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2020 Evaluation, Measurement, and Verification Plan

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1. Introduction

Evaluation, Measurement and Verification (EM&V) is an integral and required part of National Grid's energy efficiency program planning process. EM&V provides independent verification of impacts to ensure that savings and benefits claimed by the Company through its energy efficiency programs are accurate and credible. EM&V provides insight into market characteristics and guidance on energy efficiency program design to improve the delivery of cost-effective programs.

The Company's EM&V Plan continues to focus on evaluating Rhode Island sites, markets, and energy efficiency programs while leveraging as many resources as possible from evaluation studies in other National Grid territories in order to maximize value for ratepayers while minimizing costs. These studies are commissioned by the Company. They are conducted by independent evaluation firms, whose goal is to produce an accurate, complete, and transparent review of Rhode Island's energy efficiency programs and markets. The study methodologies and savings assumptions from evaluation studies are documented in the Rhode Island Technical Reference Manual. The TRM is reviewed and updated annually to reflect changes in technology, baselines and evaluation results.

The entire evaluation process is overseen by the Company along with an oversight team that includes the Rhode Island Energy Efficiency & Resource Management Council (EERMC) consultant team and the Office of Energy Resources (OER). The oversight team follows each study closely and is involved in planning, work plan development, and review of study results.

The EM&V framework of the Company provides confidence among ratepayers and stakeholders that programs are effective and EM&V activities are independent and objective.

2. Evaluation Studies Completed in 2019

The Company, with oversight from the Rhode Island EERMC evaluation consultants and the OER evaluation staff, completed 10 evaluation studies in 2019 (see below). The research studies include impact evaluations, process evaluations and market studies in the residential and commercial and industrial (C&I) sectors as well as studies that are considered cross-cutting.

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Commercial & Industrial

- 1. RI-18-CG-CustGas Impact Evaluation of PY2016 Custom Gas Installations (in progress)
- 2. RI-18-CE-CustElec Impact Evaluation of PY2016 Custom Electric Installations (in progress)

Residential

- 1. RI-19-RX-IESF Process Evaluation of Income Eligible Single Family Program
- 2. RI-19-RE-UpstrLight1a Lighting Market Assessment: 2017 Sales Data Analysis
- 3. RI-19-RE-UpstrLight1b Lighting Market Assessment: 2018 Sales Data Analysis
- 4. RI-19-RE-UpstrLight2 Lighting Market Assessment: 2018 Shelf Stocking Analysis
- 5. RI-19-RE-AppRecycle Residential Appliance Recycling Savings Update

Cross-Cutting

- 1. RI-19-XX-Jobs Jobs Study 2018
- 2. RI-18-XX-Piggybacking Piggybacking Diagnostic Study (in progress)
- 3. RI-19-XX-DataCollect Primary Data Collection for Potential Study (in progress)

Section 4 provides detailed descriptions, findings and recommendations of each of the studies listed above along with selected research studies completed in other regions and/or other National Grid jurisdictions. The results of the evaluations from other regions and National Grid jurisdictions, most commonly Massachusetts, have been judged by the Company and the oversight team to be applicable to Rhode Island's energy efficiency programs. The Company is adopting the results of these studies in 2020 program planning due to similarity, either in the measures offered, or program structure or delivery.

A complete list of historical research studies is provided in Section 5 along with a brief summary of the impact of those results in planning the Company's programs. Prior year studies that have been superseded by studies completed since the filing of the 2019 Energy Efficiency Plan have been removed from this list. These studies are available through the EERMC¹, the Rhode Island Public Utilities Commission (PUC)², and National Grid.

¹ <u>https://rieermc.ri.gov/plans-reports/evaluation-studies/</u>

² <u>http://www.ripuc.org/</u>

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3. 2020 Planned Evaluation Studies

This section describes planned studies that focus on areas of interest to the Rhode Island energy efficiency programs and build on the deep history of evaluation studies commissioned by the Company over numerous years. In order to optimize the use of evaluation resources, where programs are considered to be similar in program delivery and population served with those offered in Massachusetts, the studies will be done in conjunction with the Company's Massachusetts retail affiliate. The Company will also stay abreast of the voluminous Massachusetts evaluation activities that may be beneficial and applicable in Rhode Island.

The evaluation pathway for demonstrations, assessments and pilots is based on each demonstration, assessment, or pilot's scale, budget, scope, and the availability of external data. The EM&V team is involved in the pilot, demonstration, and assessment design process beginning at the concept stage. This ensures design and data collection are suitable to allow for effective evaluation of the pilot, demonstration, or assessment. The EM&V team will provide guidance on determining the appropriate level of evaluation for each pilot, demonstration, and assessment. For each pilot, demonstration, or assessment determined to necessitate an independent evaluation, the evaluation will follow the same established evaluation framework used in evaluation sof established programs. This includes management of the independent evaluation by OER and the EERMC Consultant evaluation team. The purpose of the evaluation is to determine impact and process learnings such that they can be used to establish a new measure, go-to market strategy or new program. See Attachment 8 for further details on pilots, demonstrations, and assessments.

Table 2 lists evaluation studies that the Company plans to conduct in 2020 to inform the next three-year planning cycle and/or the 2021 annual plan. Barring changes to the 2021 Annual Plan schedule, studies that will be incorporated into the annual plan must be completed by July 2020. Study labeling codes take the general form shown in Table 1. For example, RI-17-CG-CustGas refers to the Custom Gas Evaluation Study that started in 2017 in the commercial sector for gas while RI-18-RX-IESF refers to evaluation study started in 2018 of the income eligible single family program for electric and gas.

[State]	– [Year Study Conducted]	– [Sector]	[Fuel]	– [Keyword]
RI	18	R = residential	E = electric	
	19	C = commercial	G = gas	
	:	X = cross sector	X = electric & gas	

Table 1. Study Labeling Code Format

Sector	Study Code	Туре	Affected Programs	Study Name	State Lead
C&I	RI-20-CG-CustGasPY18	Impact	Custom	PY2018 Impact Evaluation of Custom Gas Installations	RI
C&I	RI-20-CG-CustGasPY19	Impact	Custom	PY2019 Impact Evaluation of Custom Gas Installations (sample design and begin install)	RI
C&I	RI-19-CE-CustElec	Impact	Custom	PY2018 Impact Evaluation of Custom Electric Installations (continued from 2019)	MA (with RI sites)
C&I	RI-20-CE-CustElecPY19	Impact	Custom	PY2019 Impact Evaluation of Custom Electric Installations	RI
C&I	RI-20-CX-FRSO	NTG	Multiple	C&I Free-Ridership and Spillover Study	RI
C&I	RI-19-CE-UpstrLight	Impact	Upstream	Upstream Lighting Impact Analysis	MA (with RI sites)
Residential	RI-20-RX-EWSFImpact	Impact	EnergyWise Single Family	Impact Evaluation of EnergyWise Single Family Program	RI
Residential	RI-20-RX-EWSFProcess	Process	EnergyWise Single Family	Process Evaluation of EnergyWise Single Family Program	RI
Residential	RI-20-RX-EWMFImpact	Impact	EnergyWise Multifamily	Impact Evaluation of EnergyWise Multifamily Program	RI
Residential	RI-20-RX-EWMFProcess	Process	EnergyWise Multifamily	Process Evaluation of EnergyWise Multifamily Program	RI
Residential	RI-20-RX-IEMFImpact	Impact	Income-Eligible Multifamily	Impact Evaluation of Income- Eligible Multifamily Program	RI
Residential	RI-20-RX-IEMFProcess	Process	Income-Eligible Multifamily	Process Evaluation of Income- Eligible Multifamily Program	RI
Residential	RI-20-RX-HERImpact	Impact	Behavior	Impact Evaluation of Home Energy Reports Program	RI
Residential	RI-20-RE-UpstrLight	Market	Upstream Lighting	Residential Lighting Market Assessment	МА
Residential	RI-20-RE-MSHP	TBD	Multiple	Evaluation of Ductless Mini-Split Heat Pumps	RI
Cross- cutting	RI-19-XE-HPmarket	Market	Multiple	Heat Pump Market Assessment (continued from 2019)	RI

Table 2. Planned Evaluation Studies in 2020

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Cross- cutting	RI-20-XX-Jobs	Market	Multiple	Workforce Associated with Rhode Island Energy Efficiency Programs Analysis Study	RI
Cross- cutting	RI-20-XG-GasPeak	Impact	Multiple	Gas Peak Demand Savings	RI
Cross- cutting	RI-20-XX-CSNC	Impact/ Market	Multiple	Residential and Commercial New Construction and Code Compliance Study	RI
Cross- cutting	RI-20-XX-CSDev	Impact/ Market	Multiple	Code and Standards Development Study	RI
Cross- cutting	RI-19-XX- M&VLegislation	Impact/ Process	Multiple	Legislated M&V Study	RI
Pilot/Demo /Assmt.	RI-20-CX-SEM	Impact	C&I Retrofit	Strategic Energy Management Demonstration Evaluation	RI
Pilot/Demo /Assmt.	RI-20-CG-SBHP	Impact/ Process	Small Business	Small Business Heat Pump Demonstration Evaluation	RI

The EM&V team will follow the Company's standard procurement policy that cuts across programs and jurisdictions in order to achieve the lowest cost procurement of required external services while enabling the Company to minimize administrative costs, deliver on program commitments and meet time-sensitive regulatory deadlines. The Company's standard procurement policy is supported and enforced by stand-alone internal procurement function. Contract characteristics below certain thresholds are eligible for sole-sourcing while contract characteristics above thresholds require competitive procurement unless it can be demonstrated to procurement organization that securing multiple bids is not possible or practical.

The proposed budget for evaluation study expenditures in 2020 is approximately \$3.2 million (\$ 2.1 million for electric and \$1.1 million for gas) excluding internal staffing costs. The proposed budget for EM&V comprises approximately 2% of the total portfolio budget in 2020.

Final reports along with graphical executive summaries will be made publicly available upon completion of the evaluation studies. All complete graphical executive summaries will be provided as a handout at EERMC meetings and posted on the EERMC website.³

³ <u>https://rieermc.ri.gov/plans-reports/evaluation-studies/</u>

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3.1 Commercial and Industrial Planned Evaluation Studies in 2020

a. RI-20-CG-CustGasPY18 – Impact Evaluation of PY2018 Custom Gas Installations

The objective of this impact evaluation is to provide verification of natural gas energy savings estimates for a sample of custom gas projects through site-specific inspection, metering, and analysis. The results of this study will be used to determine the realization rates for custom gas energy efficiency offerings based on installations from 2018. This will be the third year of 'rolling' evaluations in coordination with evaluation efforts in Massachusetts, where the first year was a 'full' study (as has historically been done every 3 years), while subsequent years will evaluate roughly 1/3 of the number of sites, which will keep the realization rates updated yearly.

b. RI-20-CG-CustGasPY19 – Impact Evaluation of PY2019 Custom Gas Installations

The objective of this impact evaluation is to provide verification of natural gas energy savings estimates for a sample of custom gas projects through site-specific inspection, metering, and analysis. The results of this study will be used to determine the realization rates for custom gas energy efficiency offerings based on installations from 2019. This will be the fourth year of 'rolling' evaluations in coordination with evaluation efforts in Massachusetts, where the first year was a 'full' study (as has historically been done every 3 years), while subsequent years evaluate roughly 1/3 of the number of sites, which will keep the realization rates updated yearly.

c. RI-19-CE-CustElec – Impact Evaluation of PY2018 Custom Electric Installations (continued from 2019)

The objective of this impact evaluation is to provide verification of electric energy savings estimates for a sample of both lighting and non-lighting custom electric projects through site-specific inspection, metering, and analysis. The results of this study will be used to determine the final realization rates for custom electric energy efficiency offerings based on installations from 2018. This will be the second year of 'rolling' evaluations in coordination with evaluation efforts in Massachusetts, where the first year was a 'full' study (as has historically been done every 3 years), while subsequent years evaluate roughly 1/3 of the number of sites, which will keep the realization rates updated yearly.

