	0.00	0.45

NTG Source: RLPNC 17-11 LED NTG Consensus Process

Gross Measure TRC unit:

Incentive Unit:

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LED Fixture

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: Energy Star Lighting

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 incandescents, 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: 1059. Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014 Hours Note: The average annual operating hours are 1,058.5 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 Fixture	42.10	0.03	-0.06			-0.04	-0.01

Electric kWh Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Electric kW Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Fixture	5	0.93	1.00		1.01	1.20	0.93	0.14	0.18

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Fixture	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

SPF Note: All PAs use 100% savings persistence factors.

RRe Note: The realization rate accounts for heating/cooling interactive effects

RRsp Note: The realization rate accounts for heating/cooling interactive effects

RRwp Note: The realization rate accounts for heating/cooling interactive effects

CFsp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

CFwp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

Non Energy Impact Factors

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

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Fixture	0.55	0.00	0.00	0.45

NTG Source: RLPNC 17-11 LED NTG Consensus Process

Gross Measure TRC unit: $ 23 per fixture

Incentive Unit: $ 9 per fixture

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LED FoodBank

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

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

Program: Energy Star Lighting

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 incandescents, 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 × (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: 1059. Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014 Hours Note: The average annual operating hours are 1,058.5 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 FoodBank	37.50	0.03	-0.04			-0.02	-0.01

Electric kWh Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Electric kW Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED FoodBank	5	0.50	1.00		1.01	1.20	0.93	0.14	0.18

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED FoodBank	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

SPF Note: All PAs use 100% savings persistence factors.

RRe Note: The realization rate accounts for heating/cooling interactive effects

RRsp Note: The realization rate accounts for heating/cooling interactive effects

RRwp Note: The realization rate accounts for heating/cooling interactive effects

CFsp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

CFwp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
LED FoodBank	0.00	0.00		3.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED FoodBank	0.65	0.00	0.00	0.35

NTG Source: RLPNC 17-11 LED NTG Consensus Process

Gross Measure TRC unit: $ 6 per bulb

Incentive Unit: $ 6 per bulb

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LED Bulbs (Specialty)

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

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

Program: Energy Star Lighting

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 incandescents, 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 × (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: 1059. Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014 Hours Note: The average annual operating hours are 1,058.5 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 (Specialty)	47.10	0.04	-0.05			-0.03	-0.01

Electric kWh Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Electric kW Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Bulbs (Specialty)	6	0.94	1.00		1.01	1.20	0.93	0.14	0.18

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Bulbs (Specialty)	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

SPF Note: All PAs use 100% savings persistence factors.

RRe Note: The realization rate accounts for heating/cooling interactive effects

RRsp Note: The realization rate accounts for heating/cooling interactive effects

RRwp Note: The realization rate accounts for heating/cooling interactive effects

CFsp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

CFwp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
LED Bulbs (Specialty)	0.00	0.00		3.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Bulbs (Specialty)	0.55	0.00	0.00	0.45

NTG Source: RLPNC 17-11 LED NTG Consensus Process

Gross Measure TRC unit: $ 6 per bulb

Incentive Unit: $ 3 per bulb

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HTR LED A Lamps

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

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

Program: Energy Star Lighting

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 incandescents, 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 × (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: 1059. Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014 Hours Note: The average annual operating hours are 1,058.5 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
HTR LED A Lamps	37.50	0.03	-0.04			-0.02	-0.01

Electric kWh Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Electric kW Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
HTR LED A Lamps	5	0.93	1.00		1.01	1.20	0.93	0.14	0.18

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
HTR LED A Lamps	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

SPF Note: All PAs use 100% savings persistence factors.

RRe Note: The realization rate accounts for heating/cooling interactive effects

RRsp Note: The realization rate accounts for heating/cooling interactive effects

RRwp Note: The realization rate accounts for heating/cooling interactive effects

CFsp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

CFwp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
HTR LED A Lamps	0.00	0.00		3.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
HTR LED A Lamps	0.65	0.00	0.00	0.35

NTG Source: RLPNC 17-11 LED NTG Consensus Process

Gross Measure TRC unit: $ 5 per bulb

Incentive Unit: $ 4 per bulb

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LED Reflector

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

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

Program: Energy Star Lighting

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 incandescents, 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 × (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: 1059. Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014 Hours Note: The average annual operating hours are 1,058.5 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 Reflector	58.10	0.05	-0.06			-0.04	-0.01

Electric kWh Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Electric kW Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Reflector	6	0.94	1.00		1.01	1.20	0.93	0.14	0.18

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Reflector	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

SPF Note: All PAs use 100% savings persistence factors.

RRe Note: The realization rate accounts for heating/cooling interactive effects

RRsp Note: The realization rate accounts for heating/cooling interactive effects

RRwp Note: The realization rate accounts for heating/cooling interactive effects

CFsp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

CFwp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
LED Reflector	0.00	0.00		3.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Reflector	0.55	0.00	0.00	0.45

NTG Source: RLPNC 17-11 LED NTG Consensus Process

Gross Measure TRC unit: $ 14 per bulb

Incentive Unit: $ 5 per bulb

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LED A Lamps

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

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

Program: Energy Star Lighting

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 incandescents, 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 × (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: 1059. Hours Source: NMR Group, Northeast Residential Lighting Hours-of-Use Study, May 2014 Hours Note: The average annual operating hours are 1,058.5 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 A Lamps	42.10	0.03	-0.05			-0.03	-0.01

Electric kWh Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Electric kW Source: RLPNC 17-6 2019-2021 Planning and 2017 Annual Report Market Adoption Models

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED A Lamps	5	0.93	1.00		1.01	1.20	0.93	0.14	0.18

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED A Lamps	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

SPF Note: All PAs use 100% savings persistence factors.

RRe Note: The realization rate accounts for heating/cooling interactive effects

RRsp Note: The realization rate accounts for heating/cooling interactive effects

RRwp Note: The realization rate accounts for heating/cooling interactive effects

CFsp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

CFwp Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
LED A Lamps	0.00	0.00		3.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED A Lamps	0.65	0.00	0.00	0.35

NTG Source: RLPNC 17-11 LED NTG Consensus Process

Gross Measure TRC unit: $ 5 per bulb

Incentive Unit: $ 3 per bulb

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Low Flow Showerhead w/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: 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 adaper, 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 w/thermo Control (roadrunner electric DHW)	372.00	0.06	0.00			0.00	0.00

Electric kWh Source: Verifying Thermostatic Valve Showerhead Savings.xls

Electric kW Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low Flow Showerhead w/thermo Control (roadrunner electric DHW)	7	0.78	1.00		1.00	1.00	1.00	1.00	0.94

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low Flow Showerhead w/thermo Control (roadrunner electric DHW)	0.36	0.31	0.17	0.16

Measure life Note: Massachusetts Common Assumption

ISR Source: NMR (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-service and Short-Term Retention Rates Study

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.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Low Flow Showerhead w/thermo Control (roadrunner electric DHW)	3022.00	0.00		

Water/Sewer Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low Flow Showerhead w/thermo Control (roadrunner electric DHW)	0.03	0.00	0.00	0.97

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 40 per measure

Incentive Unit: $ 15 per measure

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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: 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: 8760 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
Advanced Power Strips IR - OS	132.00	0.03	0.00			0.00	0.00

Electric kWh Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study

Electric kW Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Advanced Power Strips IR - OS	5	0.75	1.00		0.92	1.00	1.00	0.73	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Advanced Power Strips IR - OS	0.36	0.32	0.16	0.16

Measure life Note: Massachusetts Common Assumption

ISR Source: NMR (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-service and Short-Term Retention Rates Study

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

RRe Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Advanced Power Strips IR - OS	0.00	0.00		

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.

Gross Measure TRC unit: $ 100 per measure

Incentive Unit: $ 35 per measure

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Low Flow Showerhead w/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: 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 adaper, 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 w/thermo Control (roadrunner gas DHW)		0.00		1.84		0.00	0.00

Gas DHW MMBtu Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low Flow Showerhead w/thermo Control (roadrunner gas DHW)	7	0.78	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low Flow Showerhead w/thermo Control (roadrunner gas DHW)	0.00	0.00	0.00	0.00

Measure life Note: Massachusetts Common Assumption

ISR Source: NMR (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-service and Short-Term Retention Rates Study

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 w/thermo Control (roadrunner gas DHW)	3022.00	0.00		

Water/Sewer Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low Flow Showerhead w/thermo Control (roadrunner gas DHW)	0.03	0.00	0.00	0.97

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 40 per measure

Incentive Unit: $ 15 per measure

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Low Flow Showerhead thermo Control (ladybug gas DHW)

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: Water Heating

Measure Type: Flow Control

Measure Sub Type: Low Flow Showerhead

Program: 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 adaper, 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)		0.00		0.38		0.00	0.00

Gas DHW MMBtu Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

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)	7	0.78	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low Flow Showerhead thermo Control (ladybug gas DHW)	0.00	0.00	0.00	0.00

Measure life Note: Massachusetts Common Assumption

ISR Source: NMR (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-service and Short-Term Retention Rates Study

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 thermo Control (ladybug gas DHW)	621.00	0.00		

Water/Sewer Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low Flow Showerhead thermo Control (ladybug gas DHW)	0.03	0.00	0.00	0.97

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 30 per measure

Incentive Unit: $ 11 per measure

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Low Flow Showerhead thermo Control (ladybug 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: 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 adaper, 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 thermo Control (ladybug oil. Propane DHW)		0.00	0.00			0.43	0.38

Oil MMBtu Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

Propane MMBtu Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

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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 oil. Propane DHW)	7	0.78	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low Flow Showerhead thermo Control (ladybug oil. Propane DHW)	0.00	0.00	0.00	0.00

Measure life Note: Massachusetts Common Assumption

ISR Source: NMR (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-service and Short-Term Retention Rates Study

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 thermo Control (ladybug oil. Propane DHW)	621.00	0.00		

Water/Sewer Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low Flow Showerhead thermo Control (ladybug oil. Propane DHW)	0.03	0.00	0.00	0.97

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 30 per measure

Incentive Unit: $ 11 per measure

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Low Flow Showerhead w/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: 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 adaper, 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 w/thermo Control (roadrunner oil. Propane DHW)		0.00	0.00			2.09	1.84

Oil MMBtu Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

Propane MMBtu Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low Flow Showerhead w/thermo Control (roadrunner oil. Propane DHW)	7	0.78	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low Flow Showerhead w/thermo Control (roadrunner oil. Propane DHW)	0.00	0.00	0.00	0.00

Measure life Note: Massachusetts Common Assumption

ISR Source: NMR (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-service and Short-Term Retention Rates Study

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 w/thermo Control (roadrunner oil. Propane DHW)	3022.00	0.00		

Water/Sewer Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low Flow Showerhead w/thermo Control (roadrunner oil. Propane DHW)	0.03	0.00	0.00	0.97

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 40 per measure

Incentive Unit: $ 15 per measure

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Smart Strips

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

Measure Category: Plug Load | **Measure Type:** Smart Strips | **Measure Sub Type:** Smart Strip

Program: 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: 8760 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	111.00	0.02	0.00			0.00	0.00

Electric kWh Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study

Electric kW Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Smart Strips	5	0.86	1.00		0.92	1.00	1.00	0.73	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Smart Strips	0.36	0.32	0.16	0.16

Measure life Note: Massachusetts Common Assumption

ISR Source: NMR (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-service and Short-Term Retention Rates Study

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

RRe Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Smart Strips	0.00	0.00		

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.

Gross Measure TRC unit: $ 30 per measure

Incentive Unit: $ 10 per measure

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Refrigerator Recycle

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: Appliances

Measure Type: Recycling

Measure Sub Type: Refrigerator Recycling

Program: 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: 8760 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	897.00	0.11	0.00			0.00	0.00

Electric kWh Source: NMR (2008). RLPNC 18-1 Appliance Recycling Database Review and Savings Update

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
Refrigerator Recycle	8	1.00	1.00		1.00	1.00	1.00	1.00	0.92

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Refrigerator Recycle	0.31	0.34	0.16	0.19

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 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: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Refrigerator Recycle	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Refrigerator Recycle	0.56	0.00	0.00	0.44

NTG Source: NMR (2008). RLPNC 18-1 Appliance Recycling Database Review and Savings Update

Gross Measure TRC unit: $ 200 per measure

Incentive Unit: $ 50 per measure

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Low Flow Showerhead thermo Control (ladybug electric DHW)

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: Water Heating

Measure Type: Flow Control

Measure Sub Type: Low Flow Showerhead

Program: 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 adaper, 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 thermo Control (ladybug electric DHW)	76.00	0.01	0.00			0.00	0.00

Electric kWh Source: Verifying Thermostatic Valve Showerhead Savings.xls

Electric kW Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

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 electric DHW)	7	0.78	1.00		1.00	1.00	1.00	1.00	0.94

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low Flow Showerhead thermo Control (ladybug electric DHW)	0.36	0.31	0.17	0.16

Measure life Note: Massachusetts Common Assumption

ISR Source: NMR (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-service and Short-Term Retention Rates Study

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.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Low Flow Showerhead thermo Control (ladybug electric DHW)	621.00	0.00		

Water/Sewer Source: PGE Low Flow Showerhead and Thermostatic Restriction Valve

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low Flow Showerhead thermo Control (ladybug electric DHW)	0.03	0.00	0.00	0.97

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 30 per measure

Incentive Unit: $ 11 per measure

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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: Energy Star Products

Measure Description

The installation of Low E storm windows over existing windows.

Baseline Description

The basecase 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 × 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:

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	229.00	0.12	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: Culp, Thomas D., & Cort, Katherine A. Energy Savings of Low-E Storm Windows and Panels across US Climate Zones. United States.

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Energy Impact Factors

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	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low E Storm Windows, electric heat	0.38	0.62	0.00	0.01

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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Low E Storm Windows, electric heat	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low E Storm Windows, electric heat	0.00	0.00	0.00	1.00

Gross Measure TRC unit: $ 55 per measure

Incentive Unit: $ 25 per measure

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Refrigerator Recycling (Primary)

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: Appliances

Measure Type: Refrigerator Recycling

Measure Sub Type: Refrigerator Recycling

Program: 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:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Refrigerator Recycling (Primary)	897.00	0.11	0.00			0.00	0.00

Electric kWh Source: NMR (2008). RLPNC 18-1 Appliance Recycling Database Review and Savings Update

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
Refrigerator Recycling (Primary)	8	1.00	1.00		1.00	1.00	1.00	1.00	0.93

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Refrigerator Recycling (Primary)	0.31	0.34	0.16	0.19

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Refrigerator Recycling (Primary)	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Refrigerator Recycling (Primary)	0.56	0.00	0.00	0.44

NTG Source: NMR (2008). RLPNC 18-1 Appliance Recycling Database Review and Savings Update

Gross Measure TRC unit: $ 200 per measure

Incentive Unit: $ 50 per measure

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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: Energy Star Products

Measure Description

The installation of Low E storm windows over existing windows.

Baseline Description

The basecase 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 × 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:

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	5.00	0.00	0.76			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: Culp, Thomas D., & Cort, Katherine A. Energy Savings of Low-E Storm Windows and Panels across US Climate Zones. United States.

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.

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Energy Impact Factors

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	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low E Storm Windows, gas heat	0.29	0.49	0.13	0.10

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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Low E Storm Windows, gas heat	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low E Storm Windows, gas heat	0.00	0.00	0.00	1.00

Gross Measure TRC unit: $ 55 per measure

Incentive Unit: $ 25 per measure

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Freezer Recycling

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Appliances **Measure Type:** Recycling **Measure Sub Type:** Freezer Recycling

Program: 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: 8760 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	488.00	0.06	0.00			0.00	0.00

Electric kWh Source: NMR (2008). RLPNC 18-1 Appliance Recycling Database Review and Savings Update

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
Freezer Recycling	8	1.00	1.00		1.00	1.00	1.00	1.00	0.93

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Freezer Recycling	0.31	0.34	0.16	0.19

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 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: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Freezer Recycling	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Freezer Recycling	0.44	0.00	0.00	0.56

NTG Source: NMR (2008). RLPNC 18-1 Appliance Recycling Database Review and Savings Update

Gross Measure TRC unit: $ 200 per measure

Incentive Unit: $ 50 per measure

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Dehumidifier Recycling

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Appliances **Measure Type:** Dehumidifiers **Measure Sub Type:** Dehumidifier

Program: 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 dehumidifer

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 Recycling	152.70	0.03	0.00			0.00	0.00

Electric kWh Source: Energy Star Dehumidifier Savings estimate 2015-9-22

Electric kW Source: Energy Star Dehumidifier Savings estimate 2015-9-22

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	0.85	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dehumidifier Recycling	0.02	0.03	0.59	0.36

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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: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Dehumidifier Recycling	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dehumidifier Recycling	0.39	0.00	0.00	0.61

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 50 per measure

Incentive Unit: $30 per measure

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Dehumidifier

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Appliances **Measure Type:** Dehumidifiers **Measure Sub Type:** Dehumidifier

Program: Energy Star Products

Measure Description

The Installation of high efficiency dehumidifiers and the turn-in of existing inefficienct dehumidifyers.

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 dehumidifer

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	167.60	0.04	0.00			0.00	0.00

Electric kWh Source: Energy Star Dehumidifier Savings estimate 2015-9-22

Electric kW Source: Energy Star Dehumidifier Savings estimate 2015-9-22

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dehumidifier	12	0.96	1.00		1.00	1.00	1.00	0.85	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dehumidifier	0.02	0.03	0.59	0.36

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ISR Source: NMR (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-service and Short-Term Retention Rates Study

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: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Dehumidifier	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dehumidifier	0.39	0.00	0.00	0.61

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 34 per measure

Incentive Unit: $ 30 per measure

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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: Energy Star Products

Measure Description

The installation of Low E storm windows over existing windows.

Baseline Description

The basecase 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 × 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:

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	5.00	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: Culp, Thomas D., & Cort, Katherine A. Energy Savings of Low-E Storm Windows and Panels across US Climate Zones. United States.

Oil MMBtu Source: Culp, Thomas D., & Cort, Katherine A. Energy Savings of Low-E Storm Windows and Panels across US Climate Zones. United States.

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Energy Impact Factors

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	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low E Storm Windows, other heat	0.29	0.49	0.13	0.10

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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Low E Storm Windows, other heat	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low E Storm Windows, other heat	0.00	0.00	0.00	1.00

Gross Measure TRC unit: $ 55 per measure

Incentive Unit: $ 25 per measure

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Room AC (10.8)

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

Measure Category: HVAC | **Measure Type:** Cooling | **Measure Sub Type:** Room AC

Program: 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)	36.00	0.10	0.00			0.00	0.00

Electric kWh Source: energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerRoomAC.xls

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
Room AC (10.8)	8	1.00	1.00		1.00	1.00	1.00	1.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Room AC (10.8)	0.01	0.05	0.60	0.34

Measure life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR Qualified Room Air Conditioner.

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: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Room AC (10.8)	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Room AC (10.8)	0.37	0.00	0.00	0.63

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 70 per measure

Incentive Unit: $ 40 per measure

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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: 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: 5840. 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	391.00	0.08	0.00			0.00	0.00

Electric kWh Source: Environmental Protection Agency (2012), Savings Calculator for Energy Star Qualified Appliances.

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
Room air cleaners	9	0.97	1.00		1.00	1.00	1.00	0.73	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Room air cleaners	0.36	0.32	0.16	0.16

Measure life Source: Environmental Protection Agency (2012), Savings Calculator for Energy Star Qualified Appliances.

ISR Source: NMR (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-service and Short-Term Retention Rates Study

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: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Room air cleaners	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Room air cleaners	0.29	0.00	0.00	0.71

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 72 per measure

Incentive Unit: $ 40 per measure

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Pool pump (2

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Motors/Drives **Measure Type:** Variable Speed Drive **Measure Sub Type:** Pump

Program: 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: 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	824.00	0.35	0.00			0.00	0.00

Electric kWh Source: Pacific Gas and Electric The Multi-Speed Pool Pump Fact Sheet.

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
Pool pump (2	10	1.00	1.00		1.00	1.00	1.00	1.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Pool pump (2	0.00	0.00	0.50	0.50

Measure life Source: Davis Energy Group (2008). Proposal Information Template for Residential Pool Pump Measure Revisions. Prepared for Pacific Gas and 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 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: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Pool pump (2	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pool pump (2	0.05	0.00	0.00	0.95

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 300 per measure

Incentive Unit: $ 200 per measure

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Pool pump (variable)

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Motors/Drives **Measure Type:** Variable Speed Drive **Measure Sub Type:** Pump

Program: 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: 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)	1062.00	0.50	0.00			0.00	0.00

Electric kWh Source: Pacific Gas and Electric The Multi-Speed Pool Pump Fact Sheet.

