2024 Evaluation, Measurement, and Verification Plan

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1 Introduction

Evaluation, Measurement, and Verification (EM&V) is an integral and required part of Rhode Island Energy'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 also 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 projects, markets, and energy efficiency programs while leveraging as many resources as possible from evaluation studies in other jurisdictions 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 types of evaluation may include (but not limited to) the following:

- **Impact Evaluations:** Comparisons of claimed savings against actual realized savings using methods such as literature review, billing analyses, engineering methods and onsite data logging as a means of verification.
- **Process Evaluations:** Broad examinations of existing practices, such as program delivery methods, for the purpose of gathering information to draw conclusions about effectiveness of existing processes, highlight best practices, and offer suggestions for future improvements.
- **Market Assessment Studies:** Broad studies aimed at assessing changes in market conditions, such as evolving adoption rates of current energy efficiency technologies.
- **Net-to-Gross Evaluations:** Studies aimed at quantifying the rate of free-ridership and spillover associated with energy efficiency participants and non-participants.

  The free-ridership rate is the percentage of savings attributable to participants who would have installed the measures in the absence of program intervention while spillover includes the effects of two components:

  1. Participants in the program who install additional energy efficient measures outside of the program as a result of participating in the program, and
  2. Non-participants who install the installation of energy efficient measures as a result of being aware of the program

The study methodologies and savings assumptions from evaluation studies are documented in the Rhode Island Technical Reference Manual (TRM). The TRM is reviewed and updated annually to reflect changes in technology, baselines, and evaluation results.

The entire evaluation process is managed by the Company in consultation with the Rhode Island Energy Efficiency & Resource Management Council (EERMC) and the Office of Energy Resources (OER). The EERMC and OER follows each study closely and is involved in planning, work plan development, and review of interim work products and study results.

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

2 Evaluation Studies Applicable to 2024

2.1 Overview

The Company, with input from EERMC and OER, expects to complete thirteen Rhode Island-specific evaluation studies in 2023 that will be applied beginning in 2024 (see Section 2.2 below). The research studies include impact evaluations, process evaluation, and market studies in the residential and commercial and industrial (C&I) sectors, as well as studies that are considered cross-cutting.

A complete list of historical research studies is provided in Section 4 along with a brief summary of the impact of those results in planning the Company's programs. Most of these studies are posted on the EERMC website.[1] Prior year studies that have been superseded by studies completed since the filing of the 2023 Energy Efficiency Plan have been removed from this list.

Section 5 provides detailed descriptions, findings, and recommendations of each of the Rhode Island-specific studies listed in the next section, along with selected research studies completed in other regions and/or other jurisdictions. The results of the evaluations from other regions and jurisdictions, most commonly Massachusetts,[2] have been judged by the Company, in consultation with EERMC and OER, to be applicable to Rhode Island's energy efficiency programs. The Company is adopting the results of these studies in 2024 program planning due to similarity, either in the measures offered, or program structure or delivery.

2.2 Recent Rhode Island-Specific studies

Commercial

- Small Business Process Evaluation (RI-22-CX-Proc, In progress)
- C&I New Construction Baseline Study (RI-22-CX-Codes, In progress)
- Automated RTU Optimization Demonstration Evaluation (RI-22-CX-RTUOpt, In progress)
- Impact Evaluation of PY2021 Custom Gas Installations (RI-22-CG-CustGasPY21, In progress)
- Impact Evaluation of PY2021 Custom Electric Installations (RI-22-CE-CustElecPY21, In progress)
- C&I Free-Ridership and Spillover Study (RI-23-CX-FRSO, In progress)
- Commercial Cooking Gas and Electric Impact Evaluation (RI-23-CX-CommCook, In progress)

Residential and Income-Eligible

- Residential New Construction and Code Compliance Study (RI-21-RX-CSNC, Completed)
- Nonparticipant Characterization and Segmentation Research (RI-23-RX-NPSegmentation, In progress)

[1] https://rieermc.ri.gov/resources/ then scroll to "EM&V Studies."
[2] Prior to May 2022, Narragansett Electric Company was part of National Grid, which has affiliates in Massachusetts, and which facilitated the leveraging of evaluation studies.