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d. RI-20-CE-CustElecPY19 – Impact Evaluation of PY2019 Custom Electric Installations

The objective of this impact evaluation is to provide verification of electric energy savings estimates for a sample of both lighting and non-lighting custom electric projects through site-specific inspection, metering, and analysis. The results of this study will be used to determine the final realization rates for custom electric energy efficiency offerings based on installations from 2019. This is the third year of 'rolling' evaluations in coordination with evaluation efforts in Massachusetts, where the first year was a 'full' study (as has historically been done every 3 years), while subsequent years evaluate roughly 1/3 of the number of sites, which will keep the realization rates updated yearly.

e. RI-20-CX-FRSO – Commercial and Industrial Free-Ridership and Spillover Study

C&I free-ridership and spillover values will be updated based on an assessment of the behavior of both participants and nonparticipants of C&I energy efficiency programs. The results will assist in quantifying the net impacts of C&I electric and natural gas energy efficiency programs in Rhode Island. This study will include both custom and prescriptive measures from new construction and retrofit programs.

f. RI-20-CE-UpstrLight – Upstream Lighting Impact Analysis - Cont.

The objective of this impact evaluation is to provide verification of electric energy savings estimates for a sample of upstream lighting projects through site-specific inspection, metering, and analysis. The results of this study will be used to determine the impact savings factors that will apply to upstream lighting offerings. This study will leverage a parallel Massachusetts study, and the final sample will include projects at National Grid customer sites in both Rhode Island and Massachusetts. This study began in 2019 and is rolling into 2020.

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3.2 Residential Planned Evaluation Studies in 2020

a. RI-20-RX-EWSFImpact – Impact Evaluation of EnergyWise Single Family Program

The objective of this impact evaluation is to verify energy savings estimates for measures offered through the EnergyWise Single Family program. The program offers instant saving measures by installing efficient lighting, low flow showerheads, faucet aerators, programmable thermostats and smart strips during the no-cost home energy assessment and promotes weatherization measures to eligible customers. The results of this study will be used to update savings assumptions for each electric, natural gas, propane and oil measures and/or measure groups installed from 2017 and/or 2018. This study will update findings of the 2016 impact evaluation and will be bid out jointly with the other residential retrofit evaluations.

b. RI-20-RX-EWSFProcess – Process Evaluation of EnergyWise Single Family Program

The goal of this process evaluation is to assess the overall delivery of the EnergyWise Single Family program. The study will assess the effectiveness of program procedures and determine barriers to program delivery and participation, offering a qualitative complement to the EnergyWise Single Family impact evaluation. In addition, the evaluation will estimate free-ridership/spillover rates and assess other program elements such as 100% landlord incentive and the Department of Energy home energy scores. The study will identify practical approaches to improve the overall effectiveness of the program in order to reach higher participation rates and deeper savings. This study will update findings of the 2016 process evaluation and will be bid out jointly with the other residential retrofit evaluations.

c. RI-20-RX-EWMFImpact – Impact Evaluation of EnergyWise Multifamily Program

The purpose of this impact evaluation is to verify energy savings estimates for measures offered through the EnergyWise Multifamily program. The program provides incentives for installing energy efficient measures in common areas and tenant-occupied dwelling units. Offerings include efficient lighting, low flow showerheads, faucet aerators, programmable and smart thermostats, smart strips, weatherization, and heating and

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water heating equipment. Results will be used to update savings assumptions for electric, natural gas, propane and oil measures offered through the program in 2017 and/or 2018. This study will update findings of the 2016 impact evaluation and will be bid out jointly with the other residential retrofit evaluations.

d. RI-20-RX-EWMFProcess – Process Evaluation of EnergyWise Multifamily Program

The process evaluation will examine customer participation, vendor participation, and overall program processes of the EnergyWise Multifamily program. The study will assess effectiveness of program delivery procedures, determine barriers to program delivery and participation, and explore ways to improve the overall effectiveness of the program to reach higher participation rates and deeper savings. This evaluation will also assess free-ridership/spillover rates, offering a qualitative complement to the EnergyWise Multifamily impact evaluation. This study will be bid out jointly with the other residential retrofit evaluations.

e. RI-20-RX-IEMFImpact – Impact Evaluation of Income Eligible Multifamily Program

The goal of this impact evaluation is to verify energy and demand savings estimates for measures offered through the Income-Eligible Multifamily program. The program offers low-income eligible customers no-cost measures such as efficient lighting, low flow showerheads, faucet aerators, programmable and smart thermostats, smart strips, weatherization measures, and heating and water heating equipment. The outcome of the study will be used to update savings assumptions for electric, natural gas, propane and oil measures offered in 2017 and/or 2018. This study will update findings of the 2016 impact evaluation and will be bid out jointly with the other residential retrofit evaluations.

f. RI-20-RX-IEMFProcess – Process Evaluation of Income Eligible Multifamily Program

The objective of this process evaluation is to study landlord and tenant participation, Community Action Agencies, vendor participation, and overall program processes of the Income-Eligible Multifamily program. The study will assess effectiveness of program

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delivery procedures, determine barriers to program delivery and participation offering a qualitative complement to the Income-Eligible impact evaluation. This study will also help identify practical approaches to help improve overall effectiveness of the program to reach higher participation rates and deeper savings. This study will be bid out jointly with the other residential retrofit evaluations.

g. RI-20-RX-HERImpact – Impact Evaluation of the Home Energy Reports Program

The Home Energy Reports (HER) program provides personalized reports on energy consumption designed to change customer behavior. The goal of this study is to verify electric and natural gas savings from the HER program. This study will produce net savings estimates for each group of participating customers and compare those savings to implementer reported savings for periods 2017 through 2019. The study will also assess how the HER program impacts participation in other energy efficiency programs. The results of this study will be used to update the realization rates for program planning in 2021 and beyond. This study will update findings of the 2017 impact evaluation.

h. RI-20-RE-UpstrLight – Residential Lighting Market Assessment

A broad range of market assessment studies have been conducted in Massachusetts and Rhode Island to gather insights on how the lighting market is evolving in the two states. The results of these studies showed that the lighting market in Rhode Island is similar to the market in Massachusetts and the Company programs have had a strong impact on LED adoption in both states. The Company will continue to leverage lighting market assessment studies conducted in Massachusetts for application in Rhode Island and conduct a Rhode Island specific study, if necessary. This study will support potential research studies needed to inform planning activities for both retail and direct install lighting in 2021 and beyond.

i. RI-20-RE-MSHP – Evaluation of Ductless Mini-Split Heat Pumps

This study will include a process evaluation of the current Rhode Island residential ductless mini-split heat pump offering. This study may include a literature review of impacts if needed by the program.

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3.3 Cross-Sector/Other Planned Evaluation Studies in 2020

a. RI-19-XE-HPmarket – Heat Pump Market Assessment (continued from 2019)

This study will evaluate the current status of the heat pump market and assess potential for future growth of heat pumps in Rhode Island for displacing electric heat and for fuel switching for space heating and resulting cooling. The study will collect data from heat pump owners, contractors, manufacturers and distributors and review existing research and evaluation in the small commercial and residential markets to understand the current status of both supply-side and demand-side markets, trends, and perceptions.

b. RI-20-XX-Jobs – Workforce Associated with Rhode Island Energy Efficiency Programs Analysis Study

The study will identify the workforce associated with National Grid's energy efficiency programs and services delivered in Rhode Island electricity and natural gas customers. Similar to the workforce studies conducted from 2013 to 2018, the study will survey the Company, vendors, distributors, partners, and market players to quantify the number of jobs and amount of business activities associated with energy efficiency programs in 2019. This study addresses the requirements of General Law 39-2-1.2, enacted by the Rhode Island General Assembly in 2012, and is conducted annually.

c. RI-20-XG-GasPeak – Gas Passive Peak Demand Savings

The objective of this evaluation study is to determine the percentage of gas energy savings that occur during peak days and, assuming availability of necessary data, peak hours. The study (or studies) will include both the C&I and Residential sectors and will bucket savings into end use categories of heating, water heating, cooking and other. The results of this study will be used to determine the passive peak gas savings that occur due to energy efficiency activity by applying the end use percentage of gas passive peak energy savings to actual end use gas savings that occur in future years.

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d. RI-20-XX-CSNC – Residential and Commercial New Construction and Code Compliance Study

The objective of this study is to calculate the savings projected to be achieved by the Code Compliance program for the 2021-2023 period by updating the 2017 residential and commercial code compliance potential savings and attribution studies. The methodology used will be determined when the policy decision has been made on whether or not to deem savings for the Code Compliance program. This study is dependent on the outcome of ongoing policy discussions.

e. RI-20-XX-CSDev – Codes and Standards Development Study

This study would develop an evaluation framework for the Company's codes and standards development support. Previous efforts from states like California and Massachusetts will be leveraged along with local stakeholder input to produce clear guidance on how any future Codes and Standards development support will be evaluated. The performance and specific content of this study are both dependent on the outcome of ongoing policy discussions regarding codes and standards development efforts.

f. RI-19-XX-M&VLegislation – Legislated M&V Study (continued from 2019)

The objective of this study is to verify claimed energy savings from the Company's energy efficiency programs and review the Company's evaluation process as required by the M&V legislation in Rhode Island. The study will be managed by the Office of Energy Resources. The Company is providing full cooperation and will carefully review all recommendations and implement those that are feasible when developing future evaluations.

g. RI-20-CX-SEM – Strategic Energy Management Demonstration Evaluation

The objective of this evaluation is to review the methodologies and processes used to obtain and calculate the savings claimed. The results of this study will assist in monitoring and making continuous improvements to the demonstration.

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h. RI-20-CG-SBHP – Small Business Heat Pump Demonstration Evaluation

The Company is exploring a go-to market strategy for cold climate heat pumps for small business customers who heat using oil, propane, and electric resistance heat, building on its 2019 demonstration. This study will evaluate those installations from both an impact and a process standpoint. It will inform efforts toward creating scaled solution for cold climate heat pumps for small businesses.

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4. Evaluation Study Findings

Study name: Impact Evaluation of PY2016 Custom Gas Installations

Type of Study: Impact Evaluation Evaluation Conducted by: DNV-GL Date Evaluation Conducted: Expected Completion September 2019

Evaluation Objective and High-Level Findings:

The primary objective of this evaluation was to provide verification and re-estimation of energy savings for a sample of statistically-selected custom gas projects through site-specific inspection, monitoring, and analysis. The results of this study will be used to determine the gross realization rates for custom gas energy efficiency projects implemented in PY2020 and beyond.

A new steam trap calculator was introduced in 2017, reducing average steam trap savings. The PY2016 steam trap projects were calculated using the old calculator, but the new calculator has been used starting with PY2017 and going forward. As a consequence of this systematic change in practice, this study calculated realization rates for PY2020 application assuming the new calculator is fully adopted by the program, which has been confirmed.

These site-specific results were aggregated with results from National Grid sites included in the recently finalized Massachusetts Impact Evaluation of 2016 Custom Gas Installations (Study 18-20) to determine realization rates for RI.

The following table summarizes the results of the study. The study found an energy realization rate of 85%.

Territory	RI	MA	RI+MA
Total Tracking Savings (therms)	1,114,770	5,141,435	6,256,204
Total Evaluated Savings (therms)	795,000	4,534,668	5,329,668
Realization Rate	71%	88%	85%
RP@ 80%CI	10.64%	9.29%	8.07%
Sample Size	8	21	29
Error ratio	0.27	0.35	0.34

Programs to which the Results of the Study Apply:

Commercial and Industrial Gas – New Construction and Retrofit

Evaluation Recommendations included in the study:

Recommendation 1: Adopt the combined RI+MA realization rate of 85% beginning in PY2020. This study was in draft form at the time of writing; other formal recommendations have not yet been made.

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Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study:

National Grid adopted the 85% realization rate, to take effect beginning in PY2020. As this study was in draft form at the time of writing, other recommendations will be reviewed when the report is complete, and recommendations will be implemented by National Grid if deemed appropriate.

Savings Impact:

The adoption of the results of this evaluation will lead to a decrease in savings claimed by National Grid for custom gas projects.

Study name: Impact Evaluation of PY2016 Custom Electric Installations

Type of Study: Impact Evaluation Evaluation Conducted by: DNV-GL Date Evaluation Conducted: Expected Completion September 2019

Evaluation Objective and High-Level Findings:

The primary objective of this evaluation was to provide verification and re-estimation of energy and demand savings for a sample of custom lighting and non-lighting electric projects through site-specific inspection, monitoring, and analysis. The results of this study will be used to determine the gross realization rates for custom electric energy efficiency projects implemented in PY2020 and beyond.

These site-specific results were aggregated with results from National Grid sites included in the recently finalized Massachusetts Commercial and Industrial Impact Evaluation of 2016 Custom Electric Installations (Study 18-19) to determine realization rates for RI.

The following table summarizes the results of the study. The study found an energy realization rate of 99.8% for lighting and 65.5% for non-lighting.