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
Pool pump (variable)	10	1.00	1.00		1.00	1.00	1.00	1.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Pool pump (variable)	0.00	0.00	0.50	0.50

Measure life Source: Davis Energy Group (2008). Proposal Information Template for Residential Pool Pump Measure Revisions. Prepared for Pacific Gas and 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 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: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Pool pump (variable)	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pool pump (variable)	0.05	0.00	0.00	0.95

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 650 per measure

Incentive Unit: $ 500 per measure

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EnergyStar Dryer

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Appliances **Measure Type:** Clothes Dryers **Measure Sub Type:** Dryer

Program: 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 × 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	160.00	0.02	0.00			0.00	0.00

Electric kWh Source: MA TRM, 2016-2018: Energy Star Clothes Dryer

Electric kW Source: MA TRM, 2016-2018: Energy Star Clothes Dryer

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
EnergyStar Dryer	12	0.97	1.00		1.00	1.00	1.00	1.00	0.90

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
EnergyStar Dryer	0.36	0.32	0.16	0.16

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Measure life Source: SEDI HE Dryer Screening Ver.2 Using DOE2005.xls

ISR Source: NMR (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-service and Short-Term Retention Rates Study

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: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
EnergyStar Dryer	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
EnergyStar Dryer	0.43	0.00	0.00	0.57

NTG Source: NMR (2018). RLPNC 17-5/18-4 Res General Products NTG Consensus Process

Gross Measure TRC unit: $ 60 per measure

Incentive Unit: $ 50 per measure

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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: 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: 8760 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
Advanced Power Strips IR	225.00	0.05	0.00			0.00	0.00

Electric kWh Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study

Electric kW Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Advanced Power Strips IR	5	0.75	1.00		0.92	1.00	1.00	0.73	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Advanced Power Strips IR	0.36	0.32	0.16	0.16

Measure life Note: Massachusetts Common Assumption

ISR Source: NMR (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-service and Short-Term Retention Rates Study

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

RRe Source: NMR (2018). RLPNC 17-3 Smart Power Strip Metering Study

RRsp Note: National Grid assumption based on regional PA working groups.

RRwp Note: National Grid assumption based on regional PA working groups.

CFsp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

CFwp Source: The Cadmus Group, Inc. (2012). Demand Impact Model. Prepared for the Massachusetts Program Administrators.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Advanced Power Strips IR	0.00	0.00		

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.

Gross Measure TRC unit: $ 100 per measure

Incentive Unit: $ 35 per measure

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EW Pipe Insulation

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** Insulation **Measure Sub Type:** Pipe Insulation

Program: Energywise

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 DHW efficiency measure.

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
EW Pipe Insulation	33.30	0.00					

Electric kWh Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

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
EW Pipe Insulation	7	1.00	1.00		1.00	1.00	1.00	1.00	0.94

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
EW Pipe Insulation	0.36	0.31	0.17	0.16

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: 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 $
EW Pipe Insulation				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
EW Pipe Insulation	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW Bundled costs (see Participant listing)

Incentive Unit: EW Bundled costs (see Participant listing)

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EW Pre-Wx

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: Whole Home

Measure Type: Weatherization

Measure Sub Type: Pre-Weatherization

Program: 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

Deemed

Unit

Rebated Pre-Wx

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
EW Pre-Wx	0.00	0.00					

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
EW Pre-Wx	1	1.00	1.00		1.00	1.00	1.00	0.03	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
EW Pre-Wx	0.27	0.40	0.13	0.20

Measure life Note: Massachusetts Common Assumption

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ISR Note: 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: 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 $
EW Pre-Wx				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
EW Pre-Wx	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: $ 300 / job

Incentive Unit: $ 300 / job

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LED Bulbs

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: Energywise

Measure Description

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

longer lamp lifetimes.

Baseline Description

The baseline efficiency case is blend of incandescents, 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 × 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	37.10	0.04					

Electric kWh Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

Electric kWh Note: Per C-team savings from evalutaion are net. Gross Savings and NTGR provided by C-team

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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Bulbs	3	1.00	1.00		1.00	1.00	1.00	0.13	0.16

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Bulbs	0.43	0.24	0.21	0.12

Measure life Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

ISR Note: 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: 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 Bulbs	0.00	0.00		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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Bulbs	0.12	0.00	0.00	0.88

NTG Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

Gross Measure TRC unit: EW Bundled costs (see Participant listing)

Incentive Unit: EW Bundled costs (see Participant listing)

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LED Bulbs (EISA Exempt)

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

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

Program: 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 blend of incandescents, 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 × 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)	39.40	0.04					

Electric kWh Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Bulbs (EISA Exempt)	3	1.00	1.00		1.00	1.00	1.00	0.13	0.16

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Bulbs (EISA Exempt)	0.43	0.24	0.21	0.12

Measure life Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

ISR Note: 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: 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 Bulbs (EISA Exempt)	0.00	0.00		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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Bulbs (EISA Exempt)	0.12	0.00	0.00	0.88

NTG Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

Gross Measure TRC unit: EW Bundled costs (see Participant listing)

Incentive Unit: EW Bundled costs (see Participant listing)

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LED Bulbs Reflectors

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: 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 blend of incandescents, halogens, CFLs and other bulbs types, as provided by market research.

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 Bulbs Reflectors	51.00	0.05					

Electric kWh Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Bulbs Reflectors	3	1.00	1.00		1.00	1.00	1.00	0.13	0.16

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Bulbs Reflectors	0.43	0.24	0.21	0.12

Measure life Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

ISR Note: 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: 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 Bulbs Reflectors	0.00	0.00		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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Bulbs Reflectors	0.12	0.00	0.00	0.88

NTG Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

Gross Measure TRC unit: EW Bundled costs (see Participant listing)

Incentive Unit: EW Bundled costs (see Participant listing)

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Smart Strip

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Plug Load **Measure Type:** Smart Strips **Measure Sub Type:** Smart Strip

Program: 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	21.60	0.00					

Electric kWh Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

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
Smart Strip	5	1.00	1.00		1.00	1.00	1.00	0.73	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Smart Strip	0.36	0.32	0.16	0.16

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: 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 Strip		0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Smart Strip	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW Bundled costs (see Participant listing)

Incentive Unit: EW Bundled costs (see Participant listing)

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EW SHOWERHEAD

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: Water Heating

Measure Type: Flow Control

Measure Sub Type: Low Flow Showerhead

Program: 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 adaper, 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
EW SHOWERHEAD	34.30	0.00					

Electric kWh Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

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
EW SHOWERHEAD	7	1.00	1.00		1.00	1.00	1.00	1.00	0.94

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
EW SHOWERHEAD	0.36	0.31	0.17	0.16

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: 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 $
EW SHOWERHEAD	2401.00			0.03

Water/Sewer Source: The Cadmus Group, Inc. (2012). Home Energy Services Impact Evaluation. Prepared for the Electric and Gas Program Administrators of Massachusetts.

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
EW SHOWERHEAD	0.00	0.00	0.00	1.00

NTG Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

Gross Measure TRC unit: EW Bundled costs (see Participant listing)

Incentive Unit: EW Bundled costs (see Participant listing)

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Faucet aerator

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** Flow Control **Measure Sub Type:** Faucet Aerator

Program: 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 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
Faucet aerator	36.60	0.01					

Electric kWh Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

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
Faucet aerator	7	1.00	1.00		1.00	1.00	1.00	1.00	0.94

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Faucet aerator	0.36	0.31	0.17	0.16

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: 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 $
Faucet aerator	332.00	0.00		

Water/Sewer Source: The Cadmus Group, Inc. (2012). Home Energy Services Impact Evaluation. Prepared for the Electric and Gas Program Administrators of Massachusetts.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Faucet aerator	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW Bundled costs (see Participant listing)

Incentive Unit: EW Bundled costs (see Participant listing)

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LED TORCHIERE1

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Torchiere

Program: Energywise

Measure Description

The installation of ENERGY STAR® torchieres. Torchieres offer comparable luminosity to incandescents at significantly less wattage and significantly longer lifetimes.

Baseline Description

The baseline efficiency case is a blend of incandescent, compact fluorescent, and halgoen lamps. For home audit applications, the baseline is the existing fixture.

Savings principle

The high efficiency case is an ENERGY STAR® qualified torchiere.

Savings Method

Deemed

Unit

Installed torchiere

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 TORCHIERE1	37.10	0.04					

Electric kWh Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED TORCHIERE1	3	1.00	1.00		1.00	1.00	1.00	0.13	0.16

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED TORCHIERE1	0.43	0.24	0.21	0.12

Measure life Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

ISR Note: 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: 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 $
LED TORCHIERE1				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED TORCHIERE1	0.12	0.00	0.00	0.88

NTG Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

Gross Measure TRC unit: EW Bundled costs (see Participant listing)

Incentive Unit: EW Bundled costs (see Participant listing)

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LED Fixture

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: 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 blend of incandescents, 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

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	37.10	0.04					

Electric kWh Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Fixture	3	1.00	1.00		1.00	1.00	1.00	0.13	0.16

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Fixture	0.43	0.24	0.21	0.12

Measure life Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

ISR Note: 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: 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		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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Fixture	0.12	0.00	0.00	0.88

NTG Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

Gross Measure TRC unit: EW Bundled costs (see Participant listing)

Incentive Unit: EW Bundled costs (see Participant listing)

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Refrigerator Brush

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: Refrigeration

Measure Type: Refrigeration O&M

Measure Sub Type: Refrigerator Brush

Program: 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 × 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	10.90	0.00					

Electric kWh Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

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
Refrigerator Brush	5	1.00	1.00		1.00	1.00	1.00	1.00	0.93

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Refrigerator Brush	0.30	0.35	0.16	0.19

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: 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 $
Refrigerator Brush	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Refrigerator Brush	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW Bundled costs (see Participant listing)

Incentive Unit: EW Bundled costs (see Participant listing)

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Refrig rebate

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

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

Program: Energywise

Measure Description

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

Baseline Description

For Top Ten® and Most Efficient® refrigerators, the baseline is a 50% mix of available Energy Star® and Federal standard compliant refrigerators. For Energy Star® refrigerators, the baseline is a refrigerator that meets Federal standards.

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

Deemed

Unit

Installed high-efficiency refrigerator.

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
Refrig rebate	460.80	0.03					

Electric kWh Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

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
Refrig rebate	12	1.00	1.00		1.00	1.00	1.00	1.00	0.93

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Refrig rebate	0.30	0.35	0.16	0.19

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 rate is 100% since gross savings values 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 $
Refrig rebate		0.00		1.44

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
Refrig rebate	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit:

Incentive Unit:

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EW Single FamilyWiFi Thermostat - DR Enabled

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: Energywise

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 = 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
EW Single FamilyWiFi Thermostat - DR Enabled	104.00	0.23					

Electric kWh Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis. Prepared for Keith Miller and Whitney Domigan, National Grid.

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
EW Single FamilyWiFi Thermostat - DR Enabled	15	1.00	1.00		1.00	1.00	1.00	1.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
EW Single FamilyWiFi Thermostat - DR Enabled	0.26	0.40	0.14	0.20

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: 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 $
EW Single FamilyWiFi Thermostat - DR Enabled	0.00	0.00	3.63	

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
EW Single FamilyWiFi Thermostat - DR Enabled	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: $ 320 / unit

Incentive Unit: $ 180 / unit

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Participant

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Participant **Measure Type:** Participant **Measure Sub Type:** Participant

Program: Energywise

Measure Description

Baseline Description

Savings principle

Savings Method

Deemed

Unit

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	0.00	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	0.73	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Participant	0.36	0.32	0.16	0.16

ISR Note: 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.

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RRwp Note: Realization rate is 100% since gross savings values 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 $
Participant				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Participant	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: $ 460 / participant

Incentive Unit: $ 460 / participant

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LED Outdoor Fixture

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Lighting **Measure Type:** Exterior **Measure Sub Type:** LED Screw Base

Program: 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 blend of incandescents, halogens, CFLs and other bulbs types, as provided by market research.

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	37.10	0.04					

Electric kWh Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

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

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
LED Outdoor Fixture	3	1.00	1.00		1.00	1.00	1.00	0.14	0.18

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
LED Outdoor Fixture	0.43	0.24	0.21	0.12

Measure life Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

ISR Note: 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: 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 Outdoor Fixture	0.00	0.00		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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
LED Outdoor Fixture	0.12	0.00	0.00	0.88

NTG Source: NMR (2018). RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus

Gross Measure TRC unit: EW Bundled costs (see Participant listing)

Incentive Unit: EW Bundled costs (see Participant listing)

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Air Sealing Kit (Oil)

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: Building Shell

Measure Type: Air Sealing

Measure Sub Type: Air Sealing/Infiltration

Program: Energywise

Measure Description

The installation of recessed lighting cans that provide air sealing benefits.

Baseline Description

The baseline is leaky recessed lighting cans on thermal boundaries.

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).

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)	0.00	0.00				0.28	

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	0.20	0.80

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Air Sealing Kit (Oil)	0.26	0.40	0.14	0.20

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: 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 $
Air Sealing Kit (Oil)			19.28	

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
Air Sealing Kit (Oil)	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW Bundled costs (see Participant listing)

Incentive Unit: EW Bundled costs (see Participant listing)

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Wx - GAS- Non Elec

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Building Shell **Measure Type:** Insulation **Measure Sub Type:** Shell

Program: Energywise

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

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
Wx - GAS- Non Elec	72.40	0.08					

Electric kWh Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

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
Wx - GAS- Non Elec	20	1.00	1.00		1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Wx - GAS- Non Elec	0.26	0.40	0.14	0.20

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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: 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 $
Wx - GAS- Non Elec				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Wx - GAS- Non Elec	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit:

Incentive Unit:

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Wx - OIL- Non Elec

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Building Shell **Measure Type:** Insulation **Measure Sub Type:** Shell

Program: Energywise

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

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
Wx - OIL- Non Elec	96.90	0.18				14.00	

Electric kWh Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

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

Oil MMBtu Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Wx - OIL- Non Elec	20	1.00	1.00		1.00	1.00	1.00	0.00	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Wx - OIL- Non Elec	0.26	0.40	0.14	0.20

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: 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 $
Wx - OIL- Non Elec				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Wx - OIL- Non Elec	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: $ 3700 / participant

Incentive Unit: $ 2775 / participant

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Wx-Electric - Elec

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Building Shell **Measure Type:** Insulation **Measure Sub Type:** Shell

Program: Energywise

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

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
Wx-Electric - Elec	782.20	0.83					

Electric kWh Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

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
Wx-Electric - Elec	20	1.00	1.00		1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Wx-Electric - Elec	0.26	0.40	0.14	0.20

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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: 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 $
Wx-Electric - Elec			66.59	

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
Wx-Electric - Elec	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: $ 3700 / participant

Incentive Unit: $ 2775 / participant

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Programmable Thermostat (Electric heat only)

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: Energywise

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 = 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 heat only)	214.60	0.11					

Electric kWh Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

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
Programmable Thermostat (Electric heat only)	15	1.00	1.00		1.00	1.00	1.00	0.02	0.80

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable Thermostat (Electric heat only)	0.26	0.40	0.14	0.20

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: 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 $
Programmable Thermostat (Electric heat only)	0.00	0.00	3.63	

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 heat only)	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: $ 200 / unit

Incentive Unit: $ 200 / unit

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WiFi Thermostat

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: Energywise

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 = 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
WiFi Thermostat	104.00	0.23					

Electric kWh Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis. Prepared for Keith Miller and Whitney Domigan, National Grid.

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
WiFi Thermostat	15	1.00	1.00		1.00	1.00	1.00	0.20	0.80

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WiFi Thermostat	0.26	0.40	0.14	0.20

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: 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 $
WiFi Thermostat	0.00	0.00	3.63	

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	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: $ 320 / unit

Incentive Unit: $ 180 / unit

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Programmable Thermostat (Oil only)

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: Energywise

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 = 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 only)	104.00	0.18				3.40	

Electric kWh Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis. Prepared for Keith Miller and Whitney Domigan, National Grid.

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

Oil MMBtu Source: The Cadmus Group, Inc. (2012). Home Energy Services Impact Evaluation. Prepared for the Electric and Gas Program Administrators of Massachusetts.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Programmable Thermostat (Oil only)	15	1.00	1.00		1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable Thermostat (Oil only)	0.01	0.04	0.54	0.41

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: 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 $
Programmable Thermostat (Oil only)	0.00	0.00	3.63	

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 only)	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: $ 200 / unit

Incentive Unit: $ 200 / unit

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Participant

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Participant **Measure Type:** Participant **Measure Sub Type:** Participant

Program: EnergywiseMF

Measure Description

This row identifies a participant for tracking and cost purposes.

Baseline Description

Savings principle

Savings Method

Unit

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			0.00	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	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Participant	0.00	0.00	0.00	0.00

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Participant	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Participant	0.00	0.00	0.00	1.00

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Gross Measure TRC unit: $454/participant

Incentive Unit: $363/participant

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Faucet aerator

Sector: Residential **Fuel:** Electric **Program Type:** Custom

Measure Category: Water Heating **Measure Type:** Flow Control **Measure Sub Type:** Faucet Aerator

Program: 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
Faucet aerator	Calc	Calc	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.

Propane 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
Faucet aerator	7	1.00	1.00		0.86	1.00	1.00	0.58	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Faucet aerator				

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 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 $
Faucet aerator	332.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Faucet aerator	0.00	0.00	0.00	1.00

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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AIR SEALING OIL

Sector: Residential **Fuel:** Electric **Program Type:** Custom

Measure Category: Building Shell **Measure Type:** Air Sealing **Measure Sub Type:** Oil

Program: 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 air-tightness 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: 4644. 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				3.02	

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.

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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 OIL	15	1.00	1.00		1.00	1.00	1.00	1.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
AIR SEALING OIL	0.01	0.04	0.53	0.42

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 $
AIR SEALING OIL	0.00		19.35	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
AIR SEALING OIL	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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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: 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 air-tightness 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: 4644. 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					

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.

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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	15	1.00	1.00		1.00	1.00	1.00	0.41	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
AIR SEALING ELEC WITH AC	0.45	0.44	0.06	0.05

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 $
AIR SEALING ELEC WITH AC	0.00		19.35	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
AIR SEALING ELEC WITH AC	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

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Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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INSULATION OIL

Sector: Residential **Fuel:** Electric **Program Type:** Custom

Measure Category: Building Shell **Measure Type:** Insulation **Measure Sub Type:** Oil

Program: 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 × 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: 4644. 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				7.17	

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.

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
INSULATION OIL	0.01	0.04	0.53	0.42

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		47.31	

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
INSULATION OIL	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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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: 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 × 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: 4644. 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					

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.

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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	0.41	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
INSULATION ELEC WITH AC	0.45	0.44	0.06	0.05

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 ELEC WITH AC	0.00		47.31	

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
INSULATION ELEC WITH AC	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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AERATOR Oil

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** Flow Control **Measure Sub Type:** Faucet Aerator

Program: 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 Oil		0.00				0.86	

Oil MMBtu Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. 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
AERATOR Oil	7	1.00	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
AERATOR 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 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 $
AERATOR Oil	332.00		0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
AERATOR Oil	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Common Ext LED Bulb

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Lighting **Measure Type:** Exterior **Measure Sub Type:** Common LED

Program: 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	141.80		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
Common Ext LED Bulb	5	1.00	1.00		1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Ext LED Bulb	0.20	0.54	0.06	0.20

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Common Ext LED Bulb	0.00	0.00	0.00	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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Ext LED Bulb	0.00	0.00	0.00	1.00

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Common Ext LED Fixture

Sector: Residential **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Exterior **Measure Sub Type:** Common LED

Program: 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 is the existing lighting hours of use.

Savings principle

The high efficiency case is lights thaare 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Ext LED Fixture	5	1.00	1.00		1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Ext LED Fixture	0.20	0.54	0.06	0.20

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Common Ext LED Fixture	0.00		0.00	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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Ext LED Fixture	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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THERMOSTAT OIL

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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		0.00				2.30	

Oil MMBtu Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. 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
THERMOSTAT OIL	10	1.00	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
THERMOSTAT OIL	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 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 $
THERMOSTAT OIL	0.00		14.35	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
THERMOSTAT OIL	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Smart Strips

Sector: Residential | **Fuel:** Electric | **Program Type:** Prescriptive

Measure Category: Plug Load | **Measure Type:** Smart Strips | **Measure Sub Type:** Smart Strip

Program: 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: 8760 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	75.10	0.00	0.00			0.00	0.00

Electric kWh Source: NEEP (2012). Advanced Power Strips Deemed Savings Methodology.

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
Smart Strips	5	1.00	1.00		0.86	1.00	1.00	0.73	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Smart Strips	0.34	0.33	0.16	0.17

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 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 $
Smart Strips	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Smart Strips	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Dwelling Int LED Fixture

Sector: Residential **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Dwelling LED

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int LED Fixture	5	0.88	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dwelling Int LED Fixture	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Dwelling Int LED Fixture	0.00		0.00	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.

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.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Dwelling Ext Reflector

Sector: Residential

Fuel: Electric

Program Type: Custom

Measure Category: Lighting

Measure Type: Exterior

Measure Sub Type: Dwelling Reflector

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Ext Reflector	5	0.88	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dwelling Ext Reflector	0.20	0.54	0.06	0.20

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Dwelling Ext Reflector	0.00		0.00	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.

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.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Dwelling Int EISA Exempt

Sector: Residential **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Dwelling EISA

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int EISA Exempt	9	0.88	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dwelling Int EISA Exempt	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Dwelling Int EISA Exempt	0.00		0.00	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.

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.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Dwelling Int LED Bulbs

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Dwelling LED

Program: 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	35.00		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
Dwelling Int LED Bulbs	5	0.88	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dwelling Int LED Bulbs	0.43	0.24	0.21	0.12

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Dwelling Int LED Bulbs	0.00	0.00	0.00	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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Dwelling Int LED Bulbs	0.00	0.00	0.00	1.00

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Dwelling Int Reflector

Sector: Residential

Fuel: Electric

Program Type: Custom

Measure Category: Lighting

Measure Type: Interior

Measure Sub Type: Dwelling Reflector

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Dwelling Int Reflector	6	0.88	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dwelling Int Reflector	0.43	0.24	0.21	0.12

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Dwelling Int Reflector	0.00		0.00	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.