- Participation Study Dashboard Update (RI-23-RX-Dashboard, In progress)
- EnergyWise PY 2021 Impact Evaluation Study (RI-23-RX-EWisePY21, In progress)

Cross-cutting

- Comprehensive Measure Life Review (RI-23-XX-Lifetime, In progress)
- Rhode Island Energy Efficiency Workforce Development Needs Assessment (RI-22-XX-WorkDev , Completed)

2.3 Recent Studies Adopted from Other Jurisdictions

The company will not be adopting any studies from other jurisdictions at this time.

3 2024 Planned Evaluation Studies

3.1 Overview

This section describes planned studies that focus on areas of interest to the Rhode Island Energy energy efficiency programs and build on the deep history of evaluation studies commissioned by the Company over numerous years. 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 Company will consider avenues to participate in Massachusetts studies.[3]

3.2 Summary

Table 2 lists evaluation studies that the Company plans to conduct in 2024 to inform the 2025 Annual Plan and future planning cycles. Barring changes to the 2025 Annual Plan schedule, studies that will be incorporated into the Annual Plan must be completed by August 2024. The proposed budget for evaluation study expenditures in 2024 is approximately $2.8 million ($2.2 million for electric and $0.6 million for gas), excluding staffing costs. The proposed budget for EM&V comprises approximately 1.5% of the total portfolio budget in 2024.

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.

Table 1. Study Labeling Code Format

[State]	–	[Year Study Conducted]	–	[Sector]	[Fuel]	–	[Keyword]
RI		21 22 23		R = residential C = commercial X = cross sector	E = electric G = gas X = electric & gas		

[3] Despite no longer being part of National Grid, the Company plans to stay abreast of the voluminous Massachusetts evaluation activities that may be beneficial and applicable in Rhode Island and follow through as appropriate.

Table 2. Planned Evaluation Studies in 2024

Sector	Study Code	Type	Affected Programs	Study Name	State Lead
C&I	RI-24-CE-Lighting	Impact	C&I Elec	Impact Evaluation of Upstream or Downstream Prescriptive C&I Lighting	RI
C&I	RI-24-CX-CustProcessEval	Process	C&I	Process Evaluation of Custom Approach	RI
C&I	RI-23-CG-CustGasPY22	Impact	C&I Gas	Impact Evaluation of Custom Gas Installations	RI
C&I	RI-23-CE-CustElecPY22	Impact	C&I Elec	Impact Evaluation of Custom Electric Installations	RI
Cross-cutting	RI-24-XX-CCEI	Impact	C&I Elec	Impact Evaluation of Code Compliance Enhancement Initiative	RI
Cross-cutting	RI-23-XX-AESC24	Value	All Elec; All Gas	2024 Avoided Energy Supply Component Study 2024	RI
Residential	RI-24-RX-IncEligible	Impact	Residential	Impact Evaluation of Income Eligible Program	RI
Cross-cutting	RI-24-XX-StandardsSavings	Impact	All Elec; All Gas	Appliance Standards Gross Savings Review	RI
C&I	RI-24-CX-CINCProcess	Process	C&I	Process Evaluation of C&I New Construction Program	RI
C&I	RI-24-CX-ISPResearch	Impact	C&I	Commercial and Industrial Industry Standard Practice Research	RI
Cross-cutting	RI-24-XX-MultiFamCustom	Impact	All Elec; All Gas	Impact Evaluation of Multifamily Custom Approach	RI
Residential	RI-24-RX-MarketResearch	Market	Residential	Residential Market Research	RI
C&I	RI-24-CX-MarketResearch	Market	C&I	Commercial and Industrial Market Research	RI
C&I	RI-24-CX-SBDashboard	Market	Residential	Small Business Data Dashboard	RI
Cross-cutting	RI-24-XX-MeasureLife2	Impact	All Elec; All Gas	Comprehensive Measure Life Review, Phase II	RI

The evaluation pathway for pilots, demonstrations, and assessments is based on each effort's scale, budget, scope, and the availability of external data. The Company's EM&V team will provide guidance beginning at the Plan stage for all pilots, demonstrations, and assessments to ensure design and data collection are suitable to allow for effective evaluation. In cases where an independent evaluation is appropriate, the EM&V team will run the evaluation. For guidelines on the stakeholder review process and which pilots, demonstrations, and assessments will receive an independent evaluation, please see Attachment 8. The evaluation will follow the same established evaluation framework used in evaluations of established programs. This includes management of the independent evaluation vendor by the

Company's EM&V team in consultation with the EERMC and OER. See Attachment 8 for further details on pilots, demonstrations, and assessments.