Territory	MA	RI	MA+RI					
Lighting								
Total Tracking Savings (MWh)	61,381	19,143	80,524					
Total Evaluated Savings (MWh)	61,232	19,121	80,347					
Realization Rate	99.80%	99.90%	99.80%					
Error Ratio	0.26	0.05	0.23					
RP@ 90%CI	±9.2%	±5.0%	±7.6%					
	Non-Lighting							
Total Tracking Savings (MWh)	53,184	21,045	74,229					
Total Evaluated Savings (MWh)	34,158	14,592	48,619					
Realization Rate	64.20%	69.30%	65.50%					
Error Ratio	0.54	0.39	0.51					
RP@ 90%CI	±14.5%	±23.0%	±12.3%					

Programs to which the Results of the Study Apply:

Commercial and Industrial Electric – New Construction and Retrofit

Evaluation Recommendations included in the study:

Recommendation 1: Adopt the combined RI+MA realization rate of 99.8% for lighting and 65.5% for non-lighting beginning in PY2020.

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This study was in draft form at the time of writing; other formal recommendations have not yet been made.

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study:

National Grid adopted the realization rate of 99.8% for lighting and 65.5% for non-lighting, to take effect beginning in PY2020.

As this study was in draft form at the time of writing, other recommendations will be reviewed when the report is complete, and recommendations will be implemented by National Grid if deemed appropriate.

Savings Impact:

The adoption of the results of this evaluation will lead to a decrease in savings claimed by National Grid for custom non-lighting electric projects and an increase in savings claimed for custom lighting electric projects.

Study name: RI-19-RX-IESF 2018 Process Evaluation of Income Eligible Single Family Program

Type of Study: Process Evaluation Conducted by: <u>Cadeo</u> Date Evaluation Conducted: August 20, 2019

Evaluation Objective and High-Level Findings:

The goal of this process evaluation was to provide an independent, third-party assessment of National Grid's IES delivery. Cadeo's assessment identified IES elements that are functioning as intended, as well as those not being delivered optimally and contributing to delivery inefficiencies, barriers to participation, or gaps in service. Based on the assessment, The evaluation team offered recommendations for IES delivery improvement.

This process evaluation also complements the IES impact evaluation our team completed in 2018. Collectively, these evaluations provide National Grid with up-to-date, third-party feedback about IES performance from both energy savings (the impact evaluation) and delivery (process evaluation) perspectives.

The summary of findings and recommendations are provided below:

- 1. Explore an expedited home assessment approach. The current approach takes too long and limits the total number of customers National Grid can serve.
- **2. Pilot Hancock mobile application.** It's possible an available mobile application could expedite assessors' data collection responsibilities and allow them to serve more customers.
- **3.** Set data-driven expectations about participation timelines. Assessors are not consistently setting expectations with customers about the time between their home assessment and when they will receive their efficiency upgrades.
- 4. Explore opportunities to reduce installation timelines and increase contactor capacity. National Grid is not currently meeting its internal target for insulating participants' homes following their assessment and should identify opportunities to weatherize homes faster.
- 5. Implement post-installation survey. Changing the timing and focus of the current follow-up survey would help National Grid resolve issues associated with installed measures.
- **6.** Increase direct engagement with landlords. Most IES participants own their home. To better serve renters, National Grid should explore more direct engagement with landlords.
- **7. Prioritize rebuilding the state's home energy assessor capacity.** Statewide, IES lost six assessors last year; National Grid should take steps to encourage assessor retention.
- **8.** Clarify waiver process. Some stakeholders expressed confusion about the waiver process and need more guidance from IES.
- **9.** Collect additional data. National Grid should work with IES stakeholders to collect specific additional data that would improve future evaluations.

Programs to which the Results of the Study Apply:

Residential Income Eligible Single Family

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Evaluation Recommendations included in the study:

This study offered nine recommendations resulting from this study. The findings and recommendation are summarized above.

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study:

The Company incorporated these recommendations in 2020 program planning.

Savings Impact: N/A Study name: Rhode Island 2017 Lighting Sales Data Analysis

Type of Study: Market Evaluation Conducted by: NMR Group, Inc Date Evaluation Conducted: April 23, 2019

Evaluation Objective and High-Level Findings:

The study objectives included the following:

- Examine current market share and bulb shipments in Rhode Island, Massachusetts, states with upstream programs, states without upstream lighting programs, and the entire nation15
- Provide breakdowns of market share by bulb type, shape, lumen bins, and ENERGY STAR status, when data quality allow
- Explore trends in bulb market share from 2015 to 2017, based on LightTracker, and 2011 to 2018 quarterly shipment share as reported by NEMA, highlighting changes in trends (and estimation methodologies) over time
- pare average prices of LEDs to other bulb types in the bulb price analysis
- Assess A-line market share in very low (<310) and very high lumen bins (>3,300), which roughly coincide with ranges that will remain exempt when Phase

The analysis of the sales data revealed several key findings below :

Rhode Island's market share for efficient bulbs (LEDs + CFLs) stood at 60% in 2017, and LED market share increased from 16% in 2016 to 55% in 2017. Rhode Island had one of the highest efficient bulb market share in the nation in 2017, somewhere between 42% to 55%, depending on the application of CREED's adjustment for program sales. Efficient bulb market share in neighboring Massachusetts was 57%, (post-adjustment; 49% for LEDs). All program states combined had an efficient share of 43% in 2017, compared to only 30% in non-program states. Like Rhode Island, Massachusetts also saw a large boost to its LED market share in 2017 (from 26% in 2016 to 49% in 2017). The national increase was 26% in 2016 to 35% in 2017. As discussed more fully in the report, program spending was associated with higher LED market share. States with greater program spending per household tended to have greater LED market adoption, with aggressive program states (over \$5 / home) demonstrating higher adoption compared to moderate (less than \$5 / home) and non-program states. Total program spending in both Rhode Island and Massachusetts was over \$5 per household in 2017.

LEDs market share was greatest for reflector bulbs in Rhode Island in 2017. Among discount, dollar, drug, grocery, mass merchandise, and some membership stores, LEDs accounted for 60% of reflector bulb sales in 2017, 41% of A-line sales, and 29% of globe sales. In contrast, LEDs accounted for only 13% of candelabra sales. Halogens are the most common alternative to A-line bulbs (45%) and incandescents for all three types of specialty bulbs, but especially candelabras (86%).

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LED sales in Rhode Island are strongest in lumen bins most closely associated with the 60-Watt and 40-Watt incandescent bulbs. The study shows that LEDs dominate the 750 to 1,049 lumen bin (52% of all sales) and account for 38% of sales in the 450 to 749 lumen bin (18% of all sales). In contrast, the lumen bins that are currently exempt from EISA (below 310 lumens and above 2,600) remain dominated by incandescents, although they collective garner only 3% of all bulb sales.

LED and CFL prices were higher than incandescents and halogens in the regions examined – but prices for efficient bulbs were lowest in Massachusetts. The small sample size of Rhode Island households in the NCP panel yielded unreliable pricing data. Given the similarity of the Rhode Island and Massachusetts programs, NMR suggests Massachusetts as a stand-in for Rhode Island in this analysis. LEDs remained the most expensive technology (\$3.45 in Massachusetts) at the point of purchase in all areas. Yet, Massachusetts's market share of more expensive (pre-incentive) ENERGY STAR LEDs was 80%, and the state offered a generous incentive. Massachusetts had the least expensive LEDs (which reflect the application of program incentives) and the highest proportion of ENERGY STAR LEDs, which strongly suggests a program impact on price.

Programs to which the Results of the Study Apply:

Residential Upstream Lighting

Evaluation Recommendations included in the study: No formal recommendations from the study

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study: $\ensuremath{\mathsf{N/A}}$

Savings Impact: N/A Study name: Rhode Island 2018 Lighting Sales Data Analysis

Type of Study: Market Evaluation Conducted by: NMR Group, Inc Date Evaluation Conducted: September 18, 2019

Evaluation Objective and High-Level Findings:

This study objectives included the following:

- Examine current market share and bulb shipments in Rhode Island, Massachusetts, states with upstream programs, states without upstream lighting programs, and the entire nation15
- Provide breakdowns of market share by bulb type, shape, lumen bins, and ENERGY STAR status, when data quality allow
- Explore trends in bulb market share from 2015 to 2018, based on LightTracker, and 2011 to 2018 quarterly shipment share as reported by NEMA, highlighting changes in trends (and estimation methodologies) over time
- Compare average prices of LEDs to other bulb types in the bulb price analysis
- Assess A-line market share in very low (<310) and very high lumen bins (>3,300), which roughly coincide with ranges that will remain exempt when Phase

Overall, the sales data analysis as well as the cumulative body of evidence, suggests that the National Grid Rhode Island ENERGY STAR Retail Lighting Program (the Program) had an important effect on the long-term evolution of the lighting market. Based on evidence in this report, that effect appears to be waning, as non-program areas begin to catchup with program areas.

As of 2018, Rhode Island LED market share overall and for most screw-based bulb shapes was higher than that of Massachusetts, the nation, other program states, and non-program states. Likewise, Rhode Island market share of LEDs in lumen bins currently covered by the Energy Independence and Security Act (EISA) remained higher than in non-program states. Longitudinal analysis and the cumulative body of evidence that also includes shelf stocking studies and onsite saturation visits suggests that Rhode Island (and Massachusetts) program activity convinced consumers to switch to LEDs sooner than in other parts of the nation.

Yet, there are signs that natural market adoption has strengthened throughout the nation. Rhode Island's 2018 LED market share was 12th in the nation, despite having the second highest LED incentive spending per bulb in the nation. Likewise, prices for LEDs in Rhode Island were very similar to prices in the comparison areas. While this partially reflects the strong LED incentives in Rhode Island, the lack of strong price differentials across areas also points to a market undergoing transformation.

Market share by bulb shape also shows indications of market transformation for reflectors and A-lines. Although Rhode Island's LED market share for these bulb shapes exceeded those of all

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other areas considered, nearly one-half of A-line bulbs and over two-third of reflectors sold in non-program areas in 2018 were LEDs. The program now faces the challenge of converting the last few sockets – the rarely used bulbs, such as decorative bulbs (globes and candelabras) with high aesthetic value to consumers – to LEDs. Program incentives may convince a consumer to purchase a candelabra LED for the dining room or an A-line LED for the closet instead of an inexpensive four-pack of halogens.

Programs to which the Results of the Study Apply:

Residential Upstream Lighting Program

Evaluation Recommendations included in the study:

The study did not have formal recommendations but provided the following program considerations:

Consideration 1: National Grid should carefully consider the future of the program and stay alert to any regulatory movement at the state or federal level that would call for withdrawing support for A-lines, reflectors, and specialty products within the 310 to 2,600 range.

Rational: National Grid still has a role to play in the residential market as it currently stands. National Grid's efforts have boosted adoption of LEDS and made LEDs more price competitive with halogens. Although A-line LEDs represent the majority of Rhode Island bulb sales in the lumen bin most closely associated with 60-Watt incandescents, inefficient bulb types still garner more than 50% of sales in every other lumen bin. The remaining inefficient sockets may be difficult to convert to LEDS, and efforts to educate consumers and reduce LED prices may help to capture substantial savings before the market fully transforms.

Consideration 2: National Grid should carefully consider if and how to continue support for reflectors bulbs.

Rational: Market share for reflectors is high in all areas examined, including non-program areas. The long life and directional nature of LEDs makes them well suited to the most common reflector applications (recessed ceiling cans and exterior floods). This has likely enhanced their rate of naturally occurring market adoption in Rhode Island and across the nation. Traditional upstream program interventions alone may not be enough to create continued lift for reflectors.

Consideration 3: National Grid should consider continuing support for bulbs in the very low (below 310) and very high lumen range (above 3,300). Likewise, National Grid should continue support for candelabra and globe bulbs, which show fewer signs of transformation in Rhode Island and across the nation.

Rational: Incandescent bulbs account for nearly all A-line sales in the lumen bins that are currently exempt from EISA (below 310 and above 2,600) and those that will remain exempt if the next phase of EISA is eventually implemented (below 310 and above 3,300). While these represent less than 5% of A-line lighting sales in Massachusetts, it appears that these lumen bins

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remain largely untransformed. Likewise, candelabra bulbs generally and globes outside of Rhode Island and Massachusetts have very small LED market shares, suggesting that program intervention still matters. Given that the September 4, 2019 final DOE prevents globes and candelabras from being defined as general service lamps, this intervention will likely remain important for at least a few more years (when either the outcomes of lawsuits or market transformation makes LEDs the dominant bulb type). While the achieved savings will likely be small due to the limited small sales volumes and delta watts for these bins and bulb types, program support for them could help convert the remaining decorative, appliance bulbs, and high lumen bulbs that largely remain incandescent.