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.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Pipe Wrap DHW Elec

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** Insulation **Measure Sub Type:** Pipe Insulation

Program: 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

Calculated using site-specific inputs

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	129.00	0.02					

Electric kWh Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. Prepared for Massachusetts Program Administrators.

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
Pipe Wrap DHW Elec	15	1.00	1.00		0.86	1.00	1.00	0.58	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Pipe Wrap DHW Elec	0.40	0.33	0.14	0.13

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 Note: 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 Elec	0.00		0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pipe Wrap DHW Elec	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Refrig rebate

Sector: Residential **Fuel:** Electric **Program Type:** Custom

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

Program: 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

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: 8760 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	Calc	Calc				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.

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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
Refrig rebate	12	1.00	1.00		0.86	1.00	1.00	1.00	0.86

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Refrig rebate	0.29	0.34	0.16	0.20

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: 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 $
Refrig rebate	0.00	0.00	20.10	

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

Annual $ Note: NEI per participant / treated unit

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.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Custom

Sector: Residential **Fuel:** Electric **Program Type:** Custom

Measure Category: Custom **Measure Type:** Custom **Measure Sub Type:** Custom

Program: EnergywiseMF

Measure Description

Vendors install a variety of measures at multifamily facilities. Measures include

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		Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Custom	mult	1.00	1.00		0.86	1.00	1.00	0.58	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom	0.40	0.33	0.14	0.13

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Custom	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Custom	0.00	0.00	0.00	1.00

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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SHOWERHEAD Oil

Sector: Residential

Fuel: Electric

Program Type: Prescriptive

Measure Category: Water Heating

Measure Type: Flow Control

Measure Sub Type: Low Flow Showerhead

Program: 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

Calculated using site-specific inputs

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		0.00				1.14	

Oil MMBtu Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. 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
SHOWERHEAD Oil	7	1.00	1.00		0.86	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
SHOWERHEAD Oil	0.00	0.00	0.00	0.00

Measure life Source: Massachusetts common assumption

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 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	2165.00		0.58	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
SHOWERHEAD Oil	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Common Int Reflector

Sector: Residential

Fuel: Electric

Program Type: Custom

Measure Category: Lighting

Measure Type: Interior

Measure Sub Type: Common Reflector

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Int Reflector	5	1.00	1.00		1.00	1.00	1.00	0.17	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Int Reflector	0.36	0.36	0.13	0.15

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Common Int Reflector	0.00		0.00	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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Int Reflector	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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THERMOSTAT Elec with AC

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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	281.00	0.13					

Electric kWh Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. Prepared for Massachusetts Program Administrators.

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
THERMOSTAT Elec with AC	10	1.00	1.00		0.86	1.00	1.00	0.41	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
THERMOSTAT Elec with AC	0.45	0.44	0.06	0.05

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 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 $
THERMOSTAT Elec with AC	0.00		14.35	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
THERMOSTAT Elec with AC	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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THERMOSTAT Heat Pump

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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	241.00	0.10					

Electric kWh Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. Prepared for Massachusetts Program Administrators.

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
THERMOSTAT Heat Pump	10	1.00	1.00		0.86	1.00	1.00	0.01	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
THERMOSTAT Heat Pump	0.41	0.55	0.01	0.03

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 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 $
THERMOSTAT Heat Pump	0.00		14.35	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
THERMOSTAT Heat Pump	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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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: 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

Calculated using site-specific inputs

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 Oil		Calc				0.39	

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 Oil	7	1.00	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
TSV Showerhead 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 $
TSV Showerhead Oil	2723.00		0.58	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
TSV Showerhead Oil	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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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: 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

Calculated using site-specific inputs

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		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
TSV Showerhead Other	7	1.00	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
TSV Showerhead Other	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 $
TSV Showerhead Other	2723.00		0.58	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
TSV Showerhead Other	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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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: 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

Calculated using site-specific inputs

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	335.00	0.06					

Electric kWh Source: National Grid (2014). Review of ShowerStart evolve.

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
TSV Showerhead Elec	7	1.00	1.00		0.86	1.00	1.00	0.58	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
TSV Showerhead Elec	0.40	0.33	0.15	0.13

Measure life Source: Massachusetts common assumption

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 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 Elec	2165.00		0.58	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
TSV Showerhead Elec	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Vending Miser

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Vending Miser **Measure Type:** Vending Miser **Measure Sub Type:** Vending Miser

Program: 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: 8760 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	1612.00	0.18	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.

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	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Vending Miser	0.17	0.50	0.08	0.25

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 Miser	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Vending Miser	0.00	0.00	0.00	1.00

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Pipe Wrap DHW Oil

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** Insulation **Measure Sub Type:** Pipe Insulation

Program: 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

Calculated using site-specific inputs

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						1.14	

Oil MMBtu Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. 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
Pipe Wrap DHW Oil	15	1.00	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak 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 Note: 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	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pipe Wrap DHW Oil	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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SHOWERHEAD Elec

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** Flow Control **Measure Sub Type:** Faucet Aerator

Program: 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
SHOWERHEAD Elec	129.00	0.02					

Electric kWh Source: The Cadmus Group (2012). Massachusetts Multifamily Program Impact Analysis July 2012 – Revised May 2013. Prepared for Massachusetts Program Administrators.

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
SHOWERHEAD Elec	7	1.00	1.00		0.86	1.00	1.00	0.58	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
SHOWERHEAD Elec	0.40	0.33	0.15	0.13

Measure life Source: Massachusetts common assumption

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 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 Elec	2165.00		0.58	

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

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
SHOWERHEAD Elec	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Common Int LED Fixture

Sector: Residential **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Common LED

Program: 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 halgoen 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					

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.

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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	5	1.00	1.00		1.00	1.00	1.00	0.17	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Int LED Fixture	0.36	0.36	0.13	0.15

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Common Int LED Fixture	0.00		0.00	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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Int LED Fixture	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Common Int LED Bulbs

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Common LED

Program: 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	119.10		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
Common Int LED Bulbs	5	1.00	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Int LED Bulbs	0.43	0.24	0.21	0.12

ISR Source: Navigant (2018). Multi-Family Program Impact and Net-to-Gross Evaluation (RES 44). Prepared for the MA Program Administrators.

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Common Int LED Bulbs	0.00	0.00	0.00	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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Int LED Bulbs	0.00	0.00	0.00	1.00

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Common Int EISA Exempt

Sector: Residential **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Interior **Measure Sub Type:** Common EISA

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Int EISA Exempt	9	1.00	1.00		1.00	1.00	1.00	0.17	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Int EISA Exempt	0.36	0.36	0.13	0.15

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Common Int EISA Exempt	0.00		0.00	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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Int EISA Exempt	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Common Ext Reflector

Sector: Residential

Fuel: Electric

Program Type: Custom

Measure Category: Lighting

Measure Type: Exterior

Measure Sub Type: Common Reflector

Program: 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 incandescents, 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					

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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Common Ext Reflector	6	1.00	1.00		1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Common Ext Reflector	0.20	0.54	0.06	0.20

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Common Ext Reflector	0.00		0.00	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.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Common Ext Reflector	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Pipe Wrap Heating Oil

Sector: Residential **Fuel:** Electric **Program Type:** Custom

Measure Category: HVAC **Measure Type:** Insulation **Measure Sub Type:** Pipe Insulation

Program: 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

Calculated using site-specific inputs

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	Calc	Calc				0.16	

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
Pipe Wrap Heating Oil	15	1.00	1.00		1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak 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	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pipe Wrap Heating Oil	0.00	0.00	0.00	1.00

NTG Source: The Cadmus Group, Inc (2008). EnergyWise 2008 Program Evaluation.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Heating System Retrofit-Furnace

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heating **Measure Sub Type:** Retrofit Furnace

Program: 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 × 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	132.00	0.07				14.30	

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.

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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	18	1.00	1.00		1.00	1.00	1.00	0.00	1.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating System Retrofit-Furnace	0.38	0.62	0.00	0.00

Measure life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR 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 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	0.00

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.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Heating System Retrofit-Boiler

Sector: Residential **Fuel:** Electric **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heating **Measure Sub Type:** Retrofit Boiler

Program: 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 × 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		0.00				20.40	

Oil MMBtu Source: The Cadmus Group, Inc. (2012). Low Income Single Family Impact Evaluation. Prepared for the Electric and Gas Program Administrators of Massachusetts.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heating System Retrofit-Boiler	20	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating System Retrofit-Boiler	0.00	0.00	0.00	0.00

Measure life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR Qualified Boilers.

ISR Note: 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	0.00

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.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Dwelling Ext LED Fixture

Sector: Residential **Fuel:** Electric **Program Type:** Custom

Measure Category: Lighting **Measure Type:** Exterior **Measure Sub Type:** Dwelling LED

Program: 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 halgoen 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					

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.

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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	5	0.88	1.00		1.00	1.00	1.00	0.13	0.16

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Dwelling Ext LED Fixture	0.20	0.54	0.06	0.20

Measure life Source: MA Residential Lighting Worksheet 2017, including reference to Market Adoption Model

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: 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 $
Dwelling Ext LED Fixture	0.00		0.00	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.

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.

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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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 intallation 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 intallation of a wi-fi programmable thermostat, the baseline efficiencycase 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)		0.00	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
Wi-Fi programmable thermostat (controls gas heat only)	15	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Wi-Fi programmable thermostat (controls gas heat only)				

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 $
Wi-Fi programmable thermostat (controls gas heat only)			3.63	

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
Wi-Fi programmable thermostat (controls gas heat only)	0.00	0.00	0.00	1.00

Gross Measure TRC unit: MF Bundled costs (see Participant listing)

Incentive Unit: MF Bundled costs (see Participant listing)

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Low Flow Showerhead w/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 adaper, 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 w/thermo Control (roadrunner gas DHW)		0.00		1.40		0.00	0.00

Propane MMBtu Source: Verifying Thermostatic Valve Showerhead Savings.xls

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low Flow Showerhead w/thermo Control (roadrunner gas DHW)	7	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low Flow Showerhead w/thermo Control (roadrunner gas DHW)				

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 w/thermo Control (roadrunner gas DHW)	2888.00			0.03

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
Low Flow Showerhead w/thermo Control (roadrunner gas DHW)	0.15	0.00	0.00	0.85

Gross Measure TRC unit: MF Bundled costs (see Participant listing)

Incentive Unit: MF Bundled costs (see Participant listing)

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Low Flow Showerhead 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 adaper, 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)		0.00		0.21		0.00	0.00

Propane MMBtu Source: Verifying Thermostatic Valve Showerhead Savings.xls

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)	7	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low Flow Showerhead thermo Control (ladybug gas DHW)				

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 thermo Control (ladybug gas DHW)	435.00			0.03

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
Low Flow Showerhead thermo Control (ladybug gas DHW)	0.15	0.00	0.00	0.85

Gross Measure TRC unit: MF Bundled costs (see Participant listing)

Incentive Unit: MF Bundled costs (see Participant listing)

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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: . 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		0.00		0.48		0.00	0.00

Propane MMBtu Source: Federal Energy Management Program (2010). Energy Cost Calculator for Faucets and Showerheads. Accessed on 10/12/2011.

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-flow showerhead	7	1.00	1.00	1.00					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low-flow showerhead				

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	3696.00	3696.00		0.03

Water/Sewer Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts 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
Low-flow showerhead	0.00	0.00	0.00	0.85

NTG Source: TetraTech (2015) 2013-14 Rhode Island C&I Natural Gas Free Ridership and Spillover Study (Memorandum), August 2015

Gross Measure TRC unit: MF Bundled costs (see Participant listing)

Incentive Unit: MF Bundled costs (see Participant listing)

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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: . 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		0.00		0.36		0.00	0.00

Propane MMBtu Source: Federal Energy Management Program (2010). Energy Cost Calculator for Faucets and Showerheads. Accessed on 10/12/2011.

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Faucet aerator	7	1.00	1.00	1.00					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Faucet aerator				

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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	332.00	332.00		

Water/Sewer Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Faucet aerator	0.15	0.00	0.00	0.85

NTG Source: TetraTech (2015) 2013-14 Rhode Island C&I Natural Gas Free Ridership and Spillover Study (Memorandum), August 2015

Gross Measure TRC unit: MF Bundled costs (see Participant listing)

Incentive Unit: MF Bundled costs (see Participant listing)

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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

Savings equation

Hours:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Participant		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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Participant				

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Participant	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Participant				1.00

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Gross Measure TRC unit: $415/participant

Incentive Unit: $378/participant

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Pipe Wrap (Heating)

Sector: C&I **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Insulation **Measure Sub Type:** Pipe Insulation

Program: C&I Multifamily

Measure Description

Insulation upgrades to existing heating system pipes

Baseline Description

The baseline efficiency case is the existing equipment prior to the implementation of additional insulation.

Savings principle

The high efficiency case includes pipe insulation.

Savings Method

Deemed

Unit

Savings equation

Gross MMBtu_Gas = Qty × deltaMMBtu_Gas

Where:

Qty = Total number of units.

deltaMMBtu_Gas = Average annual natural gas reduction per unit.

Hours:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Wrap (Heating)			0.16				

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
Pipe Wrap (Heating)	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Pipe Wrap (Heating)				

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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 $
Pipe Wrap (Heating)				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pipe Wrap (Heating)	0.00	0.00	0.00	1.00

Gross Measure TRC unit: MF Bundled costs (see Participant listing)

Incentive Unit: MF Bundled costs (see Participant listing)

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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

Savings equation

MMBtu = Annualheatingconsumption x %SAVE x (1/1000000)

Where:

AnnualHeatingConsumption = 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:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Duct Sealing			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.

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Duct Sealing				

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			0.23	

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
Duct Sealing	0.00	0.00	0.00	1.00

Gross Measure TRC unit: MF Bundled costs (see Participant listing)

Incentive Unit: MF Bundled costs (see Participant listing)

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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 intallation 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 intallation of a wi-fi programmable thermostat, the baseline efficiencycase 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		0.00	Calc			0.00	0.00

Gas Heat MMBtu Source: The Cadmus Group (2012). Home Energy Services Impact Evaluation. 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
Programmable thermostat	15	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable thermostat				

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			3.63	

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
Programmable thermostat	0.24	0.00	0.00	0.76

Gross Measure TRC unit: MF Bundled costs (see Participant listing)

Incentive Unit: MF Bundled costs (see Participant listing)

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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

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		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	mult	1.00	1.00	0.99	0.99			Custom	Custom

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom				

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ISR 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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Custom	0.00	0.00	0.00	1.00

Gross Measure TRC unit: MF Bundled costs (see Participant listing)

Incentive Unit: MF Bundled costs (see Participant listing)

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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

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/kWhNheating

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: 4644. 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		0.00	Calc			0.00	0.00

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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					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
MF Shell Insulation				

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: 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 $
MF Shell Insulation	0.00	0.00	47.31	

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
MF Shell Insulation	0.19	0.00	0.00	0.81

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

Gross Measure TRC unit: MF Bundled costs (see Participant listing)

Incentive Unit: MF Bundled costs (see Participant listing)

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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 × HDD × (Hours per Day) × (Minutes per Hour) × (Btu/ft3-°F) × 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: 4644. 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		0.00	Calc			0.00	0.00

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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
Air Sealing	15	1.00	1.00	1.00					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Air Sealing				

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: 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.

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.

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Air Sealing	0.19	0.00	0.00	0.81

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

Gross Measure TRC unit: MF Bundled costs (see Participant listing)

Incentive Unit: MF Bundled costs (see Participant listing)

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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 recirc 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:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Demand Circulator			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
Demand Circulator	15	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Demand Circulator				

ISR Note: 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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Demand Circulator	0.00	0.00	0.00	1.00

Gross Measure TRC unit: MF Bundled costs (see Participant listing)

Incentive Unit: MF Bundled costs (see Participant listing)

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Insulation Pipe Diameter 1.5in Steam

Sector: C&I

Fuel: Gas

Program Type: Prescriptive

Measure Category: Water Heating

Measure Type: Water Heater Insulation

Measure Sub Type: 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		0.00	0.21			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Insulation Pipe Diameter 1.5in Steam				

Measure life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

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ISR Note: 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 $
Insulation Pipe Diameter 1.5in Steam	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Insulation Pipe Diameter 1.5in Steam	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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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		0.00	35.60			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
High-Pressure Steam Trap HVAC				

Measure life Source: DNV GL MA 2013,2017 Prescriptive Gas Impact Evaluation: Steam Trap Evaulation Phase 1 & 2

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ISR Note: 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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
High-Pressure Steam Trap HVAC	0.01	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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Insulation Pipe Diameter 2in Steam

Sector: C&I

Fuel: Gas

Program Type: Prescriptive

Measure Category: Water Heating

Measure Type: Water Heater Insulation

Measure Sub Type: 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		0.00	0.37			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Insulation Pipe Diameter 2in Steam				

Measure life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

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ISR Note: 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 $
Insulation Pipe Diameter 2in Steam	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Insulation Pipe Diameter 2in Steam	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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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		0.00	3.20			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					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable thermostat				

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Programmable thermostat	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 180 per measure

Incentive Unit: $ 126 per measure

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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		0.00	35.50			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Boiler Reset Control				

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%.

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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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Boiler Reset Control	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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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		0.00	8.40			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low-Pressure Steam Trap HVAC				

Measure life Source: DNV GL MA 2013,2017 Prescriptive Gas Impact Evaluation: Steam Trap Evaulation Phase 1 & 2

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ISR Note: 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-Pressure Steam Trap HVAC	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low-Pressure Steam Trap HVAC	0.01	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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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 recirc 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	96.00	0.16	195.00	19.50		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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
DEMAND CIRCULATOR	0.40	0.33	0.15	0.13

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%.

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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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
DEMAND CIRCULATOR	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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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. 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		0.00		1.70		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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Faucet aerator				

Measure life Source: Federal Energy Management Program (2010). Energy Cost Calculator for Faucets and Showerheads. Accessed on 10/12/2011.

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ISR Note: 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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Faucet aerator	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 15 per measure

Incentive Unit: $ 11 per measure

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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		0.00		5.20		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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low-flow showerhead				

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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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low-flow showerhead	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 55 per measure

Incentive Unit: $ 24.5 per measure

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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		0.00		11.40		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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Pre-rinse spray valve				

Measure life Source: DNV GL (2014)Impact Evaluation of Massachusetts Prescriptive Gas Pre-Rinse Spray Valve Measure

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ISR Note: 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 $
Pre-rinse spray valve	6410.00	6410.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pre-rinse spray valve	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 130 per measure

Incentive Unit: $ 100 per measure

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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		0.00		20.40		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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Salon Nozzle				

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%.

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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 $
Salon Nozzle	28639.00	28639.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Salon Nozzle	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 130 per measure

Incentive Unit: $ 100 per measure

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Insulation Pipe Diameter 1.5in H2O

Sector: C&I

Fuel: Gas

Program Type: Prescriptive

Measure Category: Water Heating

Measure Type: Water Heater Insulation

Measure Sub Type: 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		0.00	0.21			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Insulation Pipe Diameter 1.5in H2O				

Measure life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

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ISR Note: 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 $
Insulation Pipe Diameter 1.5in H2O	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Insulation Pipe Diameter 1.5in H2O	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 10 per measure

Incentive Unit: $ 5.6 per measure

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WiFi Tstat-heat 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-heat only		0.00	6.60				

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Tstat-heat only	15	1.00	1.00	1.00		1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WiFi Tstat-heat 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.

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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 $
WiFi Tstat-heat only	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
WiFi Tstat-heat only	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $180/unit

Incentive Unit: $126/unit

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Insulation Pipe Diameter 2in H2O

Sector: C&I

Fuel: Gas

Program Type: Prescriptive

Measure Category: Water Heating

Measure Type: Water Heater Insulation

Measure Sub Type: 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		0.00	0.36			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Insulation Pipe Diameter 2in H2O				

Measure life Source: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

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ISR Note: 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 $
Insulation Pipe Diameter 2in H2O	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Insulation Pipe Diameter 2in H2O	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 10 per measure

Incentive Unit: $ 7.7 per measure

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WiFi Thermostat - cooling and htg

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 Thermostat - cooling and htg		0.00	6.60				

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Thermostat - cooling and htg	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WiFi Thermostat - cooling and htg	0.00	0.00	0.00	0.00

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Measure life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

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 $
WiFi Thermostat - cooling and htg	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
WiFi Thermostat - cooling and htg	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $180/unit

Incentive Unit: $126/unit

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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

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
INS_DUCT_SF				

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.