The EM&V team will follow the Company's standard procurement policy that cuts across programs 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 the procurement organization that securing multiple bids is not possible or practical.

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.[4]

3.3 Commercial and Industrial Planned Studies

RI-23-CG-CustGasPY22 - Impact Evaluation of PY2022 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 2022. This will continue 'rolling' evaluation efforts, where each year will evaluate roughly 1/3 of the number of sites needed for a full sample and results will be combined with results from the previous two years, which will keep the realization rates updated yearly. This study began in summer 2023 and will continue into 2024 at which time a new cohort from 2023 will be studied.

RI-23-CE-CustElecPY22 – Impact Evaluation of PY2022 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 realization rates for custom electric energy efficiency offerings based on installations from 2022. This will continue 'rolling' evaluation efforts, where each year will evaluate roughly 1/3 of the number of sites needed for a full sample and results will be combined with results from the previous two years, which will keep the realization rates updated yearly. This study began in spring 2023 and will continue into 2024 at which time a new cohort from 2023 will be studied.

[4] https://rieermc.ri.gov/plans-reports/evaluation-studies/

RI-24-CE-Lighting - Impact Evaluation of Midstream or Downstream Prescriptive C&I Lighting

Lighting efficiency continues to be a significant contributor to savings in the C&I Electric portfolio, and it has been five years or more since C&I lighting was studied in an impact evaluation. The Company will review achieved savings in 2023 and identify whether the evaluation will focus on midstream or downstream lighting programs.

RI-24-CX-CustProcessEval - Process Evaluation of Custom Approach

Commercial and Industrial custom projects continue to be a major contributor to overall savings. The Company has many strategies for reaching customers through the custom pathway and, in addition, there are several additional administrative process steps needed in the custom pathway. This study will review both the outreach and administrative processes and develop recommendations for process improvements that may ultimately lead to greater amounts of participation and savings. A similar study is being launched in Massachusetts and it is believed that it may be possible to leverage survey instruments from that study.

RI-24-CX-CINCProcess - Process Evaluation of C&I New Construction Program

The Commercial and Industrial New Construction market continues to offer opportunities for savings. The Company's process to effectively intervene in this market will be reviewed in this study with the objective of more effectively influencing New Construction efficiency projects.

RI-24-CX-ISPResearch - Commercial and Industrial Industry Standard Practice Research

The objective of this study is to better understand what the baseline or industry standard practice (ISP) is for certain technologies. Potential areas of investigation are air compressors, where many projects use load/no load as the baseline but VFD (variable frequency drive) compressors are ever more common and could be standard practice. There may be an opportunity to study compressor ISP jointly with Massachusetts. Another potential area is a cannabis grow facility ISP study, particularly with regards to horticulture lighting. This is an emerging area in the state with great potential for efficiency. However, since it is emerging, there are varying views about what baseline practices are. These questions could be resolved with an ISP study.

RI-24-CX-MarketResearch - Commercial and Industrial Market Research

This research may focus on a few different areas: it may focus on the lighting market to understand more concretely how much fluorescent is left and controls is left to do. Updated data collection should help plan future lighting programs in the state. The research may also focus on certain C&I submarkets that have experienced lower than average participation and savings rates in an attempt to understand the particular market drivers and develop strategies for increasing participation and savings.

RI-24-CX-SBDashboard - Small Business Data Dashboard

The focus of the data dashboard would be to collect participant and non-participant data for the small business sector and map it geographically to identify which communities and, potentially, small business subtypes, are underserved. This, in turn, will assist in the development of outreach strategies for this market. A similar dashboard was constructed for the Residential sector and it has been proven to be very helpful.