Consideration 4: National Grid and the implementation contractor should consider whether incentive levels should be adjusted downward.

Rational: Rhode Island has one of the highest incentive levels in the nation. This likely reflects a combination of factors, including the cost-of-living and associated pre-incentive LED prices in the Northeast, the product mix offered, and program history. These deep incentives have helped Rhode Island and the Northeast achieve strong LED market share. Yet, as transformation progresses and LED prices remain low, it may be time to explore whether National Grid customers would continue to adopt LEDs at the same rate with a smaller incentive.

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study: The Company used results of this study to inform program planning.

Savings Impact: N/A Study name: RI-19-RE-UpstrLight1 2018 Rhode Island Shelf Stocking Study

Type of Study: 2018 Rhode Island Shelf Stocking Study Evaluation Conducted by: NMR Date Evaluation Conducted: August 29, 2019 Evaluation Objective and High-Level Findings:

The objectives of this study were to assess the following indicators at Rhode Island retailers which participated in National Grid's residential lighting program in 2016–2018:

- Total shelf share dedicated to lighting over time by channel
- The amount of shelf share dedicated to screw-based LED, CFL, halogen, and incandescent lamps by channel
- The pricing (on a per bulb basis), number of bulb packages, and shelf locations of screwbased LED, CFL, halogen, and incandescent lamps by channel
- Differences in pricing and availability for screw-based LED ENERGY STAR[®] vs. Non-ENERGY STAR products by channel
- The amount of shelf share dedicated to linear lamps (LED vs. fluorescent) by channel

The key findings are summarized below:

- The amount of space dedicated to light bulbs in general decreased between 2016 and 2018 across all channels except Discount. This indicates that retailers are shifting shelf space to non-lighting products. If retailers are beginning to shift focus from light bulbs, programs may need to adapt.
- LED shelf share has steadily increased since 2016, whereas CFL and Halogen shelf share did not change from 2017 to 2018
- Hardware & Home Improvement stores continue to devote a sizeable portion of shelf share to inefficient bulbs; 54% and 33% respectively. Despite gains in LED saturation, these retailers continue to offer a wide variety of inefficient bulbs to customers – meaning there are alternatives to LEDs readily available. The study also showed that most of the remaining halogens and incandescent bulbs represent categories currently subject to EISA Phase I (for halogens) or that would become subject to EISA Phase II (both bulb types) if the expanded general service lamp (GSL) definition is adopted.
- Incandescent (+15%) and LED (+19%) bulbs have nearly replaced CFLs in Grocery stores. Shelf stocking data show that CFL shelf space in this channel is being divided among LEDs and incandescents.
- Most (79%) of the remaining inefficient bulbs on store shelves fall into categories which are currently exempt from the Energy Independence and Security Act (EISA) of 2007 (i.e., Phase I). Whether these bulbs will remain exempt will depend on the outcome of rulemakings and potential lawsuits regarding whether to expand the definition of a GSL to include additional bulb shapes, such as reflectors and globes, or maintain their

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exemption them from EISA efficiency standards. If the GSL definition is expanded, the majority (70%) of observed inefficient bulbs would be covered by EISA and would not be permissible for resale. Otherwise, the Department of Energy's most recent proposal for EISA Phase II would have negligible impact on the fraction of exempt bulbs under current stocking practices.

- Prices of all technologies except non-smart LEDs have increased since 2016 making nonsmart LEDs an increasingly viable option for even price sensitive consumers.
- Prices of globe and reflector LEDs haven fallen steeply, outpacing other styles.

Programs to which the Results of the Study Apply:

Residential Upstream Lighting

Evaluation Recommendations included in the study:

No formal recommendations were made in this evaluation.

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study: $\ensuremath{\mathsf{N/A}}$

Savings Impact: N/A

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Study Name: RI-19-RE-AppRecycle - Residential Appliance Recycling Savings Update

Type of Study: Impact Evaluation Conducted by: NMR Group, Inc Date Evaluation Completed: April 22, 2019

Evaluation Objective and High Level Findings:

This study was designed to identify and compare the current characteristics of refrigerators and freezers being recycled through the program in 2017 and 2018 to those identified in the 2011 study, and to calculate per-unit gross energy savings, adjusted gross savings, and net savings for the 2018 program.

As expected, the per-unit savings for refrigerators and freezers decreased between 2011 and 2017/2018 by 19% and 36%, respectively. The current program recycles younger units and therefore uses less energy than those recycled in 2011. Both refrigerator and freezer savings increase between 2017 and 2018, largely because of the greater size of units recycled and, for refrigerators, the increased prevalence of side-by-side door configurations and primary units. Rhode Island and Massachusetts exhibited similar refrigerators savings in 2018, but Rhode Island savings fell below those of Massachusetts, largely reflecting the younger age of freezers.

The following tables summarize the results of study, taken from the report.

Table 3: Refrigerator Savings for 2017 and 2018

	Prior	Prior Study		Curr	ent Study	
	Factor	2011	Factor	2017	2018	Combined
Gross Energy Savings (kWh)	n/a	1,242	n/a	991	1,022	1,004
Adjusted Gross Energy Savings (kWh)	58%	716	88%	872	900	883
Net Savings (kWh)	69%	492	44%	384	396	389

Table 4: Freezer Savings for 2017 and 2018

	Prior Study			Curre	ent Study	
	Factor	2011	Factor	2017	2018	Combined
Gross Energy Savings (kWh)	n/a	1,139	n/a	721	731	724
Adjusted Gross Energy Savings (kWh)	58%	660	68%	490	497	492
Net Savings (kWh)	59%	390	56%	274	280	278

Table 14: Comparison of 2018 RI and MA Impact Factors¹

	Refrigerator			Freezer		
	Factors	RI	MA	Factors	RI	MA
Gross Energy Savings (kWh)	n/a	1,022	1,027	n/a	731	769
Adjusted Gross Energy Savings (kWh)	88%	900	903	68%	497	523
Net Savings (kWh)	44%	396	398	56%	280	295

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Programs to which the Results of the Study Apply:

Residential Products

Evaluation Recommendations included in the study:

NMR recommends that National Grid adopt the combined 2017/2018 annual energy savings estimates for use in planning and reporting savings for 2020.

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study:

The Company adopted recommended savings for use in planning and reporting savings for 2020

Savings Impact:

The adoption of these results led to a decrease in the savings that National Grid claims for appliance recycling offered through Residential Products Program.

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<u>Study Name</u>: Analysis and Recommendations regarding the Current and Future Workforce associated with Rhode Island Energy Efficiency Programs

Type of Study: Economic Impact Evaluation Conducted by: Peregrine Energy Group Date Evaluation Conducted: 2019

Evaluation Objective and High Level Findings:

The study objective was to describe in detail the workforce that supported and delivered Rhode Island energy efficiency programs and services in 2018. The study reported on numbers and types of workers associated with programs, comparing 2018 with past years. It identified and recommended future research into workforce development and training needs, and it suggested new workforce initiatives that National Grid should undertake to ensure the success of future programs. This study addresses the requirements of General Law 39-2-1.2, enacted by the Rhode Island General Assembly in 2012. The study is designed to be conducted annually.

Key Findings:

- 804.1 full-time equivalent workers were associated with 2018 Rhode Island programs.
- Aggregate number of FTEs increased for the fourth consecutive year.
- 1,415,216 hours of worker time were devoted to delivering programs and services.
- One "full-time equivalent" worker often represents the combined labors of multiple persons.
- 1,109 individual companies and agencies were associated with delivering the programs.
- 73% of these entities are either headquartered or have a physical presence in Rhode Island.

Programs to which the Results of the Study Apply: This is an overall indicator of economic impact, not applied to a specific program.

Evaluation Recommendations included in the study:

- Support additional workforce development and training to ensure the future success of programs and initiatives.
- Improve two-way communications with trade allies, providing timely information of potential program changes and soliciting trade ally market knowledge in program design decisions.
- Consider the impacts on existing skilled energy efficiency workers when making program changes.
- Take steps to conserve the current workforce to support future planned and proposed energy efficiency initiatives.
- Address workforce requirements as part of all future assessments of market needs and opportunities.
- Commission a study of workforce and training needs for all programs, including strategies to mitigate them; and specifically, with respect to the near-term promotion of cold

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climate air source heat pumps, convene a stakeholder task force to address workforce issues, challenges, and opportunities

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study:

See the Main Text, section 6.viii. Workforce Development. This section of the main text includes some of the recommendations that the Company has adopted regarding work force development. The Company took these steps because of the workforce challenges highlighted within this study.

Savings Impact:

N/A

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<u>Study name:</u> Piggybacking Diagnostic Study

Type of Study: Process Evaluation Evaluation Conducted by: DNV-GL Date Evaluation Conducted: Expected Completion October 2019

Evaluation Objective and High-Level Findings:

The primary objective of this study was to develop guidance on when it is appropriate to "piggyback" or combine Rhode Island evaluation efforts with Massachusetts studies versus pursuing stand-alone studies or adopting MA results as a proxy for RI. There are several different ways to combine data, so how to combine or when to use which of the various methods was also of interest. This was explored through acquisition and analysis of secondary research to compare and contrast inter-state characteristics between RI and MA and comparing results of past impact evaluations between RI and MA for previous piggybacking and stand-alone efforts.

Specific research objectives of this study included:

- Compile data to compare the key characteristics between two states (MA and RI) using available secondary data from National Grid and other sources. To the extent possible, compare both demand-side and supply-side characteristics.
- Perform up to 8 interviews with National Grid staff to understand differences between RI and MA in program designs and implementation and general differences in evaluation and program policies.
- Conduct a meta-analysis on up to 30 existing RI or MA studies (some that have utilized a piggybacking strategy in the recent past) to establish whether the differences between RI and MA in those studies are statistically significant when considered as a whole.
- Provide recommendations for further research. In particular, generate a decision-making matrix for when/how to piggyback.

Programs to which the Results of the Study Apply:

The results of this study will apply to all programs.

Evaluation Recommendations included in the study:

This study was in draft form at the time of writing; formal recommendations have not yet been made.

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study:

As this study was in draft form at the time of writing, recommendations will be reviewed when the report is complete, and recommendations will be implemented by National Grid if deemed appropriate.

Savings Impact:

N/A

<u>Study name</u>: Primary Data Collection for Technical Potential Study

Type of Study: Data Collection Evaluation Conducted by: DNV-GL Date Evaluation Conducted: Expected Completion September 2019

Evaluation Objective and High-Level Findings:

The objective of this study was to collect data on existing equipment currently utilized by National Grid's commercial and industrial customers in Rhode Island. Data was collected on lighting, HVAC and VSDs on the electric side, and HVAC, hot water, steam traps and boilers on the gas side. The scope included gathering data on equipment type, manufacturer, age, and nameplate information. Data was also gathered on the presence and type of distributed generation. Information on equipment operation, setpoint data, and industrial process data were not included in the scope. Business types were divided into the following categories:

- Campuses
- Education
- Food Sales
- Food Service
- Healthcare
- Hospitals
- Lodging
- Manufacturing/Industrial
- Office
- Other
- Public Assembly
- Retail
- Warehouse

In total, 87 sites were visited as part of this data collection efforts.

Programs to which the Results of the Study Apply:

N/A

Evaluation Recommendations included in the study: $\ensuremath{\mathsf{N/A}}$

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study: N/A

Savings Impact: N/A

Relative

Precision

(t-value)

±32.0%

±7.9%

±17.7%

±17.1%

±11.9%

±21.5% ±6.7%

±10.5%

±14.3%

±24.4%

±11.6%

±17.9%

±1.1%

852

332

865

245

438

619

1,226

573

1,163

50

Study name: Massachusetts Study 18-14: Lighting Hours of Use Study

Type of Study: Impact Evaluation Evaluation Conducted by: DNV-GL Date Evaluation Conducted: April 12, 2019

Evaluation Objective and High-Level Findings:

The purpose of this study was to develop building level annual hours of use (HOU) estimates for estimating savings for the upstream lighting program offering. The study provides the following key findings:

• Hours of use estimates were generated for twelve different building types based on data collected in MA beginning in 2010.