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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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
INS_DUCT_SF	0.01	0.00	0.00	0.99

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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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:

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		0.00	35.50			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
BOILER RESET 1 STAGE				

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
BOILER RESET 1 STAGE				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
BOILER RESET 1 STAGE	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $768/unit

Incentive Unit: $225/unit

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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		0.00	8.40			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low-Pressure Steam Trap HVAC				

Measure life Source: DNV GL MA 2013,2017 Prescriptive Gas Impact Evaluation: Steam Trap Evaulation Phase 1 & 2

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ISR Note: 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-Pressure Steam Trap HVAC	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low-Pressure Steam Trap HVAC	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 250 per measure

Incentive Unit: $ 50 per measure

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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	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Other, Blend	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Other, Blend				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Other, Blend	Calc	Calc		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Other, Blend	0.11	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 37787 per measure

Incentive Unit: $ 21225 per measure

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Boiler reset control (multi

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		0.00	35.50			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	15	1.00	1.00	1.00					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Boiler reset control (multi				

Measure life Source: ACEEE (2006). Emerging Technologies Report: Advanced Boiler Controls. Prepared for ACEEE.

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ISR Note: 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 (multi	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Boiler reset control (multi	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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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		0.00	3.20			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					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable thermostat				

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Programmable thermostat	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 92 per measure

Incentive Unit: $ 25 per measure

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WiFi Thermostat - cooling and htg

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 Thermostat - cooling and htg			6.60				

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Thermostat - cooling and htg	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WiFi Thermostat - cooling and htg	0.00	0.00	0.00	0.00

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Measure life Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for Programmable Thermostats. Accessed on 10/12/2011.

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 $
WiFi Thermostat - cooling and htg	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
WiFi Thermostat - cooling and htg	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $268/unit

Incentive Unit: $100/unit

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WiFi Tstat-heat 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-heat only			6.60				

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi Tstat-heat only	15	1.00	1.00	1.00		1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WiFi Tstat-heat 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.

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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 $
WiFi Tstat-heat only	0.00	0.00	0.00	0.00

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
WiFi Tstat-heat only	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $268/unit

Incentive Unit: $100/unit

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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		0.00		11.40		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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Pre-rinse spray valve				

Measure life Source: DNV GL (2014)Impact Evaluation of Massachusetts Prescriptive Gas Pre-Rinse Spray Valve Measure

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ISR Note: 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 $
Pre-rinse spray valve	6410.00	6410.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pre-rinse spray valve	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 100 per measure

Incentive Unit: $ 100 per measure

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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		0.00		5.20		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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low-Flow Showerhead				

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Low-Flow Showerhead	7300.00	7300.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low-Flow Showerhead	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 200 per measure

Incentive Unit: $ 200 per measure

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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 Certificaiton (BOC) class improves operators' ability to optimize / minimize gas and electricity use in buildings.

Baseline Description

The basecase 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		0.00	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

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Building operator certification				

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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Building operator certification	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 1695 per measure

Incentive Unit: $ 1250 per measure

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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 Certificaiton (BOC) class improves operators' ability to optimize / minimize gas and electricity use in buildings.

Baseline Description

The basecase 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		0.00	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

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Building operator certification + capital improvements				

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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Building operator certification + capital improvements	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 1695 per measure

Incentive Unit: $ 1250 per measure

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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 basecase 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:

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

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ROOF INSULATION				

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
ROOF INSULATION				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
ROOF INSULATION	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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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		0.00	35.60			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
High-Pressure Steam Trap HVAC				

Measure life Source: DNV GL MA 2013,2017 Prescriptive Gas Impact Evaluation: Steam Trap Evaulation Phase 1 & 2

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ISR Note: 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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
High-Pressure Steam Trap HVAC	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 250 per measure

Incentive Unit: $ 50 per measure

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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. 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		0.00		1.70		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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Faucet aerator				

Measure life Source: Federal Energy Management Program (2010). Energy Cost Calculator for Faucets and Showerheads. Accessed on 10/12/2011.

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ISR Note: 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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Faucet aerator	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 11 per measure

Incentive Unit: $ 11 per measure

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Building Shell	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Building Shell				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Building Shell	Calc	Calc	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
Building Shell	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
HVAC insulation	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
HVAC insulation				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
HVAC insulation	Calc	Calc	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
HVAC insulation	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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			Calc	Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Other Blend	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Other Blend				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Other Blend	Calc	Calc	-0.03	

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	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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Process

Sector: C&I | **Fuel:** Gas | **Program Type:** Custom

Measure Category: Custom | **Measure Type:** Process | **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
Process	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
Process	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Process				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Process	Calc	Calc	0.01	

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
Process	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Steam Trap	6	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Steam Trap				

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: DNV GL (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Steam Trap	Calc	Calc		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Steam Trap	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
VSDs on HVAC	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
VSDs on HVAC				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
VSDs on HVAC	Calc	Calc		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
VSDs on HVAC	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
HVAC	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
HVAC				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
HVAC	Calc	Calc	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
HVAC	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Advanced Building	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Advanced Building				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Advanced Building	Calc	Calc	-0.01	

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	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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CODES AND STANDARDS

Sector: C&I

Fuel: Gas

Program Type: Custom

Measure Category: Codes and Standards

Measure Type: Codes and Standards

Measure Sub Type: Codes and 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

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:

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	0.00	Calc			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					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CODES AND STANDARDS				

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		

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%.

Gross Measure TRC unit:

Incentive Unit:

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Comprehensive Design	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Comprehensive Design				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Comprehensive Design	Calc	Calc	-0.01	

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	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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 typical low-efficiency gas-fired fryer with 35% cooking efficiency, 16,000 Btu preheat energy, 14,000 Btu/h Idle Energy rate, and 60 lbs/h production capacity.

Savings principle

The high efficiency case cooking efficiency and Idle Energy Rate are site specific and can be determined on a case-by-case basis. To simplify the savings algorithm, typical values for food load (150 lbs/day) and preheat energy (15.500 Btu) are assumed.

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		0.00		50.80		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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COOKING-FRYER-1000				

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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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
COOKING-FRYER-1000	0.00	0.00	0.26	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 3400 per measure

Incentive Unit: $ 1150 per measure

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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-fired griddle.

Baseline Description

The baseline efficiency case is a standard efficiency (30% efficient) gas griddle.

Savings principle

The high efficiency case is a gas griddle with an efficiency of 38%.

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		0.00		13.10		0.00	0.00

Gas DHW MMBtu Source: Food Service Technology Center (2011). Gas Griddle Life-Cycle Cost Calculation. Accessed on 10/12/2011.

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COOKING-GRIDDLE 1				

Measure life Source: Food Service Technology Center (2011). Gas Griddle Life-Cycle Cost Calculation. Accessed on 10/12/2011.

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ISR Note: 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-GRIDDLE 1	0.00	0.00	0.26	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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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		Calc		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	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
VSDs on non-HVAC				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
VSDs on non-HVAC	Calc	Calc		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
VSDs on non-HVAC	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Energy Management System (building)	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Energy Management System (building)				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Energy Management System (building)	Calc	Calc	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
Energy Management System (building)	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heat Recovery, Heating	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heat Recovery, Heating				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Heat Recovery, Heating	Calc	Calc	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
Heat Recovery, Heating	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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Boiler, 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, Condensing Heating	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
Boiler, Condensing Heating	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Boiler, Condensing Heating				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Boiler, Condensing Heating	Calc	Calc	-0.08	

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	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Furnace, Heating	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Furnace, Heating				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Furnace, Heating	Calc	Calc	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
Furnace, Heating	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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		Calc		Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Kitchen Equipment	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Kitchen Equipment				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Kitchen Equipment	Calc	Calc	0.26	

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	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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		Calc		Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Food Service	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Food Service				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Food Service	Calc	Calc	0.26	

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	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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		Calc		Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Domestic Hot Water	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Domestic Hot Water				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Domestic Hot Water	Calc	Calc	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
Domestic Hot Water	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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		Calc		Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Gas driven cooling	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Gas driven cooling				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Gas driven cooling	Calc	Calc		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Gas driven cooling	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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			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)	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Combined Heat and Power (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 Source: DNV GL (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Combined Heat and Power (Gas)	Calc	Calc		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Combined Heat and Power (Gas)	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Steam boiler	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Steam 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 Source: DNV GL (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Steam boiler	Calc	Calc		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Steam boiler	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler, Non-Condensing Heating	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Boiler, Non-Condensing Heating				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Boiler, Non-Condensing Heating	Calc	Calc		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Boiler, Non-Condensing Heating	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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 oven that meets the baseline cooking energy efficiency requirements shown in Table 15.

Savings principle

The high efficiency case is an oven that meets or exceeds the high efficiency ratings shown in Table 15.

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		0.00		112.00		0.00	0.00

Gas DHW MMBtu Source: Food Service Technology Center (2011). Gas Combination 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-COMBO OVEN 1	12	1.00	1.00	1.00					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COOKING-COMBO OVEN 1				

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.

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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	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 1300 per measure

Incentive Unit: $ 1000 per measure

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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			Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Ventilation Reduction	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Ventilation Reduction				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Ventilation Reduction	Calc	Calc	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
Ventilation Reduction	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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		Calc		Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Heat Pump	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heat Pump				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Heat Pump	Calc	Calc		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heat Pump	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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		0.00		19.00		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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WATER HEATER - INDIRECT				

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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	0.09	

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 - INDIRECT	0.69	0.00	0.00	0.31

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit:

Incentive Unit:

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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		0.00	12.00			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
INFRARED HEATER - LOW INT				

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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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
INFRARED HEATER - LOW INT	0.00	0.00	0.06	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 2982 per measure

Incentive Unit: $ 750 per measure

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COND UNIT HEATER 151-400 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 151-400 MBH		0.00	40.90			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 151-400 MBH	18	1.00	1.00	1.00					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COND UNIT HEATER 151-400 MBH				

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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 151-400 MBH	0.00	0.00	-0.08	

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 151-400 MBH	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 2400 per measure

Incentive Unit: $ 750 per measure

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WATER HEATER TANK 0.67 EF

Sector: C&I **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** DHW **Measure Sub Type:** Tank 0.67 EF

Program: Large Commercial New Construction

Measure Description

The installation of a high-efficiency tank water heater over 0.67 EF.

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 tank water heater that is ENERGY STAR® rated with an Energy Factor of at least .67 and a nominal input of 75,000 Btu/hour or less.

Savings Method

Deemed

Unit

Installed high-efficiency DHW tank

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 TANK 0.67 EF			0.00	2.40			

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WATER HEATER TANK 0.67 EF	13	1.00	1.00	1.00		1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WATER HEATER TANK 0.67 EF	0.00	0.00	0.00	0.00

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
WATER HEATER TANK 0.67 EF	0.00	0.00	0.09	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
WATER HEATER TANK 0.67 EF	0.69	0.00	0.00	0.31

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $410/unit

Incentive Unit: $111/unit

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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 oven that meets the baseline cooking energy efficiency requirements shown in Table 15.

Savings principle

The high efficiency case is an oven that meets or exceeds the high efficiency ratings shown in Table 15.

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		0.00		12.90		0.00	0.00

Gas DHW MMBtu Source: Food Service Technology Center (2012). Gas Convection Oven Life-Cycle Cost Calculator. http://www.fishnick.com/saveenergy/tools/calculators/govencalc.php.

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					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COOKING-CONVECTION OVEN 1				

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	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 1886 per measure

Incentive Unit: $ 1150 per measure

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COND WATER HEATER 90%MIN 75-800

Sector: C&I

Fuel: Gas

Program Type: Prescriptive

Measure Category: Water Heating

Measure Type: DHW

Measure Sub Type: Condensing Water Heater

Program: Large Commercial New Construction

Measure Description

The installation of a high-efficiency condensing water heater over 95% 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 DHW tank

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 90%MIN 75-800			0.00	23.05			

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COND WATER HEATER 90%MIN 75-800	15	1.00	1.00	1.00		1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COND WATER HEATER 90%MIN 75-800	0.00	0.00	0.00	0.00

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 90%MIN 75-800	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
COND WATER HEATER 90%MIN 75-800	0.69	0.00	0.00	0.31

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $2000/unit

Incentive Unit: $111/unit

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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	168.00	0.12	6.70			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

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Furnace97ECM	0.38	0.62	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	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 1294 per measure

Incentive Unit: $ 800 per measure

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COND WATER HEATER 95%MIN 75-300

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 95% 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 95%MIN 75-300		0.00		31.80		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 95%MIN 75-300	15	1.00	1.00	1.00					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COND WATER HEATER 95%MIN 75-300				

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 95%MIN 75-300	0.00	0.00	-0.08	

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 95%MIN 75-300	0.69	0.00	0.00	0.31

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit:

Incentive Unit:

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Water Heating Boiler - 92% TE

Sector: C&I **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** DHW **Measure Sub Type:** Hot water boiler

Program: Large Commercial New Construction

Measure Description

The installation of a high efficiency natural gas fired condensing DHW boilers. High efficiency boilers take advantage of improved design, sealed combustion and condensing flue gases in a second heat exchanger to achieve improved efficiency.

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 meets or exceeds 92% efficiency.

Savings Method

Deemed

Unit

Installed high-efficiency condensing DHW 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
Water Heating Boiler - 92% TE			0.00	0.47			

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Water Heating Boiler - 92% TE	15	1.00	1.00	1.00		1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Water Heating Boiler - 92% TE	0.00	0.00	0.00	0.00

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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 Heating Boiler - 92% TE	0.00	0.00	0.09	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
Water Heating Boiler - 92% TE	0.40	0.00	0.00	0.60

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $3000/unit

Incentive Unit: $111/unit

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WATER HEATER - ON-DEMAND 82

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 0.82.

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 82		0.00		6.30		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 82	20	1.00	1.00	1.00					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WATER HEATER - ON-DEMAND 82				

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 82	0.00	0.00	0.09	

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 82	0.40	0.00	0.00	0.60

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit:

Incentive Unit:

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WATER HEATER - ON-DEMAND 90

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 0.90.

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 90		0.00		8.90		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 90	20	1.00	1.00	1.00					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WATER HEATER - ON-DEMAND 90				

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 90	0.00	0.00	0.09	

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 90	0.40	0.00	0.00	0.60

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit:

Incentive Unit:

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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		0.00		9.50		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					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WATER HEATER - ON-DEMAND 95				

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	

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	0.40	0.00	0.00	0.60

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit:

Incentive Unit:

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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			45.20			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					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
DIRECT FIRE HEATER				

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			0.06	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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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+			31.80	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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COMBO COND BOIL/WTR HTR 95+	0.00	0.00	0.00	0.00

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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+	0.69	0.00	0.00	0.31

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit:

Incentive Unit: $1200/unit

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Water Heating Boiler - 85% TE

Sector: C&I **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** DHW **Measure Sub Type:** Hot water boiler

Program: Large Commercial New Construction

Measure Description

The installation of a high efficiency natural gas fired DHW boilers. High efficiency boilers take advantage of improved design to achieve improved efficiency.

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 meets or exceeds 85% efficiency.

Savings Method

Deemed

Unit

Installed high-efficiency DHW 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
Water Heating Boiler - 85% TE			0.00	0.19			

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Water Heating Boiler - 85% TE	15	1.00	1.00	1.00		1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Water Heating Boiler - 85% TE	0.00	0.00	0.00	0.00

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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 Heating Boiler - 85% TE	0.00	0.00	0.09	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
Water Heating Boiler - 85% TE	0.40	0.00	0.00	0.60

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $2700/unit

Incentive Unit: $111/unit

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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		Calc		Calc	Calc

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Solar Heat Year Round (DHW)	mult	1.00	1.00	0.89					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Solar Heat Year Round (DHW)				

ISR Note: 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 (2016) Impact Evaluation of 2014 Custom Gas Installations in Rhode Island

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Solar Heat Year Round (DHW)	Calc	Calc		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Solar Heat Year Round (DHW)	0.00	0.00	0.00	1.00

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 0.139/therm

Incentive Unit: $ 0.054/therm

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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 baseline efficiency case is a typical boiler-based steamer with the following operating parameters: Preheat Energy rate = 72,000 Btu/hour, Idle Energy Rate = 18,000 Btu/hour, Heavy Load Efficiency = 18.0%, Production Capacity per pan = 23.3 lbs/hour,Average Water Consumption Rate = 40 gal/hour, and Percentage of Time in Constant Steam Mode = 40%.

Baseline Description

The baseline efficiency case is a typical boiler-based steamer with the following operating parameters: cooking energy efficiency = 18%, production capacity per pan = 23.3 lbs/hr, preheat energy rate = 72,000 Btu/hr, idle energy rate = 18,000 Btu/h, waterconsumption of 40gal/h, and Percentage of Time in Constant Steam Mode = 40%.

Savings principle

The high efficiency case is an ENERGY STAR® qualified gas-fired steamer with the following operating parameters for a 6 pan steamer: Preheat Energy Rate = 36,000 Btu/hour, Idle Energy Rate = 12,500 Btu/hour, Heavy Load Efficiency = 38.0%, Production Capacity per pan = 20 lbs/hour, and Average Water Consumption Rate = 3 gallons/hour, and Percentage of Time in Constant Steam Mode = 40%.

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: 4380. 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		0.00		105.40		0.00	0.00

Gas DHW MMBtu Source: Environmental Protection Agency (2011). Savings Calculator for ENERGY STAR Qualified Commercial Kitchen Equipment: Steam Cooker Calcs.

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COOKING-STEAMER-1000				

Measure life Source: Environmental Protection Agency (2011). Savings Calculator for ENERGY STAR Qualified Commercial Kitchen Equipment: Steam Cooker Calcs.

ISR Note: 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-STEAMER-1000	162060.00	162060.00	0.26	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 1300 per measure

Incentive Unit: $ 1000 per measure

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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		0.00		9.40		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					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WATER HEATER - ON-DEMAND 94				

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			0.09	

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 94	0.40	0.00	0.00	0.60

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit:

Incentive Unit:

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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 oven that meets the baseline cooking energy efficiency requirements shown in Table 15.

Savings principle

The high efficiency case is an oven that meets or exceeds the high efficiency ratings shown in Table 15.

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		0.00		211.30		0.00	0.00

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
COOKING-RACK OVEN 1	12	1.00	1.00	1.00					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COOKING-RACK OVEN 1				

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%.

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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-RACK OVEN 1	0.00	0.00	0.26	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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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	168.00	0.12	5.70			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

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Energy Impact Factors

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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Furnace95ECM	0.38	0.62	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	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 1132 per measure

Incentive Unit: $ 500 per measure

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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+			24.60	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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COMBO COND BOIL/WTR HTR 90+	0.00	0.00	0.00	0.00

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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+	0.69	0.00	0.00	0.31

NTG Source: TXC 35 MA C&I Upstream HVAC NTG & Market Effects Study

Gross Measure TRC unit: $1572/unit

Incentive Unit: $900/unit

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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:

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		0.00	35.50			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
BOILER RESET 1 STAGE				

RRe Note: Realization rate is assumed to be 100% since evaluation adjusts deemed savings value

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
BOILER RESET 1 STAGE		0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
BOILER RESET 1 STAGE	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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Furnace96ECM

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
Furnace96ECM	168.00	0.12	6.20			0.00	0.00

Gas Heat MMBtu Source: DNV GL (2015) Recalculation of Prescriptive Gas Furnace Savings Using a new Baseline

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Furnace96ECM	18	1.00	1.00	1.00				0.00	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Furnace96ECM	0.38	0.62	0.00	0.00

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 $
Furnace96ECM			0.05	

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
Furnace96ECM	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit:

Incentive Unit:

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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 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
Condensing boiler <= 300 mbh		0.00	14.70			0.00	0.00

Gas Heat MMBtu Source: DNV GL 2017, Gas Boiler Market Characterization Study Phase II Final Report (MA EEAC)

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					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Condensing boiler <= 300 mbh				

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	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 3,479 per measure

Incentive Unit: $ 1,000 per measure

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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		0.00	27.80			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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Boiler95				

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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	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 3848 per measure

Incentive Unit: $ 1500 per measure

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Condensing boiler 1000-1700 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 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
Condensing boiler 1000-1700 mbh		0.00	94.50			0.00	0.00

Gas Heat MMBtu Source: DNV GL 2017, Gas Boiler Market Characterization Study Phase II Final Report (MA EEAC)

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Condensing boiler 1000-1700 mbh	25	1.00	1.00	1.00					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Condensing boiler 1000-1700 mbh				

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 1000-1700 mbh	0.00	0.00	-0.08	

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 1000-1700 mbh	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 7,874 per measure

Incentive Unit: $ 7,500 per measure

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Condensing boiler 1701+ 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 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
Condensing boiler 1701+ MBH		0.00	165.30			0.00	0.00

Gas Heat MMBtu Source: DNV GL 2017, Gas Boiler Market Characterization Study Phase II Final Report (MA EEAC)

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Condensing boiler 1701+ MBH	25	1.00	1.00	1.00					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Condensing boiler 1701+ MBH				

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 1701+ MBH	0.00	0.00	-0.08	

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 1701+ MBH	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 10,601 per measure

Incentive Unit: $ 10,000 per measure

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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 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
Condensing boiler 300-499 mbh		0.00	28.00			0.00	0.00

Gas Heat MMBtu Source: DNV GL 2017, Gas Boiler Market Characterization Study Phase II Final Report (MA EEAC)

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					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Condensing boiler 300-499 mbh				

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 300-499 mbh	0.00	0.00	-0.08	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 3,879 per measure

Incentive Unit: $ 2,000 per measure

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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 oven that meets the baseline cooking energy efficiency requirements shown in Table 15.

Savings principle

The high efficiency case is an oven that meets or exceeds the high efficiency ratings shown in Table 15.