3.4 Residential and Income-Eligible Planned Studies

RI-24-RX-IncEligible - Income Eligible Impact Evaluation

Rhode Energy has not completed an impact evaluation of this program since 2018 – and that study evaluated the cohort of participants from 2015-2016. The impact values from this study are among the oldest in Rhode Island Energy's residential portfolio and suggest an update using a more recent cohort (likely 2022) is needed.

RI-24-RX-MarketResearch – Residential Market Research

There are several areas of potential interest for additional market research to support delivery of Residential energy efficiency programs. Among these are research into: HVAC market intervention strategies, customer attitudes about electrification of residential cooking, challenges and opportunities of electrification in LMI households, language and access barriers for Residential customers, and follow-ups to the Nonparticipant Characterization and Segmentation Research (RI-23-RX-NPSegmentation) which is focusing on electric heat customers. Research related to electrification will be carefully considered to make sure it is consistent with the Company's energy efficiency implementation efforts.

3.5 Cross-sector or Other Planned Studies

RI-24-XX-CCEI – Impact Evaluation of Code Compliance Enhancement Initiative (CCEI)

This study will calculate claimable savings from CCEI initiative, which involves Company education of code compliance officials. The impacts of the Company's training efforts were last studied in 2017. This study is contingent on an assessment of the Company's continuing role in this effort. While training continues to be relevant with the expected adoption of IECC2024 sometime in 2024, the Company will first assess whether it has a unique role to continue to deliver training.

RI-23-XX-AESC24 – 2024 Avoided Energy Supply Component (AESC) Study

Rhode Island Energy participates in the triennial regional AESC Study, as it has done for over 20 years. This study produces the avoided costs the Company uses in cost-effectiveness testing (see Attachment 4) and was last updated in 2021. This study kicked off in August 2023 and a final report is scheduled to be delivered in the first quarter of 2024. Rhode Island Energy will use the results of this study beginning with the 2025 Annual Plan.

RI-24-XX-StandardsSavings - Appliance Standards Gross Savings Review

This study would build from work recently completed in New Jersey and currently underway in Massachusetts to review and estimates of the electric and natural gas savings resulting from the adoption of the Appliance and Equipment Energy and Water Efficiency and Standards Act of 2021 (R.I.G.L § 39-27). The New Jersey and Massachusetts studies have identified concerns with the original estimates produced by the Appliance Standards Awareness Project. This study would apply the revised savings estimates approaches established in New Jersey and Massachusetts to the appliance standards adopted in Rhode Island.

RI-24-XX-MultiFamCustom - Multifamily Custom Measure Impact Evaluation

In 2021, the Residential evaluation team completed a comprehensive process and impact evaluation of Rhode Island Energy's market rate and income eligible multifamily programs. However, that study focused exclusively on the program's prescriptive measures and did not include custom measures, which given the program's position at the nexus of residential and commercial sector, reflect a meaningful portion of total multifamily savings. An impact study focused on custom measures would close this existing evaluation gap.

RI-24-XX-MeasureLife2 - Comprehensive Measure Life Review, Phase II

The Comprehensive Measure Life Review (RI-23-XX-Lifetime) being conducted in 2023 reviewed the measure lives of approximately 60% of the measures in the Company's benefit-cost model, assessed the quality of those measure lives and, where appropriate, recommended updated sources and values. This is an important exercise because the calculation of lifetime benefits created by the programs depend on an accurate assessment of measure lives. Because Rhode Island Energy expanded the number of measures in its model, the 2023 study was not able to review the measure lifetimes for all of the measures. This proposed study will complete the research.

4 Historic Evaluation Studies

This section contains a list of all historic studies still being used by the Company as the basis of claimed savings in the 2023 Program Plan and in the Technical Reference Manual. An at-a-glance summary shows the studies by program, followed by a more detailed table summarizing the relevant studies.