4,988

2,788

4,026

3,673

4,181

4,336

5,018

4,939

6,512

4,416

494

197

511

134

262

373

707

341

634

30

Absolute Standard Count of **Building Type** Hours of Use Precision Buildings Error (t-value) College & University 19 4,839 892 1,546 Grocery/Food Sales 28 5,468 252 430 Hospital 15 5,413 545 959

21

37

34

10

64

105

19

44

10

406

• Building type hours of use:

Industrial/Manufacturing

Restaurant/Food Service

Warehouse and storage

K-12 School

Medical Office

Office Building

Lodging

Other

Retail

Overall

Programs to which the Results of the Study Apply:

Commercial and Industrial Electric – Retrofit Program

Evaluation Recommendations included in the study:

The following recommendations were made by the evaluators conducting this study:

Recommendation 1: For lighting savings estimation, use the building specific hours of use provided in the table above.

Recommendation 2: For Government Buildings, use the Office Building hours from the table above.

Recommendation 3: For Police/Fire Stations and Court Buildings, use the "Other" building type from the table above.

Recommendation 4: For Multifamily and Other-Automotive, use the "Other" building type from the table above.

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Recommendation 5: If a building type is unknown, use the "Overall" result from the table above, which represents the average operating hours of all building types combined

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study: National Grid adopted the recommendations from this study.

Savings Impact:

This evaluation will increase claimed savings for some fixture types and decrease claimed savings for other fixture types.

Study name: Massachusetts Study 18-25: Impact Evaluation of Commercial Water Heaters

Type of Study: Impact Evaluation, Market Evaluation **Evaluation Conducted by:** DNV-GL **Date Evaluation Conducted:** May 27, 2019

Evaluation Objective and High-Level Findings:

This study had two research objectives including:

- Conduct a critical review of a 2018 analysis of daily water consumption for tankless water heaters (WHs) by the third-party implementer of the Massachusetts C&I Upstream Water Heater Initiative (Initiative) and using that analysis, or an alternative analysis, recommend water consumption estimation methods to be used for calculating deemed savings for this measure
- Conduct a technical reference manual (TRM) review to determine what estimates of average daily water consumption for commercial tankless water heaters are used in jurisdictions outside of Massachusetts.
- •

The following are summaries of the key findings.

- A review of the water usage values in the readily-available TRMs support the Initiative implementer's recent proposal to increase hot water usage values for tankless WH in C&I facilities.
- The 2018 analysis of daily water consumption for tankless WHs by the third-party implementer of the Initiative demonstrated the need to revise the current Massachusetts TRM assumption for water consumption in tankless water heaters (64 gallons-per-day (GPD)). However, the evaluators recommended alternative approaches for calculating the GPD estimates because they had concerns about the third-party implementer's analysis combining usage-per-building data from California or New York sources with units-per-building from Massachusetts PA tracking data. They also noted that half the GPD values in the implementer's analysis came from a single study which focused on California hot water usage values specific to food service end uses.

The evaluators recommended using an alternative approach to estimate GPD for tankless water heaters which could be applied in three different ways:

1) a single GPD value for the whole year;

2) a more granular approach where a GPD value is assigned to a participating facility based on its classification to one of five different hot water usage categories (multifamily, manufacturing, low usage, medium usage, and high usage); and

3) an even more granular approach where a participating site would be assigned a GPD value based on one of 16 building type categories.

• The study calculated the 2018 deemed energy savings values for WH types rebated by the Initiative. Table 2 shows these values which incorporated two adjustments:

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1) revised estimates for the energy efficiencies of baseline equipment coming out of Project 77: Upstream Water Heater Deemed Savings Impact Evaluation; and

2) new GPD estimates for tankless water heaters coming out of MA19C10-G-WHGPD - Market Quick Hit Study on Water Consumption for Tankless WHs.

Commercial WH Type	Efficiency Requirement	2018 Savings	Recalculated 2018 Savings with New Baselines	Savings Change	Realization Rate
Condensing Volume	≥0.92 thermal efficiency	5.07 (therms/MBH input)	3.67 (therms/MBH input)	28% decrease	0.72
Condensing Tank Style	≥0.95 thermal efficiency	6.14 (therms/MBH input)	6.14 (therms/MBH input)	No change	1.00
Condensing Tankless	≥0.94 Energy Factor	90 (therms/unit)	86 (therms/unit)	4% decrease in savings	0.96

Table 2: 2018 Condensing Water Heater Savings by Water Heater Type

Programs to which the Results of the Study Apply:

Commercial and Industrial Gas - Retrofit

Evaluation Recommendations included in the study:

Recommendation 1: Use new estimates for water consumption in tankless water heaters. The study described a recommended method for calculating new GPD estimates for commercial tankless WHs in Massachusetts. This method involved constructing a Massachusetts-specific building type table using New York TRM, American Society of Heating, Refrigerating and A-C Engineers (ASHRAE), and Food Service Technology Center (FSTC) gpd values modified with Massachusetts-specific building type, size, and demographics information. As noted, this method allowed the GPD value to be applied in three different ways:

1) a single GPD value for the whole year;

2) a more granular approach where a GPD value is assigned to a participating facility based on its classification to one of five different hot water usage categories (multifamily, manufacturing, low usage, medium usage, and high usage); and
3) an even more granular approach where a participating site would be assigned a GPD value based on one of 16 building type categories.

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study: National Grid plans to adopt the updated deemed savings values for 2020.

Savings Impact:

Adopting the results of this evaluation will decrease savings claimed by National Grid for this program.

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<u>Study Name</u>: Massachusetts Commercial and Industrial Upstream HVAC/Heat Pump and Hot Water NTG and Market Effects Indicator Study

Type of Study: NTG and Market Effects Evaluation Conducted by: DNV GL, NMR Group, Tetra Tech Date Evaluation Completed: September 5, 2018

Evaluation Objective and High Level Findings:

The primary purpose of this study was to measure the retrospective (2016) and estimate the prospective (2019-2021) net-to-gross ratio (NTGR) and market effects indicators for selected equipment types supported by the Upstream HVAC/Heat Pump (HP) Initiative and the Upstream Water Heater Initiative. The equipment comprises five types of HVAC/HP and gas-fired water heating equipment:

- Ductless mini-split heat pumps
- Electric water-source heat pumps
- Air-cooled unitary/split central air conditioning (>5 tons)
- Gas-fired storage water heaters between 76,000 and 300,000 BTU/hour
- Gas-fired tankless water heaters between 180,000 and 199,900 BTU/hour

Surveyors asked distributors to estimate the expected share of 2018 total sales from highefficiency equipment with and without the initiative. This information allowed the team to understand the influence distributors expect the Initiatives to have on future high-efficiency sales while not requiring them to estimate sales two to four years in the future. Using these estimates, the study calculated a 2018 Distributor-Reported NTGR which was used to inform the development of the 2019-2021 NTG.

	n	Avg. Percentage With Initiative	Avg. Percentage Without Initiative	Prospective 2018 NTG
Air-cooled unitary and split CAC and HP system (>5 tons)	7	52.0%	30.6%	41.1%
Ductless Mini-split Heat Pump	7	80.8%	34.8%	56.9%
Electric Water-source Heat Pump	6	80.5%	64.4%	19.9%
Gas-fired Storage Water Heaters	14	63.7%	57.2%	10.3%
Gas-fired Tankless Water Heaters	13	95.8%	78.1%	18.5%

This research suggests that while the Initiative did modify distributor behavior by motivating them to stock and upsell high-efficiency equipment more than they had before, these changes may not have had much impact on the surveyed buyers' decision-making. Many of the surveyed buyers indicated they were interested in high-efficiency equipment prior to the transaction and the Initiative had minimal impact on their decision to purchase an initiative-eligible unit.

Representatives from the PAs, EEAC, and Evaluators determined the prospective NTGR to use for each evaluated equipment type in the 2019-2021 Three-Year Plan. In developing these ratios, the group took into consideration the distributor self-reported retrospective and prospective NTG, the causal pathway results, and known program changes.

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Equipm	nent Type	2019	2020	2021
0	Air-cooled unitary and split CAC and HP system (>5 tons)			
VAC	Ductless mini-split heat pump (based on removing lower efficiency tier from Initiative)			47%
도 Electric water-source heat pump		50%	49%	48%
60	Gas-fired storage water heaters and indirect water heaters	31%	30%	29%
ater eatin	Volume water heaters (removing lower efficiency tier and offering multiple tiers)	60%	59%	58%
Э́Н	Gas-fired tankless water heaters	60%	59%	58%

Programs to which the Results of the Study Apply:

Commercial and Industrial Electric and Gas – New Construction

Evaluation Recommendations included in the study:

Adopt the 2019-2021 prospective NTGRs developed as part of this study, contingent on actual changes made to the initiative. The low retrospective NTGRs and findings from this study suggest that initiative changes should be considered prior to adopting NTGRs for 2019-2021.

Review efficiency requirements and incentive levels and assess whether the efficiency requirements are stringent enough, and the incentive levels high enough, to produce the expected outcomes.

Revise marketing materials to increase contractor and end-user awareness of the initiative.

Work with distributors to reduce the administrative burden of participating in the Initiative. The 2017 Process Evaluation found that many distributors experienced an increase in administrative burden and cash flow concerns as a result of participating in the Initiative. These distributors keep a portion of the incentive to cover such costs. Program staff should work with the implementer and partner distributors to develop tools or processes to reduce these concerns.

Provide training and outreach to contractors to increase understanding of Initiative reporting requirements and the importance of complying with them. To improve contractor compliance with reporting requirements, consider offering a portion of the incentive to contractors.

Require distributors to include end user contact information in each application. The evaluation team encountered difficulties in reaching 2016 Initiative participants due to tracking data quality. While the HVAC tracking data included customer contact information, many fields were blank or, when populated, did not provide surveyors enough information to reach the actual decision maker.

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study: National Grid has adopted the NTGRs from this study.

Savings Impact:

Adopting this study reduced savings claimed by National Grid for these equipment categories.

Study name: Massachusetts Study 20: Energy Optimization Study

Type of Study: Impact Evaluation **Evaluation Conducted by:** Navigant Consulting **Date Evaluation Conducted:** 10/9/2018

Evaluation Objective and High-Level Findings:

The purpose of this study was to develop a spreadsheet model that characterizes and estimates the savings, costs, and emissions reductions for various heating, cooling, and water heating measures that involve the full or partial displacement of existing oil or propane equipment with gas or electric equipment. The results of this model are being used to inform and prioritize the PAs' plans for deploying these measures under a new and evolving "energy optimization" philosophy or offering under their Residential Coordinated Delivery initiative for program years 2019 through 2021. The spreadsheet tool models the consumption, savings, costs, and emissions reductions of these energy optimization measures under three main scenarios: (1) full/early replacement, (2) partial displacement, and (3) replace on failure. This study was originally performed for the MA PAs. The efficiency levels and savings values used in the model have been updated based on the proposed 2020 efficiency levels.

The study provides the following key findings:

- All the measures considered in this study result in annual energy cost savings for the customer.
- The early replacement measures with the highest annual energy cost savings were the measures involving the replacement of propane and oil boilers with gas-fired combination boilers.
- All the measures considered in this study result in reduced CO2 emissions. The CO2 emissions reductions are comparable for the early replacement scenario (with measure savings ranging from 0.32 to 6.40 tons CO2/year) and the replace-on-failure scenario (ranging from 0.22 to 6.96 tons CO2/year).
- Suggestions to improve its accuracy and/or expand its applicability include additional analysis to better inform and refine the model inputs related to home heating, cooling, and water heating loads; installation costs for higher capacity central heat pumps; ancillary costs for ductwork, existing equipment removal and disposal, new gas service lines, electrical system upgrades, and dual system integration; the relationship between heat pump cooling and heating capacity; and heat pump performance as a function of temperature.

Programs to which the Results of the Study Apply:

High-Efficiency Heating, Cooling and Hot Water – Electric, Income Eligible Services Single family - Electric

Evaluation Recommendations included in the study:

No formal recommendations were made in this evaluation.

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Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study: $\ensuremath{\mathsf{N/A}}$

Savings Impact:

This study produced a spreadsheet tool that the PAs are using to assess the potential costs and savings for various energy optimization scenarios and measures based on user-defined inputs and operating assumptions, such as equipment capacity and switchover temperature energy and fuel prices, and home cooling, heating, and water heating load. It will help inform the PAs' decision on which measures to include in its 2019-2021 Three-Year Plan and their associated savings and costs. This tool was updated with the currently planned efficiency levels for 2020 for both ducted and mini-split heat pumps.

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Study name: Massachusetts Study 11: Water Heating, Boiler, and Furnace Cost Study

Type of Study: Market Characterization or Assessment Evaluation **Evaluation Conducted by:** Navigant Consulting **Date Evaluation Conducted:** 9/21/2018

Evaluation Objective and High-Level Findings:

The purpose of this study was to evaluate the energy-efficiency-related costs of single-family home installations of water heater, boiler, and furnace products currently rebated through the Residential Heating and Cooling program. As part of this study, there was an add-on task titled "Appendix E. Residential Water Heater Analysis (Task 7 memo). As part of this analysis, updated water heating savings was included for gas storage water heaters and electric heat pump water heaters. The updated savings are as follows and only includes end of life savings.