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		0.00		88.40		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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
COOKING-CONVEYOR OVEN 1				

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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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
COOKING-CONVEYOR OVEN 1	0.00	0.00	0.26	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 1300 per measure

Incentive Unit: $ 1000 per measure

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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 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
Condensing boiler 500-999 mbh		0.00	51.40			0.00	0.00

Gas Heat MMBtu Source: DNV GL 2017, Gas Boiler Market Characterization Study Phase II Final Report (MA EEAC)

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					

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Condensing boiler 500-999 mbh				

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 500-999 mbh	0.00	0.00	-0.08	

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	0.12	0.00	0.00	0.89

NTG Source: TetraTech (2017). 2016 Commercial and Industrial Programs Free-ridership and Spillover Study. September, 2017

Gross Measure TRC unit: $ 5,077 per measure

Incentive Unit: $ 4,000 per measure

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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/kWhNheating

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: 4644. 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		0.00	Calc		0.00	0.00	0.00

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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				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Shell Insulation				

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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Shell Insulation	0.00	0.00	52.47	0.08

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: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Shell Insulation	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Stand Alone Water Heater

Sector: Income Eligible

Fuel: Gas

Program Type: Custom

Measure Category: Water Heating

Measure Type: Water Heater

Measure Sub Type: Efficient Water Heater

Program: Low Income Multifamily

Measure Description

Installation of high efficiency water heating equipment to replace the existing inefficient water heater.

Baseline Description

The baseline efficiency case is a stand-alone tank water heater with an energy factor of 0.575.

Savings principle

The high efficiency case includes the new efficient water heater with an Energy Factor > 0.60.

Savings Method

Calc

Unit

Savings equation

Delta MMBtu = Units x (18 MMBTu/Units) x ((1/EFbase) - (1/EFee)

Unit = Total number of dwelling units utilizing the water heater

18 MMBtu/Unit = Average annual water heating energy demand per dwelling unit401

EFBASE = Energy Factor for the baseline waterheater

EFEE = Energy Factor for the new efficient water heater

Hours:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Stand Alone Water Heater			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
Stand Alone Water Heater	13	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Stand Alone Water Heater				

Measure life Source: DOE (2008). ENERGY STAR® Residential Water Heaters: Final Criteria Analysis. Prepared for the DOE.

ISR Note: 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 $
Stand Alone Water Heater			0.58	0.08

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: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Stand Alone Water Heater	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Indirect Water Heater

Sector: Income Eligible

Fuel: Gas

Program Type: Custom

Measure Category: Water Heating

Measure Type: Water Heater

Measure Sub Type: Efficient Water Heater

Program: Low Income Multifamily

Measure Description

Installation of high efficiency water heating equipment to replace the existing inefficient water heater.

Baseline Description

The baseline efficiency case is a stand-alone tank water heater with an energy factor of 0.575.

Savings principle

The high efficiency case includes the new efficient water heater with an Energy Factor > 0.60.

Savings Method

Calc

Unit

Savings equation

Delta MMBtu = Units x (18 MMBTu/Units) x ((1/EFbase) - (1/EFee)

Unit = Total number of dwelling units utilizing the water heater

18 MMBtu/Unit = Average annual water heating energy demand per dwelling unit401

EFBASE = Energy Factor for the baseline waterheater

EFEE = Energy Factor for the new efficient water heater

Hours:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Indirect Water Heater			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
Indirect Water Heater	20	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Indirect Water Heater				

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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Indirect Water Heater			0.58	0.08

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: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Indirect Water Heater	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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

Savings equation

Gross MMBtu_Gas = Qty × deltaMMBtu_Gas

Where:

Qty = Total number of units.

deltaMMBtu_Gas = Average annual natural gas reduction per unit.

Hours:

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)			1.14				

Gas Heat MMBtu Source: Illume and Navigant Consulting (2014). Rhode Island Behaviorial Program and Pilot Impacts and Process Evaluation.

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	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Pipe Wrap (Water Heating)				

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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 $
Pipe Wrap (Water Heating)			6.61	0.08

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: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pipe Wrap (Water Heating)	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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		0.00		Calc		0.00	0.00

Propane 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
Low-flow showerhead	7	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low-flow showerhead				

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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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Low-flow showerhead	3696.00	0.00		0.08

Water/Sewer Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

One-Time $ Source: Additional Non-Energy Impacts for Low Income Programs (2012)

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low-flow showerhead	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Low Flow Showerhead 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 adaper, 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)		0.00	0.21			0.00	0.00

Propane MMBtu Source: Verifying Thermostatic Valve Showerhead Savings.xls

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)	7	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low Flow Showerhead thermo Control (ladybug gas DHW)				

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 thermo Control (ladybug gas DHW)	296.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low Flow Showerhead thermo Control (ladybug gas DHW)	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Low Flow Showerhead w/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 adaper, 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 w/thermo Control (roadrunner gas DHW)		0.00		1.40		0.00	0.00

Propane MMBtu Source: Verifying Thermostatic Valve Showerhead Savings.xls

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low Flow Showerhead w/thermo Control (roadrunner gas DHW)	7	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low Flow Showerhead w/thermo Control (roadrunner gas DHW)				

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 w/thermo Control (roadrunner gas DHW)	1768.00	0.00		0.08

One-Time $ Source: Additional Non-Energy Impacts for Low Income Programs (2012)

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low Flow Showerhead w/thermo Control (roadrunner gas DHW)	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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 × HDD × (Hours per Day) × (Minutes per Hour) × (Btu/ft3-°F) × 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: 4644. 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		0.00	Calc		0.00	0.00	0.00

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Air Sealing	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Air Sealing				

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 $
Air Sealing	0.00	0.00	56.33	0.08

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: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Air Sealing	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Tankless Water Heater

Sector: Income Eligible

Fuel: Gas

Program Type: Custom

Measure Category: Water Heating

Measure Type: Water Heater

Measure Sub Type: Efficient Water Heater

Program: Low Income Multifamily

Measure Description

Installation of high efficiency water heating equipment to replace the existing inefficient water heater.

Baseline Description

The baseline efficiency case is a stand-alone tank water heater with an energy factor of 0.575.

Savings principle

The high efficiency case includes the new efficient water heater with an Energy Factor > 0.60.

Savings Method

Calc

Unit

Savings equation

Delta MMBtu = Units x (18 MMBTu/Units) x ((1/EFbase) - (1/EFee)

Unit = Total number of dwelling units utilizing the water heater

18 MMBtu/Unit = Average annual water heating energy demand per dwelling unit401

EFBASE = Energy Factor for the baseline waterheater

EFEE = Energy Factor for the new efficient water heater

Hours:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Tankless Water Heater			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
Tankless Water Heater	20	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Tankless Water Heater				

Measure life Source: DOE (2008). ENERGY STAR® Residential Water Heaters: Final Criteria Analysis. Prepared for the DOE.

ISR Note: 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 $
Tankless Water Heater			0.58	0.08

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: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Tankless Water Heater	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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. Measures include

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

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:

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

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				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom				

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

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

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Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Custom	0.00	0.00		0.08

One-Time $ Source: Additional Non-Energy Impacts for Low Income Programs (2012)

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Custom	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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 intallation 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 intallation of a wi-fi programmable thermostat, the baseline efficiencycase 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		0.00	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
Programmable thermostat	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable thermostat				

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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	16.02	0.08

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: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Programmable thermostat	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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:

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)			4.70				

Gas Heat MMBtu Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis. Prepared for Keith Miller and Whitney Domigan, National Grid.

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	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Wi-Fi Thermostat (controls gas heat only)				

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 $
Wi-Fi Thermostat (controls gas heat only)			16.02	0.08

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: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Wi-Fi Thermostat (controls gas heat only)	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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

Savings equation

MMBtu = Annualheatingconsumption x %SAVE x (1/1000000)

Where:

AnnualHeatingConsumption = 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:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Duct Sealing			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.

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Duct Sealing				

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			1.04	0.08

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: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Duct Sealing	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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:

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			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
Heating System Retrofit, Boiler	20	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating System Retrofit, Boiler				

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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Heating System Retrofit, Boiler			123.91	0.08

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: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating System Retrofit, Boiler	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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

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:

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			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
Heating System Retrofit, Furnace	18	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating System Retrofit, Furnace				

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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Heating System Retrofit, Furnace			123.91	0.08

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: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating System Retrofit, Furnace	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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:

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			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
Heating System Retrofit, Commercial Boiler	25	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating System Retrofit, Commercial 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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Heating System Retrofit, Commercial Boiler				0.08

One-Time $ Source: Additional Non-Energy Impacts for Low Income Programs (2012)

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating System Retrofit, Commercial Boiler	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Pipe Wrap (Heating)

Sector: Income Eligible **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Insulation **Measure Sub Type:** Pipe Insulation

Program: Low Income Multifamily

Measure Description

Insulation upgrades to existing heating system pipes

Baseline Description

The baseline efficiency case is the existing equipment prior to the implementation of additional insulation.

Savings principle

The high efficiency case includes pipe insulation.

Savings Method

Deemed

Unit

Savings equation

Gross MMBtu_Gas = Qty × deltaMMBtu_Gas

Where:

Qty = Total number of units.

deltaMMBtu_Gas = Average annual natural gas reduction per unit.

Hours:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Wrap (Heating)			0.16				

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
Pipe Wrap (Heating)	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Pipe Wrap (Heating)				

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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 $
Pipe Wrap (Heating)			6.61	0.08

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: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pipe Wrap (Heating)	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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		0.00	Calc			0.00	0.00

Propane 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
Faucet aerator	7	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Faucet aerator				

Measure life Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

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ISR Note: 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	332.00	0.00		0.08

Water/Sewer Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

One-Time $ Source: Additional Non-Energy Impacts for Low Income Programs (2012)

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Faucet aerator	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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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

Savings equation

Hours:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Participant			0.00				

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Participant		1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Participant				

ISR Note: 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			7.70	0.08

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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.

One-Time $ Source: Additional Non-Energy Impacts for Low Income Programs (2012)

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Participant	0.00	0.00	0.00	1.00

Gross Measure TRC unit: $ 707/participant

Incentive Unit: $ 707/participant

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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 recirc 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:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Demand Circulator			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
Demand Circulator	15	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Demand Circulator				

ISR Note: 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				0.08

One-Time $ Source: Additional Non-Energy Impacts for Low Income Programs (2012)

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Demand Circulator	0.00	0.00	0.00	1.00

Gross Measure TRC unit: LI MF Bundled costs (see Participant listing)

Incentive Unit: LI MF Bundled costs (see Participant listing)

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Weatherization

Sector: Income Eligible

Fuel: Gas

Program Type: Prescriptive

Measure Category: Building Shell

Measure Type: Insulation & Air sealing

Measure Sub Type: Weatherization

Program: 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	93.00	0.08	12.40				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

Gas Heat MMBtu Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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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	1.00	0.44

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Weatherization	0.23	0.38	0.22	0.17

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: 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 $
Weatherization	0.00	0.00	558.21	9.42

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.

One-Time $ 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%.

Gross Measure TRC unit: $ 4500 per job

Incentive Unit: $ 4500 per job

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Participants

Sector: Income Eligible **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: Participant **Measure Type:** Participant **Measure Sub Type:** Participant

Program: 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

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							

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Participants	20	1.00	1.00		1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Participants	0.00	0.00	0.00	0.00

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	0.00

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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.

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.

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

Gross Measure TRC unit:

Incentive Unit:

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Heating system replacement (gas)

Sector: Income Eligible **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heating **Measure Sub Type:** Efficient Heating

Program: Low Income Retrofit 1-4

Measure Description

Replacement of an existing gas heating system with a new high efficiency system. Electric savings are achieved from reduced run time of the heating system fan(s).

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

Installation of new high-efficiency gas heating 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
Heating system replacement (gas)	16.00	0.01	7.90				

Electric kWh Source: Cadeo (2018). Rhode Island Income Eligible Services Single Family Impact Evaluation

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
Heating system replacement (gas)	20	1.00	1.00		1.00	1.00	1.00	0.00	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating system replacement (gas)	0.38	0.62	0.00	0.00

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: 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 replacement (gas)	0.00	0.00	310.82	6.00

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.

One-Time $ 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
Heating system replacement (gas)	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 5000 per job

Incentive Unit: $ 5000 per job

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New Movers

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

A control group of homes that does not receive Home Energy Reports.

Savings principle

A home that receives Home Energy Reports.

Savings Method

Calculated using site-specific inputs

Unit

Customer receiving energy reports

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
New Movers		0.00	Calc			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
New Movers	1	1.00	1.00	1.08					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
New Movers				

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

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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: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
New Movers	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
New Movers	0.00	0.00	0.00	1.00

NTG Note: Free-ridership and spillover are not applicable as customers cannot participate without the utility program.

Gross Measure TRC unit: $ 3.86 per participant

Incentive Unit: $ 3.86 per participant

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Opt-out 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 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 using site-specific inputs

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
Opt-out dual fuel		0.00	Calc			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
Opt-out dual fuel	1	1.00	1.00	1.08					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Opt-out dual fuel				

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

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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: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Opt-out dual fuel	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Opt-out dual fuel	0.00	0.00	0.00	1.00

NTG Note: Free-ridership and spillover are not applicable as customers cannot participate without the utility program.

Gross Measure TRC unit: $ 3.86 per participant

Incentive Unit: $ 3.86 per participant

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Opt-out gas only

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 using site-specific inputs

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
Opt-out gas only		0.00	Calc			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
Opt-out gas only	1	1.00	1.00	1.08					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Opt-out gas only				

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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: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Opt-out gas only	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Opt-out gas only	0.00	0.00	0.00	1.00

NTG Note: Free-ridership and spillover are not applicable as customers cannot participate without the utility program.

Gross Measure TRC unit: $ 3.86 per participant

Incentive Unit: $ 3.86 per participant

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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 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 using site-specific inputs

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
New movers dual fuel		0.00	Calc			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
New movers dual fuel	1	1.00	1.00	1.08					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
New movers dual fuel				

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

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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: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
New movers dual fuel	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
New movers dual fuel	0.00	0.00	0.00	1.00

NTG Note: Free-ridership and spillover are not applicable as customers cannot participate without the utility program.

Gross Measure TRC unit: $ 3.86 per participant

Incentive Unit: $ 3.86 per participant

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Refill

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 using site-specific inputs

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
Refill			Calc			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
Refill	1	1.00	1.00	1.08					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Refill				

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

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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: RHODE ISLAND HOME ENERGY REPORT PROGRAM IMPACT AND PROCESS EVALUATION

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Refill	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Refill	0.00	0.00	0.00	1.00

NTG Note: Free-ridership and spillover are not applicable as customers cannot participate without the utility program.

Gross Measure TRC unit: $ 3.86 per participant

Incentive Unit: $ 3.86 per participant

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Integrated water heater/condensing boiler

Sector: Residential **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heating **Measure Sub Type:** Boiler

Program: Energy Star Heating System

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 an integrated water heater/condensing boiler with a 90% AFUE boiler and a 0.9 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		0.00	10.40		0.00	0.00	0.00

Gas Heat MMBtu Source: Cadmus (2015) High Efficiency Heating Equipment Impact Evaluation

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	17	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Integrated water heater/condensing boiler				

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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Integrated water heater/condensing boiler	0.00	0.00	2.74	

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Integrated water heater/condensing boiler	0.29	0.08	0.00	0.79

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

Gross Measure TRC unit: $ 1728 per measure

Incentive Unit: $ 600 per measure

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WiFi Enabled Thermostat with Cooling

Sector: Residential | **Fuel:** Gas | **Program Type:** Prescriptive

Measure Category: HVAC | **Measure Type:** Controls | **Measure Sub Type:** Thermostat

Program: 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 intallation 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 intallation of a wi-fi programmable thermostat, the baseline efficiencycase 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	104.00	0.23	6.60			0.00	0.00

Electric kWh Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis. Prepared for Keith Miller and Whitney Domigan, National Grid.

Electric kW Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis. Prepared for Keith Miller and Whitney Domigan, National Grid.

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.

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Energy Impact Factors

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	1.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WiFi Enabled Thermostat with Cooling	0.01	0.04	0.54	0.41

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: 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 $
WiFi Enabled Thermostat with Cooling	0.00	0.00	0.00	

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
WiFi Enabled Thermostat with Cooling	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 268 per measure

Incentive Unit: $ 75 per measure

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Heat Recovery Ventilator

Sector: Residential

Fuel: Gas

Program Type: Prescriptive

Measure Category: HVAC

Measure Type: Ventilation

Measure Sub Type: Heat Recovery Ventilator

Program: 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	-133.00	-0.07	7.70			0.00	0.00

Electric kWh Source: GDS Associates, Inc. and Summit Blue Consulting (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks.

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
Heat Recovery Ventilator	20	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heat Recovery Ventilator	0.40	0.14	0.00	0.26

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: 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 $
Heat Recovery Ventilator	0.00	0.00	0.00	

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%.

Gross Measure TRC unit: $ 960 per measure

Incentive Unit: $ 250 per measure

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Programmable Thermostat

Sector: Residential **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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 residential window AC unit with EER 9.8.

Savings principle

Savings Method

Unit

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:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Programmable Thermostat		0.00	3.20			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 Thermostat	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable Thermostat				

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ISR 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	

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Programmable Thermostat	0.58	0.00	0.00	0.42

Gross Measure TRC unit: $ 92 per measure

Incentive Unit: $ 25 per measure

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Combo Furnace

Sector: Residential **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heating **Measure Sub Type:** Furnace

Program: 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		0.00	28.00			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				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Combo 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%.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Combo Furnace	0.00	0.00	2.74	

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Combo Furnace	0.34	0.08	0.00	0.74

Gross Measure TRC unit: $ 3200 per measure

Incentive Unit: $700 per measure

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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: 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 energy factor of 0.61.

Savings principle

The high efficiency case is a stand-alone storage water heater with an energy factor >= 0.67, a condensing water heater with an energy factor >= 0.95, a tankless water heater with an energy factor >= 0.82, or an indirect water heater attached to an ENERGYSTAR® 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		0.00	0.00	7.00	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
ENERGY STAR COND WATER HEATER 0.80 UEF	15	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ENERGY STAR COND WATER HEATER 0.80 UEF				

Measure life Source: DOE (2008). ENERGY STAR® Residential Water Heaters: Final Criteria Analysis. Prepared for the DOE.

ISR Note: 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 $
ENERGY STAR COND WATER HEATER 0.80 UEF	0.00	0.00	0.70	

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
ENERGY STAR COND WATER HEATER 0.80 UEF	0.00	0.00	0.00	1.00

NTG Source: Nexus Market Research (2010). HEHE Process and Impact Evaluation. Prepared for GasNetworks

Gross Measure TRC unit: $ 1285 per measure

Incentive Unit: $ 250 per measure

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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: 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 an energy factor of 0.61.

Savings principle

The high efficiency case is a stand-alone storage water heater with an energy factor >= 0.67, a condensing water heater with an energy factor >= 0.95, a tankless water heater with an energy factor >= 0.82, or an indirect water heater attached to an ENERGYSTAR® 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)		0.00	0.00	3.60	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
ENERGY STAR STORAGE WATER HEATER .64 UEF (med draw)	12	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ENERGY STAR STORAGE WATER HEATER .64 UEF (med draw)				

Measure life Source: DOE (2008). ENERGY STAR® Residential Water Heaters: Final Criteria Analysis. Prepared for the DOE.

ISR Note: 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 $
ENERGY STAR STORAGE WATER HEATER .64 UEF (med draw)	0.00	0.00	1.30	

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)	0.13	0.13	0.00	1.00

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

Gross Measure TRC unit: $ 165 per measure

Incentive Unit: $ 100 per measure

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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: 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 an energy factor of 0.61.

Savings principle

The high efficiency case is a stand-alone storage water heater with an energy factor >= 0.67, a condensing water heater with an energy factor >= 0.95, a tankless water heater with an energy factor >= 0.82, or an indirect water heater attached to an ENERGYSTAR® 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)		0.00	0.00	3.60	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
ENERGY STAR STORAGE WATER HEATER .68 UEF (high draw)	12	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ENERGY STAR STORAGE WATER HEATER .68 UEF (high draw)				

Measure life Source: DOE (2008). ENERGY STAR® Residential Water Heaters: Final Criteria Analysis. Prepared for the DOE.

ISR Note: 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 $
ENERGY STAR STORAGE WATER HEATER .68 UEF (high draw)	0.00	0.00	1.30	

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)	0.13	0.13	0.00	1.00

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

Gross Measure TRC unit: $ 165 per measure

Incentive Unit: $ 100 per measure

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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: 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 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 an energy factor >= 0.67, a condensing water heater with an energy factor >= 0.95, a tankless water heater with an energy factor >= 0.82, or an indirect water heater attached to an ENERGYSTAR® 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		0.00	0.00	9.90	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
ENERGY STAR ON DEMAND WATER HEATER 0.87 UEF	19	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
ENERGY STAR ON DEMAND WATER HEATER 0.87 UEF				

ISR 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 $
ENERGY STAR ON DEMAND WATER HEATER 0.87 UEF			1.23	

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	0.28	0.25		0.97

Gross Measure TRC unit: $ 718 per measure

Incentive Unit: $ 600 per measure

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Boiler Reset Controls

Sector: Residential | **Fuel:** Gas | **Program Type:** Prescriptive

Measure Category: HVAC | **Measure Type:** Controls | **Measure Sub Type:** Boiler Control

Program: 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		0.00	4.50			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 Controls	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Boiler Reset Controls				

Measure life Source: ACEEE (2006). Emerging Technologies Report: Advanced Boiler Controls. Prepared for ACEEE.