Table 3. Historic Evaluation Studies

Sector	Program	Study type	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024 Plan
Residential	EnergyWise SF	Impact										
	EnergyWise SF	Process				HEAT Loan						
	EnergyWise SF	Market										
	Income Eligible SF	Impact										
	Income Eligible SF	Process										
	EnergyWise MF	Impact										
	EnergyWise MF	Process										
	EnergyWise MF	Market										
	Income Eligible MF	Impact										
	Income Eligible MF	Process										
	Home Energy Reports	Impact										
	Home Energy Reports	Process										
	EnergyStar Lighting	Impact/Market										
	EnergyStar Products	Impact										
	HVAC	Impact							Demo	HP		
	HVAC	Process/Market										
	Connected Solutions	Impact/Process										
Cross-cutting/Special	Potential Study	Market										
	Workforce	Impact/Market										
	Avoided Cost	Benefits										
	Economic Impacts	Benefits										
	Participation	Market										
	Non-Paticipant	Market										
	RASS	Market										
	Gas Peak Demand	Impact										
	Piggybacking Study	Process										
	Heat Pumps Study	Market										
	ES Homes/Codes&Standards	Impact/Market										
	Legislated M&V Study	Market										
	Free Ridership/Spillover	Market										
	Lifetime	Impact										
	C&I NEIs	Impact										
	C&I Cooking	Impact										
	All	Value										
C&I Electric	Custom	Impact										
	HVAC	Impact										
	Industrial Process	Impact										
	CAIR	Impact										
	Refridgeration, Motors, Othe	Impact										
	Custom Lighting	Impact										
	Street Lighting	Impact										
	CDA	Impact										
	CHP	Impact										
	Prescriptive Lighting	Impact										
	Upstream Lighting	Impact										
	Upstream Lighting	Process										
	Prescriptive HVAC	Impact		chillers								
	Prescriptive VSD	Impact										
	Prescriptive CAIR	Impact										
	Connected Solutions	Impact										
	All	Market										
	All	Impact										
	All	Process										
	All	NTG										
C&I Gas	Custom	Impact										
	Prescriptive	Impact	steam trap		steam trap	steam trap						
	All	Market										
	All	Impact										
	All	Process										
	All	NTG										
Small Business	Lighting	Impact	presc.									
	Non-Lighting Electric	Impact										
	All	Process										
	All	Market										
	All	NTG										

These studies are available through the EERMC, the PUC, and Rhode Island Energy.

Table 4. Completed Evaluation Studies Applicable in 2023

2023		
Study	**Impact Descriptions**	**Sector**
Cadeo & NMR, Residential New Construction and Code Compliance Study, May 2023	The study updated the User Design Reference Home baseline measure level efficiencies, observed how building practices have changed over time, and identified the level of code compliance.	Res
Cadeo, Comprehensive Measure Life Review, August 2023 (draft)	The study reviewed prescriptive measure life assumptions and ensured they aligned with recent research, Rhode Island evaluation studies, and industry best practices. The study also recommended measure life updates when appropriate.	Cross-Cutting
2022		
Study	**Impact Descriptions**	**Sector**
DNV, C&I Lighting Market Characterization and Adjusted Measure Life Study, August 2022	The study calculated adjusted measure lives for non-residential custom and prescriptive lighting measures for RI.	C&I
DNV, Impact Evaluation of PY2020 Custom Gas Installations, August 2022	The study updated realization rates for custom gas projects, as part of a rolling effort that incorporated results from PY2018, PY2019, and PY2020.	C&I
DNV, Impact Evaluation of PY2020 Custom Electric Installations, August 2022	The study updated realization rates for custom electric projects, as part of a rolling effort that incorporated results from PY2018, PY2019, and PY2020.	C&I
DNV, Rhode Island Cannabis Industry Standard Practice, August 2022	The study identified industry standard practices for the medical market cannabis industry with a focus on horticultural lighting, lighting controls, cultivation area HVAC, HVAC controls, and dehumidification.	Cross- Cutting
Cadeo, Nonparticipant Market Barriers Study, June 2022	The study characterized the customer groups not participating in Rhode Island Energy's energy efficiency programs, determined barriers to participation, and identified opportunities to engage nonparticipants.	Cross- Cutting