- 1. HPWH < 55 gallon 1592 (4.8%*1592 (additional heating penalty)) = 1516 kWh/year
- 2. HPWH > 55 gallon 197 kWh/year
- Gas Storage WH average medium and high draw patterns (1.9+2.2)/2 = 2.05 MMBTU/year
- 4. Tankless Water Heater 6.6 MMBTU/year

Programs to which the Results of the Study Apply:

High-Efficiency Heating, Cooling and Hot Water – Electric and Gas

Evaluation Recommendations included in the study:

No formal recommendations were made in this evaluation.

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study:

N/A (no formal recommendations were made in this evaluation)

Savings Impact:

This study reduced the claimable energy savings for electric heat pump water heaters and had minimal impacts on the savings for gas water heaters.

Study Name: Massachusetts Study 17-3 Advanced Power Strip Metering Study - Revised

Type of Study: Impact Evaluation Conducted by: NMR Group, Inc Date Evaluation Completed: March 18, 2019

Evaluation Objective and High Level Findings:

The objectives of this study were to investigate three impact factors for Advanced Power Strips (APS):

- Baseline Energy Use
- Energy Reduction Potential (ERP)
- Realization Rate (savings reduction due to improperly setup APS)

Importantly, this study was designed as a metering study and not as an impact evaluation, therefore, it is necessary to combine results with in-service rate and short-term retention to calculate adjusted gross savings. The table below presents the updated metered impact factors for baseline energy use and ERP. The realization rate was 92% for all technologies.

	•
	Updated Value
Baseline Usage	
Tier 1 – All (blend of HEC and PC)	449 kWh
Tier 2 – All (HEC only)	471 kWh
Energy Reduction Potential (ERP)
Tier 1 – All	25%
Tier 2 – All	44%
Baseline Demand	
Tier 1 – All	52 W
Tier 2 – All	58 W
Demand Reduction Potential (DR	P)
Tier 1 – All	19%
Tier 2 – All	41%

Updated Metered Impact Factors

The study provides the following key findings:

- All types of APS strips demonstrated statistically significant savings compared to nonsmart power strips.
- Although there was variation across ERP values based on both Tier 1 end-uses and Tier 2 technology types, the differences between these groups were not statistically significant.
- Study results were in line with other advanced power strip field studies.

Programs to which the Results of the Study Apply:

Residential Products, EnergyWise Multifamily, Income Eligible Retrofit Programs

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Evaluation Recommendations included in the study:

This study does not make any recommendations.

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study: N/A

Savings Impact:

The results of this study are being used to adjust claimed savings for Tier 1 and Tier 2 APS. Specifically, this study provided evaluated impact factors (baseline use, energy reduction potential, and realization rate) for APS.

For Tier 1 APS, this study found lower baseline energy usage and realization rates compared to what was assumed for 2018 program planning. However, the study found higher energy reduction potential. When combined, this leads to an overall increase in gross unadjusted savings.

For Tier 2 APS, this study found lower baseline energy usage, realization rates, and ERP compared to what was assumed for 2018 program planning. When combined, this leads to an overall decrease in gross unadjusted savings compared.

Study Name: Massachusetts Study MA19R02-E Delta Watt Update

Type of Study: Impact Evaluation Conducted by: NMR Group, Inc Date Evaluation Completed: April 10, 2019

Evaluation Objective and High Level Findings:

This evaluation was conducted on behalf of the Massachusetts Program Administrators (PAs) to update some of the inputs used to calculate LED delta watts in the RLPNC 17-6 Lighting Market Adoption Models (MAMs).

Updating the wattage by bulb type and sales share based on actual 2018 LED sales resulted in increased delta watts for GSL and Specialty and decreased delta watts for Reflectors. These changes are based on differences in types of bulbs purchased through the program in 2018 versus 2017. Generally, in 2018 consumers purchased a higher proportion of high equivalent wattage LEDs in the GSL and Specialty categories, and lower equivalent wattage LEDs in the Reflector category through the program.

Bulb Type and				Delta	Watts			
MAM Year	2018	2019	2020	2021	2022	2023	2024	2025
GSL 2017	33	33	34	34	34	34	34	35
GSL 2018	36	36	38	38	38	38	38	38
Reflector 2017	46	46	46	47	47	47	47	47
Reflector 2018	42	42	42	43	42	43	43	43
Specialty 2017	36	37	37	38	39	39	40	40
Specialty 2018	39	40	41	41	42	42	43	43

The following table summarizes the MAM Gross Delta Watt Comparison 2017 vs. 2018, taken from the report.

Programs to which the Results of the Study Apply:

Residential Lighting

Evaluation Recommendations included in the study:

This study does not make any recommendations.

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Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study: $N/\!A$

Savings Impact:

The increase in delta watts for GSL and Specialty LEDs increases first-year program savings. The decrease in delta watts for Reflectors reduces first-year program savings.

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Study name: Massachusetts Wi-Fi Thermostat Impact Evaluation—Secondary Research Study

Type of Study: Impact Evaluation Conducted by: Navigant Date Evaluation Conducted: September 10, 2018

Evaluation Objective and High-Level Findings:

MA PAs and EEAC asked Navigant to perform this comprehensive secondary literature review on WIFI thermostats, utilizing existing research performed for other jurisdictions to summarize savings findings around the country and provide recommended savings values for interim use.

Navigant's secondary research findings on Wi-Fi thermostat savings suggest wide variation and no consensus in overall findings, or findings by study category. As a result of the large number of divergent study values presently available, Navigant recommends the PAs use caution when selecting savings values to use for planning purposes, as forthcoming primary research could either increase or decrease savings relative to the values of 104 kWh and 66 therms per year currently used in the state. Studies in 2017 and 2018 show a considerable decline in researched savings values relative to earlier studies. Furthermore, the divergent findings in this literature review again point to the need for primary research specific to Massachusetts to generate reliable and robust estimates of savings specific to the state's customers, existing baseline, climate zone and other salient factors.

Programs to which the Results of the Study Apply:

Residential HVAC, Income Eligible SF and MF, EnergyWise MF

Evaluation Recommendations included in the study:

Until primary research can be completed, Navigant recommends annual savings values of 31 therms for combustion heating, 97 kWh for electric heating, and 64 kWh for Central Air Conditioning for use until primary research and analysis findings are complete.

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study:

The Company adopted recommended savings for use in planning and reporting savings for 2020

Savings Impact:

The adoption of these results led to an decrease in electric and gas savings for Wi-Fi thermostats.

Study name: Massachusetts Res 34 Home Energy Services Impact Evaluation

Type of Study: Impact Evaluation Conducted by: Navigant Consulting Date Evaluation Conducted: August 29, 2018

Evaluation Objective and High-Level Findings:

This HES Impact Evaluation was designed to estimate the gross per-unit energy savings associated with the HES measures offered in 2015 and 2016. In total, the team evaluated 29 measures across four fuel types (natural gas, electric, heating oil, and propane); nine of which were not part of the previous evaluation (completed in 2012).

The evaluation also yielded realization rates, for insulation and air sealing, that the PAs will use to adjust the ex-ante gross savings produced by each HES Lead Vendor's (LV) proprietary energy modeling software.

The scope of this evaluation did not include LED lighting or smart strips—both common HES measures—since both measures were being evaluated through a different, concurrent, evaluation effort.

The study provides the following key findings:

Weatherization

- The evaluation team's billing analysis determined that HES participants who weatherized their natural gas heated homes (i.e., installed air sealing and/or insulation) saved, on average and statewide, 130 therms per year. This result is somewhat lower than the statewide findings from the previous evaluation in 2012. The PAs should use the realization rates shown below to adjust their LV-estimated weatherization savings.
- Realization Rates by LV:
 - CLEAResult (estimated savings = 169 and evaluated savings = 127) 75%
 - RISE (estimated savings = 265 and evaluated savings = 179) 68%
 - CET (estimated savings = 182 and evaluated savings = 152) 83%
 - Statewide (estimated savings = 178 and evaluated savings = 130) 73%

<u>Thermostats</u>

• Programmable and Wi-Fi thermostats are estimated to have save 3.6% and 6%, respectively, of HES participants' annual heating consumption.

Furnaces and Boilers

• Due to an increase in heating loads, relative to the previous evaluation, savings increased for furnaces (while the opposite is true for boilers).

Refrigerators

• The savings associated with refrigerator replacement is greater than the previous evaluation (1,001 kWh/year, compared to 661 kWh/year)

Programs to which the Results of the Study Apply:

Residential EnergyWise Single Family

Evaluation Recommendations included in the study:

Recommendation 1: Use the ex post results determined through this evaluation as ex ante savings for future program years. The results of this impact evaluation reflect the most recent and relevant set of gross savings values for the measures installed through HES. While the PAs will likely continue to evolve how they serve their residential customers programmatically, these savings represent the best estimates of future measure-specific savings for single-family family customers in Massachusetts. The evaluation team therefore recommends the PAs use the results included in this evaluation as part of ongoing three-year planning efforts. This includes the LV- and weatherization-specific realization rates contained in this report.

Recommendation 2: Investigate programmable and wi-fi thermostats further. The evaluation team's thermostat-related recommendation consists of two parts. First, the current design of HES allows Energy Specialists and HPCs to leave uninstalled thermostats with participants. If future iterations of HES continue this practice, the evaluation team recommends that PAs estimate a thermostat installation rate as part of the next evaluation. Second, this evaluation—as well as the previous impact evaluation—relied on a literature review to estimate savings for thermostats. Literature reviews offer insight into possible savings generated by programmable and wi-fi thermostats but are not specific to Massachusetts and the customers who participate in HES. Given the increasing importance of thermostats as an energy efficiency and demand response measure, the team recommends the PAs conduct primary research to more definitely understand the impact of these important residential measures in their region.

Explain Whether or Not National Grid Decided to Adopt Recommendations from the Study:

The Company adopted recommended ex-post savings for measures not covered by the previous impact evaluation of the EnergyWise program. A comprehensive impact evaluation is planned in 2020 to revisit savings from the EnergyWise program.

Savings Impact:

The Company adopted recommended ex-post savings for measures not covered by the previous impact evaluation of the EnergyWise program. These measures include oil/propane savings for air sealing kits, showerheads, pipe insulation and programmable thermostats

2013 2014 2015 2018 2019 Sector 2012 2016 2017 Program Study type EnergyWise SF Impact EnergyWise SF HEAT Loan Process Income Eligible SF Impact Income Eligible SF Process EnergyWise MF Impact EnergyWise MF Process Income Eligible MF Impact Income Eligible MF Residential Process Home Energy Reports Impact Home Energy Reports Process EnergyStar Lighting Impact/Market EnergyStar Products Impact HVAC Impact HVAC Market RNC Impact Potential study Market Job Impact Jobs Avoided Cost Benefits Cross-cutting REMI Benefits Market Participation RASS Market Demand Response Impact Pilots Home Energy Monitoring Impact Custom Impact HVAC Impact Industrial Process Impact CAIR Impact Refrigeration, Motors, Other Impact Custom Lighting Impact Street Lighting Impact CDA Impact C&I Electric СНР Impact Prescriptive Lighting Impact Upstream Lighting Impact Upstream Lighting Process Prescriptive HVAC Impact chillers Prescriptive VSD Impact Prescriptive CAIR Impact All NTG Custom Impact C&I Gas Prescriptive Impact MA steam traps All NTG prescriptive Lighting Impact Non-Lighting Electric Impact Small Business HVAC Market All NTG

5. Historical Evaluation Studies

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These studies are available through the EERMC⁴, the PUC⁵, and National Grid.