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ISR Note: 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	0.00	

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%.

Gross Measure TRC unit: $ 300 per measure

Incentive Unit: $ 100 per measure

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WiFi Enabled Thermostat

Sector: Residential **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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 intallation 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 intallation of a wi-fi programmable thermostat, the baseline efficiencycase 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		0.00	6.60			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
WiFi Enabled Thermostat	15	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WiFi Enabled Thermostat				

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	0.00	

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
WiFi Enabled Thermostat	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 268 per measure

Incentive Unit: $ 75 per measure

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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: 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 fan.

Baseline Description

The baseline efficiency case is a 85% AFUE (negotiated) furnace.

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		0.00	8.10		0.00	0.00	0.00

Gas Heat MMBtu Source: Cadmus (2015) High Efficiency Heating Equipment Impact Evaluation

Energy Impact Factors

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		

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Furnace (forced hot air) 95% AFUE w/ECM				

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.

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	

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Furnace (forced hot air) 95% AFUE w/ECM	0.24	0.00	0.00	0.76

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

Gross Measure TRC unit: $ 1453 per measure

Incentive Unit: $ 300 per measure

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Furnace (forced hot air) >= 97% AFUE

Sector: Residential **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heating **Measure Sub Type:** Furnace

Program: 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 fan.

Baseline Description

The baseline efficiency case is a 85% AFUE (negotiated) furnace.

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		0.00	9.20		0.00	0.00	0.00

Gas Heat MMBtu Source: Cadmus (2015) High Efficiency Heating Equipment Impact Evaluation

Energy Impact Factors

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		

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Furnace (forced hot air) >= 97% AFUE				

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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Furnace (forced hot air) >= 97% AFUE	0.00	0.00	47.16	

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Furnace (forced hot air) >= 97% AFUE	0.24	0.00	0.00	0.76

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

Gross Measure TRC unit: $ 2142 per measure

Incentive Unit: $ 500 per measure

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Boiler (forced hot water) >= 95% AFUE

Sector: Residential **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heating **Measure Sub Type:** Boiler

Program: Energy Star Heating System

Measure Description

Installation of a new space heating gas-fired condensing boiler.

Baseline Description

The baseline efficiency case is a boiler with an AFUE equal to 82%.

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		0.00	14.10		0.00	0.00	0.00

Gas Heat MMBtu Source: Cadmus (2015) High Efficiency Heating Equipment Impact Evaluation

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	19	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Boiler (forced hot water) >= 95% AFUE				

Measure life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR Qualified Boiler.

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ISR Note: 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	

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Boiler (forced hot water) >= 95% AFUE	0.29	0.08	0.00	0.79

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

Gross Measure TRC unit: $ 4176 per measure

Incentive Unit: $ 800 per measure

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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: 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 an energy factor >= 0.67, a condensing water heater with an energy factor >= 0.95, a tankless water heater with an energy factor >= 0.82, or an indirect water heater attached to an ENERGYSTAR® 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		0.00	8.00			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
Indirect Water Heater	20	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Indirect Water Heater				

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	

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Indirect Water Heater	0.66	0.00	0.00	0.34

NTG Source: Nexus Market Research (2010). HEHE Process and Impact Evaluation. Prepared for GasNetworks

Gross Measure TRC unit:

Incentive Unit:

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Integrated water heater/condensing boiler 95

Sector: Residential **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heating **Measure Sub Type:** Boiler

Program: 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

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 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		0.00	12.80		0.00	0.00	0.00

Gas Heat MMBtu Source: Cadmus (2015) High Efficiency Heating Equipment Impact Evaluation

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	17	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Integrated water heater/condensing boiler 95				

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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Integrated water heater/condensing boiler 95	0.00	0.00	2.74	

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Integrated water heater/condensing boiler 95	0.29	0.08	0.00	0.79

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

Gross Measure TRC unit: $ 3365 per measure

Incentive Unit: $ 1200 per measure

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Boiler (forced hot water) 90% AFUE

Sector: Residential **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Heating **Measure Sub Type:** Boiler

Program: Energy Star Heating System

Measure Description

Installation of a new space heating gas-fired boiler.

Baseline Description

The baseline efficiency case is a boiler with an AFUE equal to 82%.

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) 90% AFUE		0.00	11.40			0.00	0.00

Gas Heat MMBtu Source: Cadmus (2015) High Efficiency Heating Equipment Impact Evaluation

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Boiler (forced hot water) 90% AFUE	18	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Boiler (forced hot water) 90% AFUE				

Measure life Source: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR Qualified Boiler.

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ISR Note: 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) 90% AFUE	0.00	0.00	49.70	

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Boiler (forced hot water) 90% AFUE	0.29	0.08	0.00	0.79

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

Gross Measure TRC unit: $ 3915 per measure

Incentive Unit: $ 450 per measure

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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 intallation 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 intallation of a wi-fi programmable thermostat, the baseline efficiencycase 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			1.01				

Gas Heat MMBtu Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

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	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable thermostat				

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 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	

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	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 115 / unit

Incentive Unit: $ 115 / unit

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Energy Wise Single FamilyWeatherization

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:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Energy Wise Single FamilyWeatherization			11.09				

Gas Heat MMBtu Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Energy Wise Single FamilyWeatherization	25	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Energy Wise Single FamilyWeatherization				

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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Energy Wise Single FamilyWeatherization			66.59	

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
Energy Wise Single FamilyWeatherization	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 3,750/participant

Incentive Unit: $ 2,800/participant

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SF 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 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 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
SF Aerator				0.08			

Gas DHW MMBtu Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
SF Aerator	7	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
SF Aerator				

Measure life Note: Massachusetts Common Assumption

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

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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 $
SF Aerator	332.00			

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
SF Aerator	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 10 / unit

Incentive Unit: $ 10 / unit

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WiFi 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 intallation 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 intallation of a wi-fi programmable thermostat, the baseline efficiencycase 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 programmable thermostat			6.60				

Gas Heat MMBtu Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis. Prepared for Keith Miller and Whitney Domigan, National Grid.

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
WiFi programmable thermostat	15	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
WiFi programmable thermostat				

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 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 $
WiFi programmable thermostat	0.00	0.00	3.63	

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 programmable thermostat	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 350 / unit

Incentive Unit: $ 200 / unit

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Energy Wise Single FamilyShowerhead

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
Energy Wise Single FamilyShowerhead				0.19			

Gas DHW MMBtu Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Energy Wise Single FamilyShowerhead	7	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Energy Wise Single FamilyShowerhead				

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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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Energy Wise Single FamilyShowerhead	2401.00			0.03

Water/Sewer Note: MA HES assumption

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
Energy Wise Single FamilyShowerhead	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 20 / unit

Incentive Unit: $ 20 / unit

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SF Pipe Wrap

Sector: Residential **Fuel:** Gas **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 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
SF Pipe Wrap				0.06			

Gas DHW MMBtu Source: DNV GL RI EnergyWise Single Family Evaluation, July 2016

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
SF Pipe Wrap	7	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
SF Pipe Wrap				

Measure life Note: Massachusetts Common Assumption

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

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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 $
SF Pipe Wrap				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
SF Pipe Wrap	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 12 / unit

Incentive Unit: $ 12 / unit

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SF Air Sealing Kit (Gas)

Sector: Residential

Fuel: Gas

Program Type: Prescriptive

Measure Category: Building Shell

Measure Type: Air Sealing

Measure Sub Type: Air Sealing/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 on thermal boundaries.

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).

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
SF Air Sealing Kit (Gas)			0.39				

Gas Heat MMBtu Source: Rise Engineering (2015). Memo on Pilot Findings for LED inserts for Recessed Light Cans.

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
SF Air Sealing Kit (Gas)	12	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
SF Air Sealing Kit (Gas)				

Measure life Source: Rise Engineering (2015). Memo on Pilot Findings for LED inserts for Recessed Light Cans.

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ISR Note: 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 $
SF Air Sealing Kit (Gas)			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.

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.

Annual $ Note: NEI per unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
SF Air Sealing Kit (Gas)	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit:

Incentive Unit:

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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: 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 adaper, 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)		0.00	0.21			0.00	0.00

Propane MMBtu Source: Verifying Thermostatic Valve Showerhead Savings.xls

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)	7	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low Flow Showerhead thermo Control (ladybug gas DHW)				

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 thermo Control (ladybug gas DHW)	435.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low Flow Showerhead thermo Control (ladybug gas DHW)	0.15	0.00	0.00	0.85

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

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Demand Circulator

Sector: Residential

Fuel: Gas

Program Type: Custom

Measure Category: Water Heating

Measure Type: Flow Control

Measure Sub Type: Demand Circulator

Program: 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 recirc 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:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Demand Circulator			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
Demand Circulator	15	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Demand Circulator				

ISR Note: 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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Demand Circulator	0.00	0.00	0.00	1.00

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Air Sealing

Sector: Residential

Fuel: Gas

Program Type: Custom

Measure Category: Building Shell

Measure Type: Air Sealing

Measure Sub Type: Air Sealing/Infiltration

Program: 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 × HDD × (Hours per Day) × (Minutes per Hour) × (Btu/ft3-°F) × 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: 4644. 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		0.00	Calc			0.00	0.00

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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	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Air Sealing				

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 $
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.

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.

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Air Sealing	0.19	0.00	0.00	0.81

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

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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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: 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		0.00		Calc		0.00	0.00

Propane 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
Low-flow showerhead	7	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low-flow showerhead				

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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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Low-flow showerhead	3696.00	0.00		

Water/Sewer Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low-flow showerhead	0.15	0.00	0.00	0.85

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

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Participant

Sector: Residential **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: Participant **Measure Type:** Participant **Measure Sub Type:** EW MF

Program: EnergyWise Multifamily

Measure Description

This row identifies a participant for tracking and cost purposes.

Baseline Description

Savings principle

Savings Method

Unit

Savings equation

Hours:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Participant			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	17.2	1.00	1.00	1.00					

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Participant				

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Participant	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Participant				1.00

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Gross Measure TRC unit: $ 390/participant

Incentive Unit: $ 304/participant

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Pipe Wrap (Water Heating)

Sector: Residential **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: Water Heating **Measure Type:** Insulation **Measure Sub Type:** Pipe Insulation

Program: 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:

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)			1.14				

Gas Heat MMBtu Source: Illume and Navigant Consulting (2014). Rhode Island Behaviorial Program and Pilot Impacts and Process Evaluation.

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	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Pipe Wrap (Water Heating)				

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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 $
Pipe Wrap (Water Heating)				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pipe Wrap (Water Heating)	0.00	0.00	0.00	1.00

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Low Flow Showerhead w/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: 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 adaper, 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 w/thermo Control (roadrunner gas DHW)		0.00		1.40		0.00	0.00

Propane MMBtu Source: Verifying Thermostatic Valve Showerhead Savings.xls

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low Flow Showerhead w/thermo Control (roadrunner gas DHW)	7	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low Flow Showerhead w/thermo Control (roadrunner gas DHW)				

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 w/thermo Control (roadrunner gas DHW)	2888.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low Flow Showerhead w/thermo Control (roadrunner gas DHW)	0.15	0.00	0.00	0.85

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

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Faucet aerator

Sector: Residential **Fuel:** Gas **Program Type:** Custom

Measure Category: Water Heating **Measure Type:** Flow Control **Measure Sub Type:** Faucet Aerator

Program: 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		0.00	Calc			0.00	0.00

Propane 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
Faucet aerator	7	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Faucet aerator				

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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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
Faucet aerator	332.00	0.00		

Water/Sewer Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Faucet aerator	0.15	0.00	0.00	0.85

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

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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MF Shell Insulation

Sector: Residential **Fuel:** Gas **Program Type:** Custom

Measure Category: Building Shell **Measure Type:** Insulation **Measure Sub Type:** Shell

Program: 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/kWhNheating

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: 4644. 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		0.00	Calc			0.00	0.00

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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				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
MF Shell Insulation				

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.

Non Energy Impact Factors

Measure	Water: Gallons	Sewer: Gallons	Annual $	One-time $
MF Shell Insulation	0.00	0.00	47.31	

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
MF Shell Insulation	0.19	0.00	0.00	0.81

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

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Custom

Sector: Residential **Fuel:** Gas **Program Type:** Custom

Measure Category: Custom **Measure Type:** Custom **Measure Sub Type:** Custom

Program: EnergyWise Multifamily

Measure Description

Vendors install a variety of measures at multifamily facilities. Measures include

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		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	mult	1.00	1.00	0.99	0.99			Custom	Custom

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Custom				

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ISR 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				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Custom	0.00	0.00	0.00	1.00

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Programmable thermostat

Sector: Residential **Fuel:** Gas **Program Type:** Custom

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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 intallation 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 intallation of a wi-fi programmable thermostat, the baseline efficiencycase 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		0.00	Calc			0.00	0.00

Gas Heat MMBtu Source: The Cadmus Group (2012). Home Energy Services Impact Evaluation. 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
Programmable thermostat	15	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Programmable thermostat				

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	3.63	

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
Programmable thermostat	0.24	0.00	0.00	0.76

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

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Wi-Fi programmable thermostat (controls gas heat only)

Sector: Residential **Fuel:** Gas **Program Type:** Custom

Measure Category: HVAC **Measure Type:** Controls **Measure Sub Type:** Thermostat

Program: 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 intallation 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 intallation of a wi-fi programmable thermostat, the baseline efficiencycase 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 thermostat (controls gas heat only)		0.00	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
Wi-Fi programmable thermostat (controls gas heat only)	15	1.00	1.00	1.00	1.00				

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Wi-Fi programmable thermostat (controls gas heat only)				

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 $
Wi-Fi programmable thermostat (controls gas heat only)	0.00	0.00	3.63	

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
Wi-Fi programmable thermostat (controls gas heat only)	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Duct Sealing

Sector: Residential **Fuel:** Gas **Program Type:** Custom

Measure Category: HVAC **Measure Type:** Ducting **Measure Sub Type:** Duct Sealing

Program: 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

Savings equation

MMBtu = Annualheatingconsumption x %SAVE x (1/1000000)

Where:

AnnualHeatingConsumption = 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:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Duct Sealing			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.

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Duct Sealing				

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			0.23	

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
Duct Sealing	0.00	0.00	0.00	1.00

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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Pipe Wrap (Heating)

Sector: Residential **Fuel:** Gas **Program Type:** Prescriptive

Measure Category: HVAC **Measure Type:** Insulation **Measure Sub Type:** Pipe Insulation

Program: EnergyWise Multifamily

Measure Description

Insulation upgrades to existing heating system pipes

Baseline Description

The baseline efficiency case is the existing equipment prior to the implementation of additional insulation.

Savings principle

The high efficiency case includes pipe insulation.

Savings Method

Deemed

Unit

Savings equation

Gross MMBtu_Gas = Qty × deltaMMBtu_Gas

Where:

Qty = Total number of units.

deltaMMBtu_Gas = Average annual natural gas reduction per unit.

Hours:

Measure Gross Savings per Unit

Measure	KWh	KW	Gas Heat MMBtu	Gas DHW MMBtu	Gas Other MMBtu	Oil MMBtu	Propane MMBtu
Pipe Wrap (Heating)			0.16				

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
Pipe Wrap (Heating)	15	1.00	1.00	1.00	1.00				

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Pipe Wrap (Heating)				

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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 $
Pipe Wrap (Heating)				

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Pipe Wrap (Heating)	0.00	0.00	0.00	1.00

Gross Measure TRC unit: EW MF Bundled costs (see Participant listing)

Incentive Unit: EW MF Bundled costs (see Participant listing)

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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

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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak 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.

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		

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%.

Gross Measure TRC unit: $150k for res+C&I C&S

Incentive Unit: $150k for res+C&I C&S

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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: Residential New Construction

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		0.00		0.48	0.00	0.00	0.00

Gas DHW MMBtu Source: Verifying Thermostatic Valve Showerhead Savings.xls

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Low-flow showerhead	7	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Low-flow showerhead				

Measure life Source: Massachusetts common assumption

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ISR Note: 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 $
Low-flow showerhead	3696.00	0.00		

Water/Sewer Source: The Cadmus Group (2012). Massachusetts 2011 Residential Retrofit Multifamily Program Impact Analysis. Prepared for the Massachusetts Program Administrators.

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Low-flow showerhead	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $ 10 per measure

Incentive Unit: $ 10 per measure

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Hot water heating_tier4

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_tier4	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_tier4	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Hot water heating_tier4	0.36	0.31	0.17	0.16

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_tier4	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Hot water heating_tier4	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $400/home

Incentive Unit: $200/home

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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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Hot water heating_tier3	0.36	0.31	0.17	0.16

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Hot water heating_tier3	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $400/home

Incentive Unit: $150/home

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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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Hot water heating_tier2	0.36	0.31	0.17	0.16

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_tier2	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Hot water heating_tier2	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $400/home

Incentive Unit: $150/home

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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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Hot water heating_tier1	0.36	0.31	0.17	0.16

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_tier1	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Hot water heating_tier1	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $400/home

Incentive Unit: $50/home

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Cooling_tier4

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

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_tier4	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_tier4	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Cooling_tier4	0.01	0.04	0.54	0.41

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_tier4	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Cooling_tier4	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $11,688/home

Incentive Unit: $6,000/home

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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

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	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
CP	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CP	0.01	0.04	0.54	0.41

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 $
CP	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
CP	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $1074/home

Incentive Unit: $310/home

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Heating_tier4

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_tier4	Calc	Calc	Calc	Calc	Calc	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_tier4	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating_tier4	0.38	0.62	0.00	0.00

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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_tier4	0.00	0.00	189.00	

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating_tier4	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $11,688/home

Incentive Unit: $6,000/home

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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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Cooling_tier3	0.01	0.04	0.54	0.41

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Cooling_tier3	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $7688/home

Incentive Unit: $2000/home

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating_tier3	0.38	0.62	0.00	0.00

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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	189.00	

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating_tier3	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $7688/home

Incentive Unit: $2000/home

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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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Cooling_tier2	0.01	0.04	0.54	0.41

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Cooling_tier2	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $4860/home

Incentive Unit: $1875/home

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating_tier2	0.38	0.62	0.00	0.00

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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	189.00	

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating_tier2	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $4860/home

Incentive Unit: $1875/home

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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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Cooling_tier1	0.01	0.04	0.54	0.41

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Cooling_tier1	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $1630/home

Incentive Unit: $1050/home

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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

Savings principle

Savings Method

Calculated using site-specific inputs

Unit

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.

Energy Impact Factors

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
CP-DHW	0.36	0.31	0.17	0.16

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 $
CP-DHW	0.00	0.00		

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%.

Gross Measure TRC unit: $400/home

Incentive Unit:

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Adaptive Reuse	0.01	0.04	0.54	0.41

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%.

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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	0.00	189.00

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%.

Gross Measure TRC unit: $1177/home

Incentive Unit: $700/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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier3 Cooling Gas	0.03	0.05	0.43	0.50

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier3 Cooling Gas	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $9330/home

Incentive Unit: $2335/home

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Heating_tier1	0.38	0.62	0.00	0.00

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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	189.00	

Annual $ Note: NEI per participant / treated unit

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Heating_tier1	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $1630/home

Incentive Unit: $1050/home

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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.

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier2	0.38	0.62	0.00	0.00

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier2	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $2767/home

Incentive Unit: $1875/home

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Renovation Rehab Domestic Hot Water_tier4 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_tier4 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.

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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_tier4 Gas	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Domestic Hot Water_tier4 Gas	0.36	0.31	0.17	0.16

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_tier4 Gas	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_tier4 Gas	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $400/home

Incentive Unit: $200/home

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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.

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Domestic Hot Water_tier3 Gas	0.36	0.31	0.17	0.16

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_tier3 Gas	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $400/home

Incentive Unit: $150/home

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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.

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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 Gas	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Domestic Hot Water_tier2 Gas	0.36	0.31	0.17	0.16

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_tier2 Gas	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_tier2 Gas	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $400/home

Incentive Unit: $150/home

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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.

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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 Gas	15	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Domestic Hot Water_tier1 Gas	0.36	0.31	0.17	0.16

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_tier1 Gas	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_tier1 Gas	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $400/home

Incentive Unit: $50/home

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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

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.

Energy Impact Factors

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab CP heating	0.38	0.62	0.00	0.00

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 CP heating	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab CP heating	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $787/home

Incentive Unit: $310/home

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Renovation Rehab Heating_tier4

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_tier4	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.

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Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Heating_tier4	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier4	0.38	0.62	0.00	0.00

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_tier4	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier4	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $12995/home

Incentive Unit: $6,000/home

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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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier2 Cooling Gas	0.03	0.05	0.43	0.50

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier2 Cooling Gas	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $2767/home

Incentive Unit: $1875/home

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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.

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier3	0.38	0.62	0.00	0.00

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier3	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $9330/home

Incentive Unit: $2335/home

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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

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.

Energy Impact Factors

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab CP	0.01	0.04	0.54	0.41

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 CP	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab CP	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: ESH Bundled costs

Incentive Unit: ESH Bundled costs

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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.