Cadeo, Participation and Multifamily Census Study, June 2022	The study identified trends and drivers in participation and the likelihood of nonparticipants opting into a residential program in the future. The study also developed an algorithm to identify multifamily buildings suitable for RIE's multifamily programs.	Cross- Cutting
Guidehouse, Rhode Island 2021 Energy Efficiency Workforce Analysis – Final Report, May 2022	This study quantified the workforce that was involved in delivering The Narragansett Electric Company's Rhode Island programs in 2021. The workforce analysis reported the number of jobs associated with the programs, compared them to past years, and provided narrative context for those findings and observations.	Cross-Cutting
Guidehouse, Solar Inverter Power Factor Correction Demonstration Evaluation (MA21DR03), May 2022	The purpose of this MA/RI evaluation was to improve power factor via use of the voltage control capacity of solar inverters. The study found that the solar inverter PFC resulted in negative total feeder savings or an increase in kVAh.	Res
DNV, O&M and Non-O&M NEI Study (MA20X10-B-CIOMNEI), October 2021	This study developed O&M and non-O&M non-energy impacts (NEIs) across all C&I measures and programs.	C&I
DNV, 2021 Cross-State Summer DR Program – Final Impact Evaluation Results (MA21DR05-E-C&I), June 2022	The purpose of this study was to present the final impact results for the 2021 summer season of C&I demand response programs.	C&I
DNV, Cross-State C&I Active Demand Reduction Initiative Winter 2020/2021 Evaluation Report (MA21DR02-E), January 2022	The purpose of this study was to assess program initiative impact and identify process improvement opportunities for the 2020/2021 winter season of C&I demand response programs. The study also developed retrospective realization rates for C&I interruptible participants and battery participants.	C&I

2021

Study	Impact Descriptions	Sector

DNV, Impact Evaluation of PY2019 Upstream Lighting Program, July 2021	This study updated prospective realization rates and impact factors for the C&I Upstream lighting program. The values reflect decreasing ISR values for Screw-in products and increasing ISRs for linear products. These will be applicable for 2022, 2023, and beyond.	C&I
DNV, Impact Evaluation of PY2019 Custom Gas Installations, September 2021	The study updated realization rates for custom gas projects, as part of a rolling effort that incorporated results from PY2017, PY2018, and PY2019.	C&I
DNV, Impact Evaluation of PY2018 Custom Electric Installations, September 2021	The study updated realization rates for custom electric projects, as part of a rolling effort that incorporated results from PY2016, MA PY2017/18, and PY2018.	C&I
DNV, Impact Evaluation of PY2019 Custom Electric Installations, September 2021	The study updated realization rates for custom electric projects, as part of a rolling effort that incorporated results from PY2016, PY2018, and PY2019.	C&I
Cadeo, Appliance Recycling Impact Factor Update, June 2021	This study updated the gross kWh savings, realization rates and NTG factors for refrigerator and freezer recycling measures.	Res
DNV, Franchise Controls Deemed Savings Study, March 2021 (Leveraged study from MA)	This study recommended a deemed savings value of 5,344 kWh for a building automation system (BAS) measure that controls small individual food service appliances.	C&I
DNV, Lifetime Gross AML Adjustment Analyses, July 2021 (Leveraged study from MA)	This study updated Adjusted Measure Lives (AML) for lighting applications, excluding New Construction and stand-alone controls. Overall, the programs are seeing decreased AMLs as market adoption accelerates.	C&I
DNV, Upstream Lighting NTG, June 2021 (Leveraged study from MA)	This study updated NTG values for upstream lighting technologies and adjusted the values down significantly due to heavy free ridership.	C&I
DNV, Ground Source Heat Pump eTRM Measure Review, March 2021 (Leveraged study from MA)	This study recommended that GSHPs be broken out from ASHPs into their own category offering in order to allow the program to attribute savings, baselines, and lifetimes in a more defensible way. It also recommended the GSHP lifetime be updated to 25 years.	C&I
DNV, NRNC Market Characterization Study, June 2021 (Leveraged study from MA)	This study produced factors to be applied to IECC 2015-based code LPD to determine baseline LPD requirements.	C&I
DNV, Energy Management System ISP Study, 2021 (Leveraged study from MA)	This study identified industry standard practices for energy management systems, with a particular focus on criteria for determining when an existing system should be considered failed.	C&I
DNV, C&I HVAC NTG & Market Effects	This study established Net to Gross Ratios for six technologies supported by the Upstream HVAC Initiative.	C&I