20	19
Study	Impact Descriptions
NMR, Residential Appliance Recycling Impact Factor Update. April 2019	This study updated gross savings, realization rate and net savings estimates for refrigerator and freezer recycling offered through ENERGY STAR Products program.
NMR, Delta Watts Update. April 2019. (Leveraged study from MA)	This MA study updated delta watts for general service lamps, specialty and reflectors. Rhode Island adopted the results to update gross savings calculation for its Residential Upstream Lighting program.
NMR, RLPNC 17-9 2019-21 Planning Assumptions: Lighting Hours-of-Use and In-Service Rate. July 2018. (Leveraged study from MA)	This study recommended planning values for hours of use and in-service rates for general service lamps, specialty and reflectors. Rhode Island adopted the results to update impacts for its Residential Upstream Lighting program.
NMR, RLPNC 17-3 Advanced Power Strip Metering Study (Revised). March 2019. (Leveraged study from MA)	This study yielded recommended gross electric savings and realization rates from advanced power strips offered through the Home Energy Services and upstream programs. Rhode Island adopted the result from this study to inform savings for Tier 1 and Tier 2 advanced power strips offered through its Retail Products program.
Navigant, Wifi Thermostat Impact Evaluation Secondary Research Study. September 2018. (Leveraged study from MA)	This study recommended annual savings values of 31 therms for combustion heating, 97 kWh for electric resistance heating, and 64 kWh for central air conditioning for Wifi thermostats. Rhode Island adopted these results to update savings assumptions for Wifi thermostats in HVAC and residential retrofit programs.
DNV-GL, Impact Evaluation of PY2016 Custom Gas Installations. Anticipated September 2019.	The study updated realization rates for custom gas projects, as part of a study leveraging the MA study of the same program element.
DNV-GL, Impact Evaluation of PY2016 Custom Electric Installations. Anticipated September 2019.	The study updated realization rates for custom electric projects, as part of a study leveraging the MA study of the same program element.

⁴ <u>https://rieermc.ri.gov/plans-reports/evaluation-studies/</u> ⁵ <u>http://www.ripuc.org/</u>

20	18
Study	Impact Descriptions
Energy & Resource Solutions, Two-Tier Steam Trap Savings Study. April 2018.	This MA study recommends a two-tier approach for prescriptive steam traps. It calculates deemed savings to be 8.4 MMBtu/yr for system operating pressure ≤15 psig, and 35.6 MMBtu/yr for system operating pressure is >15 psig.
DNV GL, Impact Evaluation of PY 2015 Rhode Island Commercial and Industrial Upstream Lighting Initiative. September 2018.	The study updated impact factors for the Upstream Lighting initiative. The RI study leveraged the MA study of the same initiative.
DNV GL, Rhode Island Commercial & Industrial Impact Evaluation of 2013-2015 Custom Comprehensive Design Approach. October 2018.	The study updated the realization rate for the CDA initiative. The RI study leveraged the MA study of the same initiative.
DNV GL, Impact Evaluation of PY2016 RI C&I Small Business Initiative: Phase I. June 2019.	The study updated impact factors for the Small Business initiative. The RI study leveraged the MA study of the same initiative.
DNV GL, Prescriptive C&I Loadshapes of Savings. March 2018.	This MA study pooled known sources of 8,760 savings loadshapes in an interactive tool to estimate general prescriptive measure loadshapes over customizable time periods.
DNV GL, P78 Upstream LED Net-to-gross Analysis. August 2018.	This MA study updated net-to-gross values for the C&I Upstream Lighting initiative for 2019, 2020, and 2021.
DNV GL, P86 Lighting Hours of Use Study. April 2019.	This MA study used lighting hours of use data from several previous studies to determine hours of use by building type for the C&I Upstream Lighting program.
DNV GL, P81 Process Evaluation of C&I Upstream Lighting Initiative. September 2018.	The MA study updated in-service rates for the C&I Upstream Lighting initiative.
Illume Advising LLC, Rhode Island Statewide Behavioral Evaluation: Savings Persistence Literature Review. January 2018.	This study reviewed the existing research on the persistence of savings generated by HERs with particular attention to the applicability of each study to Rhode Island. The study explored potential impacts on the HER program when reducing the cadence of reports.
Synapse Energy Economics, Avoided Energy Supply Components in New England 2018 Report. March 2018.	This study developed new estimates of avoided costs associated with energy efficiency measures for program administrators throughout New England States. Rhode Island used the avoided costs of energy, capacity, natural gas, fuel oil, environmental costs and demand reduction induced price effects resulting from this study for 2019 program planning.

Navigant, 2017 Seasonal Savings Evaluation.	This study evaluated the Nest thermostat
March 2018.	optimization program offered in Massachusetts
	and Rhode Island. The study found that the
	program achieved energy and demand savings of
	57 MWh and 134 kW, respectively, in Rhode
	Island
Navigant, 2017 Residential Wifi Thermostat	This study evaluated the controllable thermostats
Demand Response. April 2018.	as a demand response technology offered
	through Massachusetts and Rhode Island
	ConnectedSolutions programs. The study found
	average demand savings of 0.44 kW per
	thermostat in Massachusetts and 0.52 kW per
	thermostat in Rhode Island.
NMR, Rhode Island Lighting Market Assessment.	This Residential study estimated lighting
July 2017	saturation and other critical market indicators in
	Rhode Island and included a detailed comparison
	to Massachusetts. The study concluded that the
	two markets are substantially similar, therefore
	Rhode Island can use the results from the recently
	completed net-to-gross consensus study in MA to
	inform program planning for the Residential
	Upstream Lighting program.
Research Into Action, Rhode Island HEAT Loan	This study assessed the extent to which HEAT
Assessment. December 2018	Loan encourages uptake of weatherization and
	HVAC projects through the EnergyWise program.
	Findings from this study will be used to inform
	program planning and support future potential
	studies in Rhode Island.
NMR, Rhode Island Residential Appliance	This study developed an inventory of residential
Saturation Survey. October 2018	end-uses, including appliances, consumer
	electronics, neating and cooling equipment,
	thermostats, water heating, and building
	characteristics. Findings from this study will be
	future notantial studies in Bhada Island
Cadeo Bhada Island Impact Evaluation of Income	This study deemed savings values and realization
Cadeo, Rhode Island Impact Evaluation of Income	rates for electric and gas participants using hilling
	and anging analysis. The Company adopted
2018	the deemed sovings values in the 2010 program
	nlan
NMR BIDNC 17-11 LED Net-to-Gross Consonsus	This study yielded recommended prospective pot
Panel Report June 2018 (Leveraged study from	to-gross ratios for 2019 to 2021 for the
$M\Delta$	Residential Unstream Lighting program in MA
	Rhode Island adonted the NTG established for
	2019 and 2020 due to similarity in lighting market
	condition

NMR, RLPNC 18-5 Home Energy Assessment LED Net-to-Gross and EUL Consensus, July 2018	The study yielded recommended net-to-gross and estimated useful life for direct installed LED bulbs
(leveraged study from MA)	offered through the Home Energy Services
	Initiative in Massachusetts. Rhode Island adopted
	the results from this study to inform 2019 and
	2020 planning for the Residential EnergyWise
NMP PLDNC 18 4 Products Not to Gross	program.
Consensus Study August 2018 (Leveraged study	Residential Retail products for 2019 to 2021 in
from MA)	Massachusetts. Rhode Island adopted the results
- ,	from this study to inform 2019 and 2020 planning
	for the Residential Products program.
Navigant, MA Residential Electric Loadshape and	This study collected saturation, penetration and
Baseline Study (Heating and Cooling Season	usage behavior data for all major electric and gas
report). July 2018. (Leveraged study from MA)	appliances in Massachusetts. Rhode Island
	this study
NMR, RLPNC 17-4/17-5 Products Impact	This study vielded estimates of in-service rates
Evaluation of In-service and Short-term Retention	(ISRs) and short-term retention rates for products
Rates Study. March 2018. (Leveraged study from	currently offered through the Residential
MA)	Consumer Products Core Initiative or the Mass
	Save [®] Home Energy Assessment (HEA) Programs.
	Rhode Island adopted the result from this study to
	Residential Products program
NMR/Tetra Tech, TXC34 Massachusetts	This study yielded recommended net-to-gross
Residential HVAC Net-to-Gross and Market Effects	ratios for selected heating, cooling, and water
Study. July 2018. (Leveraged study from MA)	heating measures that will receive Mass Save®
	Standard rebates in 2019-2021. Rhode Island
	adopted the result from this study to inform
	savings for measures offered through Residential
Tetra Tech, Market-Rate Multifamily NEL – Phase L	This MA study reviewed non-energy impacts
Final Memo. March 2018.	associated with market-rate multifamily
	properties, including whether or not any
	additional NEIs should be applied, whether NEI
	values differ based on type and ownership of
	building, and whether there is double counting of
Totra Tach Non Energy Impact Framework Study	NEIS.
Report January 2018	and had the following recommendations: do not
	count existing property value NEIs, review the
	BCR-model-related differences highlighted in the
	study and determine whether there is a reason
	for each, and, in cases where an NEI for one
	initiative or measure is applied to a different
	initiative or measure, provide clear public
	documentation of now the decision was made.

DNV GL, NMR Group, Tetra Tech, Massachusetts Commercial and Industrial Upstream HVAC/Heat Pump and Hot Water NTG and Market Effects Indicator Study. September 2018.	 This MA study updated NTG for the following upstream equipment: Ductless mini-split heat pumps Electric water-source heat pumps Air-cooled unitary/split central air conditioning (>5 tons) Gas-fired storage water heaters between 76,000 and 300,000 BTU/hour Gas-fired tankless water heaters between 180,000 and 199,900 BTU/hour
DNV GL, Evaluation of 2017 Demand Response Demonstration: C&I ConnectedSolutions. February 2018.	This MA study reviewed the baseline application and impacts calculated by the AutoGrid system, examine the effectiveness of the Connected Solution baseline, and assess ex-post impacts. It was also designed to understand customer acceptance and experience with the intervention, readiness of systems for larger deployment, and PA and vendor success in delivery.
20	017
Study	Impact Descriptions
ILLUME Advising, LLC, Rhode Island Home Energy Report Program Impact and Process Evaluation. August 2017	This study estimated realization rates for electric and gas savings for program years 2014 to 2016 using a billing analysis. The realization rates from this study were adjusted to remove potential double counted savings from HER and other energy efficiency programs.
Navigant, Rhode Island Energy Efficiency Program Customer Participation Study – Phase 1, October 2017	The study characterized participants and non- participants in several energy efficiency programs and identified customers that can be potentially targeted to increase participation.
NMR, 2017 Rhode Island Single-Family Code Compliance/Baseline Study, July 2017	This study yielded the final agreed upon baseline values to update the User Defined Reference Home (UDRH) in Rhode Island
ICF, 2017 Rhode Island Residential Code Savings Analysis	This study found that the average Rhode Island home could attain annual electric savings of 3,690 kWh and gas savings of 10 MMBtu if it fully complied with the state's building energy code.
NBI, 2017 Rhode Island Commercial Code Savings Analysis	This study found that the average Rhode Island commercial building could attain annual electric savings of 0.73 kWh/sf and gas savings of 0.90 MMBtu/sf if it fully complied with the state's building energy code.

NMR, 2017 Rhode Island Code Compliance	The study found residential and commercial
Enhancement Initiative Attribution and Savings	attribution factors of 23% and 46, respectively,
Study	which were used along with study results on
	average savings as well as construction activity
	projections to calculate the CCEI's projected
	savings from 2018-2020.
Peregrine Energy Group, Analysis of Job Creation	A study of the job impacts of National Grid's
from 2016 Expenditures for Energy Efficiency in	energy efficiency programs delivered to Rhode
Rhode Island by National Grid, April 2017	Island electricity and natural gas customers in
	2016. The study estimated that 702 FTE workers,
	across 923 companies and agencies were
	employed in 2016 as a result of investments
	energy efficiency programs in Rhode Island.
New Buildings Institute, Energy Impacts of	This study quantified the energy impacts of
Commercial Building Code Compliance in Rhode	energy code compliance patterns from field data
Island, July 2017	collection and analysis of building characteristics.
The Cadmus Group, Inc., Ductless Mini-Split Heat	This study estimated savings from various types of
Pump Impact Evaluation, 2016	heat pumps.
DNV-GL, Impact Evaluation of 2014 Custom HVAC	The study updated realization rates for custom
Installations, September 2017	electric HVAC projects, as part of a study
	leveraging the MA study of the same program
	element.
DNV-GL, 2014 RI Custom Process Impact	The study updated realization rates for custom
Evaluation, December 2017	process projects, as part of a study leveraging the
	MA study of the same program element.
TetraTech, C&I Programs Freeridership & Spillover	This study updated free-ridership and spillover
Study, September 2017	values for the C&I electric and gas programs.
DNV-GL, MA C&I Steam Trap Evaluation Phase 2,	This study updated steam trap savings estimates.
Feb, 2017	
DNV-GL, Gas Boiler Market Characterization Study	This study updated C&I condensing boiler savings
Phase II: Final Report, March 2017	
DNV-GL, MA45 Prescriptive Programmable	Inis study updated programmable thermostat
Thermostats, March 2017	deemed gas savings for C&I programs.
20	116
Study	Impact Descriptions
DNV-GL, Impact Evaluation of 2014 Custom Gas	This study yielded an energy realization rate for
Installations in Rhode Island	Custom Gas projects.
Final Report, July 2016	
DNV-GL, Impact Evaluation of 2014 RI Prescriptive	This study yielded an energy realization rate for
Compressed Air Installations	prescriptive compressed air compressors, dryers,
Final Report, July 2016	and EE accessories.
DINV-GL, Impact Evaluation of 2012 National Grid-	inis study yielded an energy realization rate for
Knode Island Prescriptive Chiller Program	prescriptive chillers.
L Final Report, July 2016	1