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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 Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier1	0.38	0.62	0.00	0.00

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier1	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $1838/home

Incentive Unit: $1050/home

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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

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.

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	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Domestic Hot Water_tier1	0.36	0.31	0.17	0.16

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_tier1	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Domestic Hot Water_tier1	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $100/home

Incentive Unit: $75/home

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Renovation Rehab Heating_tier1 heating

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

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 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.

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Renovation Rehab Heating_tier1 heating	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier1 heating	0.38	0.62	0.00	0.00

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 heating	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier1 heating	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $1838/home

Incentive Unit: $1050/home

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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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier1 cooling	0.03	0.05	0.43	0.50

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		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier1 cooling	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $1838/home

Incentive Unit: $1050/home

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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

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.

Energy Impact Factors

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab CP-DHW	0.36	0.31	0.17	0.16

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 CP-DHW	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab CP-DHW	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $100/home

Incentive Unit: $75/home

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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

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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab CP heating_gas	0.38	0.62	0.00	0.00

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 CP heating_gas	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab CP heating_gas	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $787/home

Incentive Unit: $310/home

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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

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

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

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab CP heating_elec	0.38	0.62	0.00	0.00

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 CP heating_elec	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab CP heating_elec	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $787/home

Incentive Unit: $310/home

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Renovation Rehab Heating_tier4 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

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_tier4 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_tier4 Cooling Gas	25	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00

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Measure	Winter Peak Energy %	Winter Off-Peak Energy %	Summer Peak Energy %	Summer Off-Peak Energy %
Renovation Rehab Heating_tier4 Cooling Gas	0.03	0.05	0.43	0.50

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_tier4 Cooling Gas	0.00	0.00		

Net to Gross Factors

Measure	FR	Sop	Sonp	NTG
Renovation Rehab Heating_tier4 Cooling Gas	0.00	0.00	0.00	1.00

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

Gross Measure TRC unit: $12995/home

Incentive Unit: $6,000/home

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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	0.9
Convention Center	1.2
Court House	1.2
Dining: Bar Lounge/Leisure	1.3
Dining: Cafeteria/Fast Food	1.4
Dining: Family	1.6
Dormitory	1
Fire Stations	0.8
Exercise Center	1
Gymnasium	1.1
Healthcare-Clinic	1
Hospital	1.2
Hotel	1
Library	1.3
Manufacturing Facility	1.3
Motel	1
Motion Picture Theatre	1.2
Multi-Family	0.7
Museum	1.1
Office	0.9
Parking Garage	0.3
Penitentiary	1
Performing Arts Theatre	1.6
Police/Fire Station	1
Post Office	1.1
Religious Building	1.3
Retail	1.4
School/University	1.2
Sports Arena	1.1
Town Hall	1.1
Transportation	1
Warehouse	0.6
Workshop	1.4

[1] IECC 2012

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Table 2: Lighting Power Densities Using the Space-by-Space Method (WATTSb,i)

Common Space Types	**Lighting Power Density (W/ft^2)**
Atrium – First 40 feet in height	0.03 per ft. ht.
Atrium – Above 40 feet in height	0.02 per ft. ht.
Audience/seating	
For Auditorium	0.9
For performing arts theater	2.6
For motion picture theater	1.2
Classroom/lecture/training	1.3
Conference/meeting/multipurpose	1.2
Corridor/transition	0.7
Dining Area	0.9
Bar/lounge/leisure dining	1.4
Family dining area	1.4
Dressing/fitting room performing arts theater	1.1
Electrical/mechanical	1.1
Food preparation	1.2
Laboratory for classrooms	1.3
Laboratory for medical/industrial/research	1.8
Lobby	1.1
Lobby for performing arts theater	3.3
Lobby for motion picture theater	1
Locker room	0.8
Lounge/Recreation	0.8
Office - enclosed	1.1
Office – open plan	1
Restroom	1
Sales area	1.6
Stairway	0.7
Storage	0.8
Workshop	1.6
Courthouse/police station/penitentiary	
Courtroom	1.9
Confinement cells	1.1
Judge Chambers	1.3
Penitentiary audience seating	0.5
Penitentiary classroom	1.3
Penitentiary dining	1.1
BUILDING SPECIFIC SPACE-BY-SPACE TYPES	
Automotive – service/repair	0.7
Bank/office – banking activity area	1.5
Dormitory living quarters	1.1
Gymnasium/fitness center	

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Fitness area	0.9
Gymnasium audience/seating	0.4
Playing area	1.4
COMMON SPACE-BY-SPACE TYPES	1.4
Healthcare clinic/hospital	
Corridors/transition	1
Exam/treatment	1.7
Emergency	0.8
Public and staff lounge	0.8
Medical Supplies	1.4
Nursery	0.9
Nurse Station	1
Physical Therapy	0.9
Patient room	0.7
Pharmacy	1.2
Radiology/imaging	1.3
Operating room	2.2
Recovery	1.2
Lounge Recreation	0.8
Laundry – washing	0.6
Hotel	
Dining area	1.3
Guest rooms	1.1
Hotel lobby	2.1
Highway lodging dining	1.2
Highway lodging guest rooms	1.1
Library	
Stacks	1.7
Card File and cataloguing	1.1
Reading area	1.2
Manufacturing	
Corridors/transition	0.4
Detailed Manufacturing	1.3
Equipment Room	1
Extra high bay (> 50-foot floor-ceiling height)	1.1
High bay (25 – 50-foot floor-ceiling height)	1.2
Low bay (< 25-foot floor-ceiling height)	1.2
Museum	
General Exhibition	1
Restoration	1.7
Parking Garage – garage areas	0.2
Convention Center	
Exhibit space	1.5
Audience/seating area	0.9
Fire Stations	
Engine Room	0.8
Sleeping quarters	0.3

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Post Office	
Sorting area	0.9
Religious building	
Fellowship hall	0.6
Audience seating	2.4
Worship pulpit/choir	2.4
Retail	
Dressing/fitting area	0.9
Mall concourse	1.6
Sales area	1.6
BUILDING SPECIFIC SPACE-BY-SPACE TYPES	
Sports areana	
Audience seating	0.4
Court sports area – Class 4	0.7
Court sports area – Class 3	1.2
Court sports area – Class 2	1.9
Court sports area – Class 1	3
Ring sports area	2.7
Transportation	
Air/train/bus baggage area	1
Airport concourse	0.6
Terminal – ticket counter	1.5
Warehouse	
Fine material storage	1.4
Medium/bulky material	0.6

[1] IECC 2012

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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

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Device Code	Device Description	Rated Watts
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

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Device Code	Device Description	Rated Watts
	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

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Device Code	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 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

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Device Code	Device Description	Rated Watts
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
Four Foot T8 High Efficient / Reduce Wattage Systems (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

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Device Code	Device Description	Rated Watts
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

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Device Code	Device Description	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

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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

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Table 4: Retrofit Existing Lighting Wattage Tables

Device Code	Device Description	Rated Watts
Incandescent Lamps		
1I0015	15W INC	15
1I0020	20W INC	20
1I0025	25W INC	25
1I0034	34W INC	34
1I0036	36W INC	36
1I0040	40W INC	40
1I0042	42W INC	42
1I0045	45W INC	45
1I0050	50W INC	50
1I0052	52W INC	52
1I0054	54W INC	54
1I0055	55W INC	55
1I0060	60W INC	60
1I0065	65W INC	65
1I0067	67W INC	67
1I0069	69W INC	69
1I0072	72W INC	72
1I0075	75W INC	75
1I0080	80W INC	80
1I0085	85W INC	85
1I0090	90W INC	90
1I0093	93W INC	93
1I0100	100W INC	100
1I0120	120W INC	120
1I0125	125W INC	125
1I0135	135W INC	135
1I0150	150W INC	150
1I0200	200W INC	200
1I0300	300W INC	300
1I0448	448W INC	448
1I0500	500W INC	500
1I0750	750W INC	750
1I1000	1000W INC	1000
1I1500	1500W INC	1500
Low Voltage Halogen Fixture (includes Transformer)		
1R0020	20W LV HALOGEN FIXT	30
1R0025	25W LV HALOGEN FIXT	35
1R0035	35W LV HALOGEN FIXT	45
Low Voltage Halogen Fixture (includes Transformer) (cont.)		
1R0042	42W LV HALOGEN FIXT	52
1R0050	50W LV HALOGEN FIXT	60
1R0065	65W LV HALOGEN FIXT	75
1R0075	75W LV HALOGEN FIXT	85
Halogen/Quartz Lamps		

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Device Code	Device Description	Rated Watts
1T0035	35W HALOGEN LAMP	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
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
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

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Device Code	Device Description	Rated Watts
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
Pulse Start Metal Halide Lamp/Ballast		
1M0100P	100W MH CWA	128
1M0100R	100W MH LINEAR	118
1M0150P	150W MH CWA	190
1M0150R	150W MH LINEAR	172
1M0175P	175W MH CWA	208
1M0175R	175W MH LINEAR	190
1M0200P	200W MH CWA	232
1M0200R	200W MH LINEAR	218
1M0250P	250W MH CWA	288
1M0250R	250W MH LINEAR	265
1M0300P	300W MH CWA	342
1M0300R	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

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Device Code	Device Description	Rated Watts
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

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Device Code	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

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Device Code	Device Description	Rated Watts
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

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Device Code	Device Description	Rated Watts
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
Six Foot T12 & T12HO Systems		
1F72HSE	1L6’ T8HO/ELIG	80
1F72HSS	1L6' F72HO/STD/STD	113
1F72SSM	1L6' STD/EEMAG	80
1F72SSS	1L6' STD/STD	95
2F72HSE	2L6'T8 HO/ELIG	160
2F72HSM	2L6' F72HO/STD/EEMAG	193
2F72HSS	2L6' F72HO/STD	195
2F72SSM	2L6' STD/EEMAG	135
2F72SSS	2L6' STD/STD	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
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

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Device Code	Device Description	Rated Watts
2F80SSE	2L8' T8 HO/ELIG	160
Eight Foot T12 Systems		
1F96SEE	1L8' EE/ELIG	60
1F96SES	1L8' EE/STD	83
1F96SSE	1L8' STD/ELIG	70
1F96SSS	1L8' STD/STD	100
2F96SEE	2L8' EE/ELIG	109
2F96SEM	2L8' EE/EEMAG	123
2F96SES	2L8' EE/STD	138
2F96SSE	2L8' STD/ELIG	134
2F96SSM	2L8' STD/EEMAG	158
2F96SSS	2L8' STD/STD	173
3F96SES	3L8' EE/STD	221
3F96SSS	3L8' STD/STD	273
4F96SEE	4L8' EE/ELIG	218
4F96SEM	4L8' EE/EEMAG	246
4F96SES	4L8' EE/STD	276
4F96SSE	4L8' STD/ELIG	268
4F96SSM	4L8' STD/EEMAG	316
4F96SSS	4L8' STD/STD	346

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Table 5: Retrofit 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
1C3240S	32/40W CIRCLINE HW	80
2C0005S	2/5W COMPACT HW	14

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Device Code	Device Description	Rated Watts
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
Compact Fluorescents (CFL's) (cont.)		
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
1F21SSE	1L3' 21W T5/ELIG	24
2F21SSE	2L3' 21W T5/ELIG	47
1F39HSE	1L3' 39W T5HO/ELIG	42
2F39HSE	2L3' 39W T5HO/ELIG	85

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Device Code	Device Description	Rated Watts
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

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Device Code	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 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
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

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Device Code	Device Description	Rated Watts
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
Four Foot T8 High Efficient / Reduce Wattage Systems (cont.)		
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
1L003	3 WATT LED	3

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Device Code	Device Description	Rated Watts
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

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Device Code	Device Description	Rated Watts
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

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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

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Table 6a: Upstream Lighting Savings

Product type	Category	Installation Rate	Gross kW Saved per Unit	HVAC Interactive Effect (kWh)
G24 LED	5	76%	0.0124	102%
A-line, 40/60w	4	76%	0.0323	99%
A-line, 75/100w	4	76%	0.0454	99%
Decoratives	4	76%	0.0203	99%
LED Retrofit kit, <25W	3	76%	0.0392	103%
LED Retrofit kit, >25W	3	76%	0.0577	103%
MR16	3	76%	0.0225	103%
PAR20	3	76%	0.0287	103%
PAR30	3	76%	0.0389	103%
PAR38	3	76%	0.0451	103%
Stairwell Kit, 2ft w/sensor	2	76%	0.0358	100%
Stairwell Kit, 4ft w/sensor	2	76%	0.0309	100%
TLED, 2ft	1	76%	0.0079	104%
TLED, 4ft	1	76%	0.0158	104%

Table 6b: Upstream Lighting Hours of Use

Building Type	Hours of Use	Building Type	Hours of Use
College & University	4,839	Medical Office	3,673
Grocery/Food Sales	5,468	Office Building	4,181
Hospital	5,413	Other	4,336
Industrial/Manufacturing	4,988	Restaurant/Food Service	5,018
K-12 School	2,788	Retail	4,939
Lodging	4,026	Warehouse and storage	6,512

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Table 7: Baseline Efficiency Requirements for C&I Unitary Air Conditioners[c]

Equipment Type	Size Category	Subcategory or Rating Condition	Baseline Efficiency After 1/2014
Air conditioners, air cooled	<65,000 Btu/h[b]	Split system	13.0 SEER
		Single package	13.0 SEER
	≥65,000 Btu/h and <135,000 Btu/h	Split system and single package	11.2 EER[a] 11.4 IEER[a]
	≥135,000 Btu/h and <240,000 Btu/h	Split system and single package	11.0 EER[a] 11.2 IEER[a]
	≥240,000 Btu/h and <760,000 Btu/h	Split system and single package	10.0 EER[a] 10.1 IEER[a]
	≥760,000 Btu/h	Split system and single package	9.7 EER[a] 9.8 IEER[a]
Air conditioners, Water cooled	<65,000 Btu/h	Split system and single package	12.1 EER 12.3 IEER
	≥65,000 Btu/h and <135,000 Btu/h	Split system and single package	12.1 EER[a] 12.3 IEER[a]
	≥135,000 Btu/h and <240,000 Btu/h	Split system and single package	12.5 EER[a] 12.7 IEER[a]
	≥240,000 Btu/h	Split system and single package	12.4 EER[a] 12.6 IEER[a]
Air conditioners, evaporatively cooled	<65,000 Btu/h	Split system and single package	12.1 EER 12.3 IEER
	≥65,000 Btu/h and <135,000 Btu/h	Split system and single package	12.1 EER[a] 12.3 IEER[a]
	≥135,000 Btu/h and <240,000 Btu/h	Split system and single package	12.0 EER[a] 12.2 IEER[a]
	≥240,000 Btu/h	Split system and single package	11.9 EER[a] 12.1 IEER[a]

a. Deduct 0.2 from the required EERs for units with a heating section other than electric heat.[1]

b. Single-phase air-cooled air conditioners <65,000 Btu/h are regulated by the National Appliance Energy Conservation Act of 1987 (NAECA); SEER values are those set by NAECA.

c. Baseline determined by International Code Council (2012). *2012 International Energy Conservation Code;* Page C-38, Table C403.2.3(1)

Baseline determined by International Code Council (2012). 2012 International Energy Conservation Code; Page C-38, Table C403.2.3(1)

The Program does not differentiate units by heating section types, therefore the highest baseline efficiency is assumed for all heating section types in each equipment category

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Table 8: Baseline Efficiency Requirements for C&I Heat Pumps

Equipment Type	Size Category (Cooling Capacity)	Subcategory or Rating Condition	Baseline Efficiency After 1/1/2014[i]	
			Cooling Mode	Heating Mode
Air cooled	<65,000 Btu/h[b]	Split system	13.0 SEER	7.7 HSPF
		Single package	13.0 SEER	7.7 HSPF
	≥65,000 Btu/h and <135,000 Btu/h	Split system and single package / 47°F db/43°F wb outdoor air	11.0 EER[a] 11.2 IEER[a]	3.3 COP
	≥135,000 Btu/h and <240,000 Btu/h	Split system and single package / 47°F db/43°F wb outdoor air	10.6 EER[a] 10.7 IEER[a]	3.2 COP
	≥240,000 Btu/h	Split system and single package / 47°F db/43°F wb outdoor air	9.5 EER[a] 9.6 IEER[a]	3.2 COP
Water source	<17,000 Btu/h	86°F entering water (Cooling Mode) / 68°F entering water (Heating Mode)	11.2 EER	4.2 COP
	≥17,000 Btu/h and <135,000 Btu/h	86°F entering water / 68°F entering water (Heating Mode)	12.0 EER	4.2 COP
Groundwater source	<135,000 Btu/h	59°F entering water (Cooling Mode) / 50°F entering water (Heating Mode)	16.2 EER	3.6 COP
Ground source	<135,000 Btu/h	77°F entering water / 32°F entering water (Heating Mode)	13.4 EER	3.1 COP

db = dry-bulb temperature, °F; wb = wet-bulb temperature, °F.

a. Deduct 0.2 from the required EERs for units with a heating section other than electric heat[1].

b. Single-phase air-cooled air conditioners <65,000 Btu/h are regulated by the National Appliance Energy Conservation Act of 1987 (NAECA); SEER values are those set by NAECA.

[i] International Code Council (2012). 2012 International Energy Conservation Code. Page C-40, Table C403.2.3(2)

The Program does not differentiate units by heating section types, therefore the highest baseline efficiency is assumed for all heating section types in each equipment category

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Table 9: Water Chilling Packages - Minimum Efficiency Requirements

Equipment Type	Size Category (Tons)	Units	Path A		Path B	
			Full Load	IPLV	Full Load	IPLV
Air-cooled chillers	< 150	EER	9.562	12.5	NA	NA
	≥ 150	EER	9.562	12.75	NA	NA
Water cooled, electrically operated, positive displacement (rotary screw and scroll)	< 75	kW/ton	0.78	0.63	0.8	0.6
	≥ 75 and < 150	kW/ton	0.775	0.615	0.79	0.586
	≥ 150 and < 300	kW/ton	0.68	0.58	0.718	0.54
	≥ 300	kW/ton	0.62	0.54	0.639	0.49
Water cooled, electrically operated, centrifugal	< 150	kW/ton	0.634	0.596	0.639	0.45
	≥ 150 and < 300	kW/ton	0.634	0.596	0.639	0.45
	≥ 300 and < 600	kW/ton	0.576	0.549	0.6	0.4
	≥ 600	kW/ton	0.57	0.539	0.59	0.4

Note: Compliance with this standard may be obtained by meeting the minimum requirements of Path A or B, however, both the Full Load and IPLV must be met to fulfill the requirements of Path A or B.

Table 10: Chiller Load Factors

Equipment Type	Full Load	IPLV
Air-cooled chillers	0.715	0.715
Water cooled chillers <300 Tons	0.882	0.823
Water cooled chillers >300 Tons	0.762	0.765

National Grid load factors based on a 1994 study.

Table 11: Cooling and Heating Equivalent Full Load Hours

Building (or Space) Type	Cooling Full Load Hours ($EFLH_{cool}$)	Heating Full Load Hours ($EFLH_{heat}$)
National Grid RI (NE – South Coastal)	817	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]

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[1] KEMA (2011). C&I Unitary AC LoadShape Project – Final Report. Prepared for the Regional Evaluation, Measurement & Verification Forum.

[2] Ibid.

[3] United Illuminating Company, Connecticut Light & Power Company (2010). UI and CL&P Program Savings Documentation for 2011 Program Year.

Table 12: Savings Factors for ECM HVAC Fan Motors

Factor	Box Size	Value	Units
Box Size Factor	< 1000 CFM	0.32	Watts/CFM
Box Size Factor	≥ 1000 CFM	0.21	Watts/CFM
$\%Flow_{ANNUAL}$	ALL	0.52	-
$\%Flow_{SP}$	ALL	0.63	-
$\%Flow_{WP}$	ALL	0.33	-

Factors based on engineering analyses developed at National Grid

Table 13: Savings Factors for Cooler Night Covers

Cooler Case Temperature	**Savings Factor (ΔkW/foot)**
Low Temperature (-35 F to -5 F)	0.03
Medium Temperature (0 F to 30 F)	0.02
High Temperature (35 F to 55F)	0.01

CL&P Program Savings Documentation for 2011 Program Year (2010). Factors based on Southern California Edison (1997). *Effects of the Low Emissive Shields on Performance and Power Use of a Refrigerated Display Case.*

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Table 14: Savings Factors for C&I VSDs (kWh/HP and kW/HP)

	Building Exhaust Fan	Cooling Tower Fan	Chilled Water Pump	Boiler Feed Water Pump	Hot Water Circulating. Pump	MAF - Make-up Air Fan	Return Fan	Supply Fan	WS Heat Pump Circulating Loop
Annual Energy Savings Factors (kWh/HP)									
University/College	3,641	449	745	2,316	2,344	3,220	1,067	1,023	3,061
Elm/H School	3,563	365	628	1,933	1,957	3,402	879	840	2,561
Multi-Family	3,202	889	1,374	2,340	2,400	3,082	1,374	1,319	3,713
Hotel/Motel	3,151	809	1,239	2,195	2,239	3,368	1,334	1,290	3,433
Health	3,375	1,705	2,427	2,349	2,406	3,002	1,577	1,487	3,670
Warehouse	3,310	455	816	2,002	2,087	3,229	1,253	1,205	2,818
Restaurant	3,440	993	1,566	1,977	2,047	2,628	1,425	1,363	3,542
Retail	3,092	633	1,049	1,949	2,000	2,392	1,206	1,146	2,998
Grocery	3,126	918	1,632	1,653	1,681	2,230	1,408	1,297	3,285
Offices	3,332	950	1,370	1,866	1,896	3,346	1,135	1,076	3,235
Summer Demand Savings Factors (kW/HP_{SP})									
University/College	0.109	-0.023	0.056	0.457	0.457	0.109	0.102	0.064	0.056
Elm/H School	0.377	-0.023	0.056	0.457	0.457	0.109	0.102	0.064	0.275
Multi-Family	0.109	-0.023	0.056	0.457	0.457	0.109	0.102	0.064	0.056
Hotel/Motel	0.109	-0.023	0.056	0.457	0.457	0.109	0.102	0.064	0.056
Health	0.109	-0.023	0.056	0.457	0.457	0.109	0.102	0.064	0.056
Warehouse	0.109	-0.023	0.056	0.457	0.457	0.261	0.102	0.064	0.056
Restaurant	0.261	-0.023	0.056	0.457	0.457	0.109	0.102	0.064	0.178
Retail	0.109	-0.023	0.056	0.457	0.457	0.109	0.102	0.064	0.056
Grocery	0.261	-0.023	0.056	0.457	0.457	0.109	0.102	0.064	0.178
Offices	0.109	-0.023	0.056	0.457	0.457	0.109	0.102	0.064	0.056
Winter Demand Savings Factors (kW/HP_{WP})									
University/College	0.377	-0.006	0.457	0.457	0.457	0.109	0.113	0.113	0.457
Elementary/High School	0.457	-0.006	0.457	0.457	0.457	0.109	0.113	0.113	0.457
Multi-Family	0.109	-0.006	0.457	0.355	0.384	0.109	0.113	0.113	0.355
Hotel/Motel	0.109	-0.006	0.457	0.418	0.444	0.109	0.113	0.113	0.418
Health	0.377	-0.006	0.457	0.275	0.298	0.109	0.113	0.113	0.275
Warehouse	0.377	-0.006	0.457	0.178	0.193	0.261	0.113	0.113	0.178
Restaurant	0.109	-0.006	0.457	0.355	0.384	0.109	0.113	0.113	0.355
Retail	0.109	-0.006	0.457	0.275	0.298	0.109	0.113	0.113	0.275
Grocery	0.457	-0.006	0.457	0.418	0.444	0.109	0.113	0.113	0.418
Offices	0.457	-0.006	0.457	0.418	0.444	0.109	0.113	0.113	0.418

Chan, Tumin (2010). Formulation of a Prescriptive Incentive for the VFD and Motors & VFD impact tables at NSTAR. Prepared for NSTAR.

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Table 15: Baseline Efficiency Requirements for Gas and Electric Commercial Ovens

Equipment Type	Baseline Efficiency	Efficiency Requirement
Gas-Fired Convection Oven	30%	>=44%
Gas-Fired Combination Oven	35%	>=44%
Gas-Fired Conveyor Oven	20% Heavy Load	>=44%
Gas-Fired Rack Oven	30%	>=50%
Commercial Electric Oven	Convection Cooking: 65% at 80lb/hr, 3.0 kW idle mode, 3.0 kW preheat Steam Cooking: 40% at 100lb/hr, 10.0 kW idle mode, 3.0kW preheat	

Table 16: HVAC Interactive Effects for C&I Lighting

Program	Lighting Type	Gas Impact (MMBtu/ΔkWh)[i]	Oil Impact (MMBtu/ΔkWh)[ii]
C&I New Construction	Lighting Systems	-0.00043	-0.00083
	Lighting Controls	-0.00028	-0.00055
	Upstream Lighting - LEDs	-0.00050[iii]	
	Upstream Lighting - Fluorescents	-0.00039	-0.00077
C&I Retrofit	Lighting Systems	-0.00043	-0.00083
	Lighting Controls	-0.00028	-0.00055

[i] C&I Lighting Interactive Effects 2015
[ii] C&I Lighting Interactive Effects 2015
[iii] Heating interactive effect; DNV-GL (2018), Impact Evaluation of PY2015 C&I Upstream Lighting

Table 17: Default kW Reduction per CFM by CAIR Dryer Capacity

Dryer Capacity ($CFM_{DRYE}R$)	kW Reduction per CFM [1]
<100	0.00474
≥100 and <200	0.00359
≥200 <300	0.00316
≥300 <400	0.0029
≥400	0.00272

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Table 18: CAIR Compressor kW Reduction per Horsepower

Control Type	Nominal Horsepower (HP)	kW Reduction per Horsepower [1]	
		New Construction	Retrofit
Load/No Load	≥15 and <25	0.076	0.102
Load/No Load	≥25 and <75	0.114	0.102
VSD	≥15 and <25	0.159	0.207
VSD	≥25 and <75	0.228	0.206
Variable Displacement	≥50 and <75	0.11	0.116

Table 19: Baseline Efficiency Requirements for C&I Gas-Fired Boilers

Equipment Type	Subcategory	Size Category (Input)	Minimum Efficiency[a]	Test Procedure
Boilers, hot water	Gas-fired	<300,000 Btu/h	80% AFUE	10 CFR Part 430
		>=300,000 Btu/h and <=2,500,000 Btu/h[b]	80% E_t	10 CFR Part 431
		>2,500,000 Btu/h[c]	82% E_c	10 CFR Part 430

a. Annual Fuel Utilization Efficiency (AFUE), Thermal efficiency (Et), Combustion efficiency (Ec)

b. Maximum capacity – min. and max. ratings as provided for and allowed by the units controls

c. These requirements apply to boilers with rated input of 8 MMBtu/h or less that are not packaged boilers and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers

Adapted from 2012 International Energy Conservation Code; Table 6.8.1F

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Appendix B: Non-Energy Impacts

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 measure	One Time
	LED Bulb	Lighting Quality and Lifetime	O&M savings due to more efficient bulbs	$3.00	per measure	One Time
Various	All Measures with oil savings	National Security	Reducing the need for foreign energy imports thereby increasing national security	MMBTU Oil Savings * $1.83	per measure	Annual
	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 measure	Annual

(1) The NEIs in this table represent impacts that accrue specifically measures in the 2019 RI portfolio of programs.

(2) Source of NEIs is "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

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Annual per kWh Non-Energy Impacts for Commercial and Industrial Electric Programs

Program		End Use	NEI	Annual $/kWh
New Construction	Prescriptive	Lighting	O&M	0.020
	Custom	Compressed Air	O&M	0.026
Retrofit	Prescriptive	HVAC	Administrative costs, other costs, other labor costs, O&M, rent revenue	0.097
		Lighting	Administrative costs, material handling, material movement, other labor costs, O&M, sales revenue, waste disposal	0.027
	Custom	CHP Systems	Administrative costs, O&M	-0.015
		Lighting	Administrative costs, material handling, material movement, other costs, other labor costs, O&M, product spoilage, rent revenue, sales revenue, waste disposal	0.059

New Construction Source: Tetra Tech (2015) Stage 2 Results - Commercial and Industrial New Construction Non-Energy Impacts Study - Final Report
Retrofit Source: Tetra Tech (2012), Final Report - Commercial and Industrial Non-Energy Impacts Study

Annual per Therm Non-Energy Impacts for Commercial and Industrial Gas Programs

Program		End Use	NEI	Annual $/Therm
New Construction	Prescriptive	Boilers	Admin costs, material movement, other costs, other labor, O&M, product spoilage, waste disposal	-0.08
		Other Gas Heating	Admin costs, material movement, other costs, other labor, O&M, product spoilage, waste disposal	0.05
	Custom	Commercial Kitchen	Admin costs, material movement, other costs, other labor, O&M, product spoilage, waste disposal	3.40
Retrofit	Prescriptive	HVAC	Admin costs, material movement, other costs, other labor, O&M, product spoilage, waste disposal	1.35
	Custom	HVAC	Admin costs, material movement, other costs, other labor, O&M, product spoilage, waste disposal	0.23

New Construction Source: Tetra Tech (2015) Stage 2 Results - Commercial and Industrial New Construction Non-Energy Impacts Study - Final Report
Retrofit Source: Tetra Tech (2012), Final Report - Commercial and Industrial Non-Energy Impacts Study

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Per Participant Non-Energy Impacts for Residential Electric Measures

Program	NEI	Description	Measure Category	Value	Duration
Residential New Construction	Thermal Comfort	Greater participant-perceived comfort in home	N/A	$77.00	Annual
	Noise Reduction	Less participant-perceived noise in the home		$40.00	Annual
Residential Cooling and Heating Equipment	Thermal Comfort	Greater participant-perceived comfort in home	Cool Smart AC System	$2.24	Annual
			Cool Smart HP System	$2.88	
			Ductless Mini Split HP System	$2.53	
			Down size 1/2 ton	$0.19	
			QIV and Check up	$0.47	
	Noise Reduction	Less participant-perceived noise in the home	Cool Smart AC System	$2.03	Annual
	Home Durability	Increased home durability from better quality heating, cooling and structural materials	Cool Smart AC System	$0.65	Annual
			Cool Smart HP System	$0.84	
			Ductless Mini Split HP System	$0.65	
			Down size 1/2 ton	$0.07	
			QIV and Check up	$0.18	
			Thermostats	$1.33	
	Equipment Maintenance	Reduced maintenance costs of owning newer and/or more efficient appliance equipment	Cool Smart AC System	$1.07	Annual
			Cool Smart HP System	$1.34	
			Down size 1/2 ton	$0.37	
			QIV and Check up	$0.87	
	Health Benefits	Fewer colds and viruses, improved indoor air quality and ease of maintaining healthy relative humidity from weatherization	Cool Smart AC System	$0.07	Annual
			Cool Smart HP System	$0.09	
			Ductless Mini Split HP System	$0.08	
			Down size 1/2 ton	$0.01	
			QIV and Check up	$0.01	
			Thermostats	$0.13	
Single Family - Income Eligible	Arrearages	Reduced arrearage carrying costs as a result of customers being more able to pay their lower bills	N/A	$2.61	Annual

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Program	NEI	Description	Measure Category	Value	Duration
Services	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
	Improved Safety			$2.67	Annual
	Thermal Comfort	Greater participant-perceived comfort in home	Insulation	$30.13	Annual
			Air Sealing	$35.89	
			Heating System	$33.24	
			Duct sealing	$0.81	
			Pipe wrap	$6.60	
			Thermostat	$5.78	
	Noise Reduction	Less participant-perceived noise in the home	Insulation	$13.56	Annual
			Air Sealing	$16.39	
	Home Durability	Increased home durability from better quality heating, cooling and structural materials	Insulation	$8.76	Annual
			Air Sealing	$10.61	
			Heat pumps	$9.72	
			Thermostat	$1.68	
			Hot Water System	$0.20	
			Air Sealing	$5.69	
			Duct Sealing	$0.23	
			Heating System	$27.43	
Single Family -	Equipment	Reduced maintenance costs of owning newer	Heating System	$9.72	Annual

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Program	NEI	Description	Measure Category	Value	Duration
Income Eligible Services	Maintenance	and/or more efficient appliance equipment	Heat Pumps	$27.43	
	Health Benefits	Fewer colds and viruses, improved indoor air quality and ease of maintaining healthy relative humidity from weatherization	Insulation	$193.15	Annual
			Duct sealing	$5.17	
			Pipe wrap	$42.43	
			Air Sealing	$230.08	
			Heating System/Heat Pumps	213.13	
			Thermostat	37.07	
			Replacement Freezer/Refrigerator	$26.61	
			Showerhead	$1.72	
			Hot Water System	$1.65	
	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
	Improved Safety		Insulation	$17.40	Annual
			Air Sealing	$2.24	
			Heating System/ Heat Pumps	$18.87	
			Hot Water System	$4.44	
			Replacement Freezer/Refrigerator	$1.40	
	Price Hedging		N/A	$0.005/kWh	One-Time
EnergyWise Single Family and Multifamily	Thermal Comfort	Greater participant-perceived comfort in home	Insulation	$25.15	Annual
			Air Sealing	$10.13	
			Thermostat	$3.99	
	Noise Reduction	Less participant-perceived noise in the home	Insulation	$11.54	Annual
			Air Sealing	$4.88	
	Home Durability	Increased home durability in terms of maintenance requirements because of better quality heating, cooling and structural materials	Insulation	$9.82	Annual
			Air Sealing	$3.95	
			Aerator	$0.37	

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Program	NEI	Description	Measure Category	Value	Duration
			Showerheads	$0.37	
			Thermostat	$1.33	
	Health Benefits	Fewer colds and viruses, improved indoor air quality and ease of maintaining healthy relative humidity as a result of weatherization in home	Insulation	$0.80	Annual
			Air Sealing	$0.32	
			Thermostat	$0.13	
	Rental Units Marketability	Financial savings to owners of MF rental housing as a result of increased marketability of the more efficient housing.	Showerheads/Aerator	$0.01	Annual
	Rental Units Marketability	Financial savings to owners of MF rental housing as a result of increased marketability of the more efficient housing.	Air Sealing	$0.07	Annual
	Reduced Tenant Complaints	Savings to owners of MF rental housing in terms of staff time and materials as a result of fewer tenant complaints with the more efficient measures.	Showerheads/Aerator	$0.20	Annual
			Air Sealing	$1.37	
			Refrigerator	$1.44	
			Showerhead	$0.03	
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
	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
EnergyWise Income Eligible Multifamily	Thermal Comfort	Greater participant-perceived comfort in home	Insulation	$25.38	Annual
			Heating System	$28.01	

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Program	NEI	Description	Measure Category	Value	Duration
Retrofit			Air Sealing	$30.23	
	Noise Reduction	Less participant-perceived noise in the home	Insulation	$13.56	Annual
			Air Sealing	$16.39	
	Home Durability	Increased home durability in terms of maintenance requirements because of better quality heating, cooling and structural materials	Insulation	$8.76	Annual
			Heating System	$27.43	
			Air Sealing	$10.61	
	Health Benefits	Fewer colds and viruses, improved indoor air quality and ease of maintaining healthy relative humidity as a result of weatherization in home	Insulation	$4.77	Annual
			Heating System	$5.27	
			Air Sealing	$5.69	
	Improved Safety		Heating System	$45.05	Annual
	Equipment Maintenance	Reduced maintenance costs of owning newer and/or more efficient appliance equipment	Heating System	$9.72	Annual

[1] Source of residential and income-Eligible NEIs is 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.

[2] Source of Thermal Comfort, Health Benefits, and Improved Safety is 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.

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Per Participant Non-Energy Impacts for Residential Gas Programs

Program	NEI	Description	Measure Category	Value	Duration
Residential Heating and Cooling equipment	Thermal Comfort	Greater participant-perceived comfort in home	Combo Condensing boiler/DHW	$1.21	Annual
			Furnace w/ECM	$27.18	
			Boiler 90%	$27.61	
			Boiler 95%	$27.49	
			Thermostat	$3.99	
	Home Durability	Increased home durability in terms of maintenance requirements because of better quality heating, cooling and structural materials	Combo Condensing boiler/DHW	$0.39	Annual
			DHW	$0.70	
			DHW - Tankless	$1.23	
			DHW - Stand Alone	$1.30	
			Furnace w/ECM	$7.12	
			Boiler 90%	$7.33	
			Boiler 95%	$7.28	
			Thermostat	$1.33	
	Equipment Maintenance	Reduced maintenance costs of owning newer and/or more efficient appliance equipment	Combo Condensing boiler/DHW	$1.10	Annual
			Furnace w/ECM	$11.98	
			Boiler 90%	$13.88	
			Boiler 95%	$13.47	
	Health Benefits	Fewer colds and viruses, improved indoor air quality and ease of maintaining healthy relative humidity from weatherization	Combo Condensing boiler/DHW	$0.04	Annual
			Furnace w/ECM	$0.87	
			Boiler 90%	$0.89	
			Boiler 95%	$0.88	
			Thermostat	$0.13	
EnergyWise Single Family	Thermal Comfort	Greater participant-perceived comfort in home	N/A	$25.15	Annual
	Noise Reduction	Less participant-perceived noise in the home		$11.54	Annual

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Program	NEI	Description	Measure Category	Value	Duration
	Home Durability	Increased home durability from better quality heating, cooling and structural materials		$9.82	Annual
	Health Benefits	Fewer colds and viruses, improved indoor air quality and ease of maintaining healthy relative humidity from weatherization		$0.80	Annual
EnergyWise Multi Family / C&I Multifamily	Thermal Comfort	Greater participant-perceived comfort in home	Insulation	$25.15	Annual
			Thermostat	$3.99	
			Air Sealing	$10.13	
	Noise Reduction	Less participant-perceived noise in the home	Insulation	$11.54	Annual
			Air Sealing	$4.88	
	Home Durability	Increased home durability in terms of maintenance requirements because of better quality heating, cooling and structural materials	Insulation	$9.82	Annual
			Air Sealing	$3.95	
	Health Benefits	Fewer colds and viruses, improved indoor air quality and ease of maintaining healthy relative humidity as a result of weatherization in home	Insulation	$0.80	Annual
			Air Sealing	$0.32	
Single Family - Income Eligible Services	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	Annual
			Air Sealing	$35.89	
			Heating System	$33.24	
	Noise Reduction	Less participant-perceived noise in the home	Insulation	$13.56	Annual
			Air Sealing	$16.39	
	Home Durability	Increased home durability in terms of maintenance requirements because of better quality heating, cooling and structural materials	Insulation	$8.76	Annual
			Air Sealing	$10.61	
			Heating System	$27.43	
	Equipment Maintenance	Reduced maintenance costs of owning newer and/or more efficient appliance equipment	Heating System	$9.72	Annual
	Health Benefits	Fewer colds and viruses, improved indoor air quality and ease of maintaining healthy relative	Insulation	$193.15	Annual
			Air Sealing	$230.08	

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Program	NEI	Description	Measure Category	Value	Duration
		humidity as a result of weatherization in home	Heating System	$213.13	
	Price Hedging		N/A	$0.76/ MMBtu	One Time
	Improved Safety		Insulation	$17.40	Annual
			Air Sealing	$2.24	
			Heating System	$18.87	
Single Family - Income Eligible Services	Arrearages	Reduced arrearage carrying costs as a result of customers being more able to pay their lower bills	N/A	$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
EnergyWise Income Eligible Multifamily Retrofit	Rental Units Marketability	Financial savings to owners of LI rental housing as a result of increased marketability of the more efficient housing.	Air Sealing	$0.07	Annual
	Property Durability	Financial savings to owners of LI rental housing as a result of more durable and efficient materials being installed.	Air Sealing	$2.58	Annual
	Reduced Tenant Complaints	Savings to owners of LI rental housing in terms of staff time and materials as a result of fewer tenant complaints with the more efficient measures.	Air Sealing	$1.37	Annual
	Arrearages	Reduced arrearage carrying costs as a result of customers being more able to pay their lower bills	N/A	$2.61	Annual

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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
	Notices	Financial savings to utility as a result of fewer notices sent to customers for late payments and terminations		$0.34	Annual
EnergyWise Income Eligible Multifamily Retrofit	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	$25.38	Annual
			Air Sealing	$30.23	
			Thermostat	$4.87	
			Heating System	$28.01	
	Noise Reduction	Less participant-perceived noise in the home	Insulation	$13.56	Annual
			Air Sealing	$16.39	
	Home Durability	Increased home durability in terms of maintenance requirements because of better quality heating, cooling and structural materials	Insulation	$8.76	Annual
			Air Sealing	$10.61	
			Heating System	$9.72	
	Equipment Maintenance	Reduced maintenance costs of owning newer and/or more efficient appliance equipment	Heating System	$27.43	Annual
	Health Benefits	Fewer colds and viruses, improved indoor air quality and ease of maintaining healthy relative humidity as a result of weatherization in home	Insulation	$4.77	Annual
			Air Sealing	$5.69	
			Heating System	$5.27	

[1] Source of residential and income-Eligible NEIs is 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.

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[2] Source of Thermal Comfort, Health Benefits, and Improved Safety is 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.

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Appendix D: 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

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Appendix E: 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 under-estimation 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.
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.

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TERM	DESCRIPTION
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	A period of relatively high or low system energy cost, by season. The energy periods defined by ISO-NE are: • **Summer Peak**: 6am–10pm, Monday–Friday (except ISO holidays), June–September • **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 • **Winter Peak:** 6am–10pm, Monday–Friday (except ISO holidays), January–May and October–December • **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.
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".
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).

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TERM	DESCRIPTION
Heating Seasonal Performance Factor (HSPF)	A measure of the seasonal heating mode efficiencies of heat pumps expressed as the ratio 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 who is eligible to participate in a program, but does not. A non-participant may install a measure because of a program, but the installation of the measure is not through regular program channels; as a result, their actions are normally only detected through evaluations.
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 who installs a measure through regular program channels and receives any benefit (i.e. incentive) that is available through the program because of their participation. Free-riders are a subset of this group.
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.

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TERM	DESCRIPTION
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, *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.
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 system for grouping customers with similar characteristics. For the purpose of this manual, the sectors are Commercial and Industrial (C&I), Small Business, Residential, and Low Income.
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.

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