DNV-GL, Multifamily Impact Evaluation, National Grid Rhode Island, January 2016	This study estimated realization rates for electric and gas savings for 2013 participants using a billing analysis. The results include a low level of precision and thus the realization rates are not applicable. The Company has been improving
	processes in line with the study's
	recommendations.
Research Into Action, National Grid Rhode Island	This study surveyed customers, vendors,
EnergyWise Single Family Process Evaluation,	contractors, and lending agencies to order to
August 2016	assess customer experience, HEAT Loan lender
	perspectives on the program, performance of the
	lead vendor and sub-contractors and lessons
	learned from programs elsewhere in the country.
DNV-GL, Impact Evaluation of 2014 EnergyWise	This study estimated deemed savings values and
Single Family Program, National Grid Rhode	realization rates for electric and gas 2014
Island, August 2016	participants using billing and engineering analysis.
	The Company adopted the deemed savings values
	in the 2017 program plan.
Massachusetts Special and Cross-Cutting Research	This study developed Non Energy Impacts for low
Area: Low-Income Single-Family Health- and	Income programs, based on USODE's
Safety-Related Non-Energy Impacts (NEIS) Study.	Weatherization Assistance Program tailored to
the Massachusetts Program Administrators	war prior values primarily based on avoidance of
August 5, 2016	deaths due to thermal stress
Cadmus Group: Large Commercial and Industrial	National Grid commissioned this study to evaluate
On-Bill Repayment Program Evaluation	the financing component of the large commercial
September, 2016	and industrial (ICI) energy efficiency program.
	Cadmus evaluated the program design.
	performance, and sustainability: the overall
	market for the program; and the program's
	penetration of that market to date.
Ductless Mini-Split Heat Pump (DMSHP) Final	Heating and cooling memos that describe the
Heating Season Results; Ductless Mini-Split Heat	number of full load hours found with field
Pump (DMSHP) Cooling Season Results, COOL	installed systems in MA and RI; these hours were
SMART Impact Evaluation Team, 2015 / 2016	used with historic data on incentivized systems to
	come up with average savings per unit.
DNV GL, Stage 2 Results—Commercial and	The purpose of this study was to quantify the
Industrial New Construction Non-Energy Impacts	dollar value of participant NEIs for C&I NC projects
Study—Final Report, prepared for the	completed in 2013, and to estimate gross NEIs per
Massachusetts Program Administrators, March	unit of energy savings resulting from NC electric
2016	and gas measures separately.

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20	015
Study	Impact Descriptions
Cadmus, Inc., High Efficiency Heating Equipment Impact Evaluation: Final Report, March 2015	The study determined revised deemed savings values for each furnace and boiler measure, including condensing boilers and early replacement of heating equipment. The study also reflected the increasing baseline for standard efficiency heating equipment.
DNV-GL, Retrofit Lighting Controls Measure Summary of Findings: Final Report (MA), October 2014	The study examined trends in lighting control savings and noted a decrease in savings over previous program years. It recommended updated coincidence factors as well as potential program and technology areas that may yield higher savings. Finally, the study recommended a change in the savings calculation algorithm for lighting controls.
Tabors Caramanis Rudkevich, Avoided Energy Supply Costs in New England: 2015 Report, April 2015	This study developed new estimates of avoided costs for application in 2016 through 2018 energy efficiency programs throughout the six New England states. Avoided costs were developed for natural gas, electric energy, electric capacity, demand reduction induced price effects (DRIPE), other fuels (oil, propane and wood), and carbon.
DNV-GL, Massachusetts 2013 Prescriptive Gas Impact Evaluation; Steam Trap Evaluation Phase 1, March 2015	The study concluded that there should continue to be both prescriptive and custom pathways for steam trap retrofit incentives, and further recommended that a group convene to review and revise the deemed savings estimate for steam traps. The study also recommended the use of a six year lifetime for steam traps.
Cadmus, Inc., LED Incremental Cost Study – Modeling LightTracker LED and Halogen Pricing Data, June 2015	This memo summarizes selected findings from the LightTracker LED, CFL, and halogen pricing data modeling effort and the resulting state-level price forecast through 2020 for LED, CFL, and halogen bulbs. These results are based on light bulb price data from 25 states that lacked LED programs from 2009 to 2014.
Cadmus, Inc., Cool Smart Incremental Cost Study: Final Report, July 2015	This incremental cost study estimates how manufacturing production costs (MPCs) and purchase prices of residential air conditioning (AC) and heat pump (HP) equipment change as equipment efficiency increases. The results support Cool Smart program enhancements and cost-effectiveness analysis, as well as potential upstream residential upstream heating, ventilation and air conditioning (HVAC) incentive programs.

Codesus las Lighting Interpative Effects (tudy	This many dataila the musliminant findings of the
Cadmus, Inc., Lighting Interactive Effects Study	This memo details the preliminary findings of the
Preliminary Results – Draft, April 2015	Lighting Interactive Effects study evaluated for the
	Massachusetts (MA) Program Administrators to
	better understand and report the true impact of
	energy efficient lighting retrofits. It recommended
	factors for electric and gas energy to be applied to
	residential program savings.
20	14
Study	Impact Descriptions
DNV GL, 2014, Impact Evaluation of National Grid	The evaluation examined the gas and water
Rhode Island C&I Prescriptive Gas Pre-Rinse Spray	savings associated with the installation of
Valve Measure	reduced-flow pre-rinse spray valves. The results
	are based on site measurements from MA and RI
	facilities. The final gross gas and water savings are
	11.4 MMBtu and 6.410 gallons per spray valve
	respectively
NMR Group Inc. Northeast Residential Lighting	This multi-State study provided updated hours-of-
Hours-of-lise Study	use assumptions for residential lighting programs
	in various room types
The Cadmus Croup, Impact Evaluation: Phode	This PL specific impact evaluation focused on the
Intercountus Group, Impact Evaluation. Knoue	This Ri-specific impact evaluation focused on the
Island Income Eligible Services, volume II	electric and gas savings resulting from the
	participation of these dwellings in in-nome
The Cadmus Group, National Grid Income Eligible	retrofit of electrical components and
Services Process Evaluation	weatherization of electric, gas, and fossil fuel
	heated homes. It used billing analysis, engineering
	reviews, and interviews for the process
	components.
National Grid, Macroeconomic Impacts of Rhode	This study quantifies the macroeconomic impacts
Island Energy Efficiency Investments	of National Grid's 2014 EE Program Plan for
REMI Analysis of National Grid's Energy Efficiency	Rhode Island and provides updated economic
Programs	impact multipliers to quantify the benefits of
	future EE programs in the Rhode Island economy.
	This updates the multipliers from an economic
	impact study conducted by Environment
	Northeast (ENE) in 2009.
20	13
Study	Impact Descriptions
KEMA, Inc., Impact Evaluation of 2011 Rhode	The Custom and Prescriptive Lighting studies
Island Prescriptive Lighting Installations	involved the impact evaluation of components of
	the Large Commercial and Industrial electric
	efficiency programs. The studies included on-site
KEMA Inc. Impact Evaluation of 2011 Rhode	engineering and end-use metering of a statistically
Island Custom Lighting Installations	drawn random cample of participants. The custom
	portion of the study was coupled with the results
	for the study was coupled with the results
	or the 2013 Massachusetts Custom Lighting study.

KEMA, Inc., Impact Evaluation of 2011 Prescriptive	On-site monitoring and verification of installation
Gas Measures	provided updated impacts for four major
	prescriptive gas measures. Programs and
	measures are similar between National Grid
	affiliates in MA and RI, and results are applied to
	RI. The overall realization rate for the four
	measures was approximately 102% and the
	relative precision was about ±15%.
KEMA, Inc., and DMI, Inc., Impact Evaluation of	This evaluation provided a new estimate of the
2011-2012 Prescriptive VSDs	impacts of prescriptive variable speed drives,
	based on pre-post metering of measures installed
	in 2011 and 2012. Programs and measures are
	similar between National Grid affiliates in MA and
	RI, and results are applied to RI. Key findings
	include an annual kWh realization rate was 94%
	with a relative precision of +/- 23%, and
	identification of factors that influenced the
	realization rate.
The Cadmus Group, Inc., 2012 Residential	The results of this study yielded updated net-to-
Heating, Water Heating, and Cooling Equipment	gross factors and estimates of the timing of
Evaluation: Net-to-Gross, Market Effects, and	and cooling moasures. Programs and moasures are
	similar between National Grid affiliates in MA and
	BL and results are applied to BL
KEMA. Inc., Impact Evaluation of 2010 Prescriptive	RI, and results are applied to RI. The RI Prescriptive lighting study listed above did
KEMA, Inc., Impact Evaluation of 2010 Prescriptive Lighting Installations	RI, and results are applied to RI. The RI Prescriptive lighting study listed above did not examine case lighting separately from other
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KEMA, Inc., Impact Evaluation of 2010 Prescriptive Lighting Installations Opinion Dynamics (2013). Massachusetts Cross-	RI, and results are applied to RI. The RI Prescriptive lighting study listed above did not examine case lighting separately from other lighting systems. To complement the RI-specific results, this MA study provided impact updates on case lighting. This study provided an updated realization rate for
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KEMA, Inc., Impact Evaluation of 2010 Prescriptive Lighting Installations Opinion Dynamics (2013). Massachusetts Cross- Cutting Behavioral Program Evaluation Integrated Report. 20 Study TetraTech, Final Report – Commercial and	RI, and results are applied to RI. The RI Prescriptive lighting study listed above did not examine case lighting separately from other lighting systems. To complement the RI-specific results, this MA study provided impact updates on case lighting. This study provided an updated realization rate for savings from gas customers who participate in the Opt-out channel of the Home Energy Reports program. 12 Impact Descriptions This report provides a comprehensive set of
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KEMA, Inc., Impact Evaluation of 2010 Prescriptive Lighting Installations Opinion Dynamics (2013). Massachusetts Cross- Cutting Behavioral Program Evaluation Integrated Report. 20 Study TetraTech, Final Report – Commercial and Industrial Non-Energy Impacts Study, (prepared for Massachusetts Program Administrators), June 29, 2012	RI, and results are applied to RI. The RI Prescriptive lighting study listed above did not examine case lighting separately from other lighting systems. To complement the RI-specific results, this MA study provided impact updates on case lighting. This study provided an updated realization rate for savings from gas customers who participate in the Opt-out channel of the Home Energy Reports program. 12 Impact Descriptions This report provides a comprehensive set of statistically reliable Non-energy impact (NEI) estimates across the range of C&I prescriptive and custom retrofit programs offered by the MA electric and gas Program Administrators (Pas). The analytical methods used allow this report's findings to be applicable to RI.

2011	
Study	Impact Descriptions
KEMA, Inc., C&I Lighting Loadshape Project, Prepared for the Regional Evaluation, Measurement, and Verification Forum, June 2011.	A compilation of lighting loadshape data from the Northeast. The study provided updated coincidence factors for the Energy Initiative and Small Business Lighting programs. The Small Business program summer coincidence factor went from 0.80 to 0.79, while the Energy Initiative summer coincidence went from 0.88 to 0.89
KEMA, Inc., C&I Unitary HVAC Loadshape Project Final Report, Prepared for the Regional Evaluation, Measurement, and Verification Forum, June 2011.	From end use metering, the study produced updated diversity and equivalent full load hours for unitary HVAC measures
2010	
Study	Impact Descriptions
ADM Associates, Inc., Residential Central AC Regional Evaluation, Final Report, October 2009	kWh and kW savings figures for the installation of efficient residential CAC systems
2007	
Study	Impact Descriptions
RLW Analytics, Small Business Services Custom Measure Impact Evaluation, March 23, 2007	Verification of energy savings from custom lighting projects in the Small Business Services program.
RLW Analytics, Impact Evaluation Analysis of the 2005 Custom SBS Program, May 29, 2007	Realization rates for the Small Business Services program