Measurement, 2021 (Leveraged study from MA)		
Guidehouse, RCD Virtual Assessment Study, March 2021 (Leveraged study from MA)	This study found that in-service rates are lower for self-installed measures. Rhode Island leveraged results from this study to update the in-service rates for instant savings measures in the EnergyWise Single Family program.	Res
Guidehouse, Comprehensive TRM Review, April 2021 (Leveraged study from MA)	This study updated savings assumptions and effective useful lives (EUL) of several residential measures in MA. Rhode Island adopted the results from this study to update savings and EUL assumptions for several measures in the residential programs.	Res
NMR, Low Income Multifamily Health NEI (TXC 50), July 2021 (Leveraged study from MA)	This study produced NEI values associated with energy efficiency programs in Income Eligible, Multifamily buildings. A total of 4 health and safety NEIs were monetized as part of this study. Arthritis, Thermal Stress (cold), Home Productivity, and reduced fire risk were all found to have Annual Per unit values of $49, $1,426, $49, and $13, respectively, totaling $1536. These values are allocated to all applicable air sealing, insulation, and heating measures.	Res
NMR, Residential New Construction Quick Hit NEI Study (MA20X14-RNCNEI), September 2021 (Leveraged study from MA)	The study produced updated NEI values for heating related measures offered through the Residential New Construction program. The total Heating NEIs for RNC went from an Annual Per Unit value of $117 to $142.33 due to increases in thermal comfort and noise reduction related impacts.	Res
NMR, Residential Downstream/Upstream Products Net-to-Gross Study, June 2021 (Leveraged study from MA)	This study yielded prospective net-to-gross ratios and retrospective and prospective in-service rates for products supported by the Residential Retail or Residential Coordinated Delivery Initiatives. Rhode Island adopted the results from this study to update 2022 planning assumptions for ENERGY STAR Products program.	Res
NMR, Low-rise Residential New Construction Net-to-Gross Study, July 2021 (Leveraged study from MA)	This study yielded prospective and retrospective net-to-gross ratios for measures supported by the Low Rise Residential New Construction offering. Rhode Island adopted the results from this study to update 2022 planning assumptions.	Res
NMR, Renovations and Additions Net-to-Gross Study, July 2021 (Leveraged study from MA)	This study yielded prospective and retrospective net-to-gross ratios for measures supported by the Renovations and Additions Residential New Construction offering. Rhode Island adopted the results from this study to update 2022 planning assumptions.	Res
Guidehouse, Impact Analysis of Residential Wi-Fi Thermostats, Jun 2021 Results Presentation	This study updated savings assumptions for programmable and Wi-Fi thermostats delivered through retail and direct install channels. Rhode Island adopted the draft results from this study to update savings for programmable and Wi-Fi	Res

(Leveraged study from MA)	thermostat measures in the residential HVAC and retrofit programs.	
RI-20-XG-GasPeak – C&I Gas Peak Demand Savings	This study supplied peak gas demand daily percentages of energy consumption by end use and building type for the C&I sector. These results could be used to calculate the gas daily energy savings that have occurred as a result of C&I program activity.	C&I
RI-20-XG-GasPeak – Residential Gas Peak Demand Savings	This study supplied peak gas demand daily percentages of energy consumption by end use for the residential sector. These results could be used to calculate the gas daily energy savings that have occurred as a result of residential program activity.	Res
Net-to-Gross Research of RCD and Select Products Measures (MA20R28)	For RI, the study applied new NTG results for the residential gas and electric HVAC programs.	Res
Synapse Energy Economics, Avoided Energy Supply Components in New England 2021 Report. May 2021.	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 2022 program planning.	All
2020		
Study	**Impact Descriptions**	**Sector**
Cadeo, Impact and Process Evaluation of EnergyWise Single Family Program, September 2020.	This study updated gross savings, in-service rates, and net-to-gross ratios for the EnergyWise Single Family program.	Res
Cadeo, Impact and Process Evaluation of EnergyWise Multi Family Program, September 2020.	This study updated gross savings, realization rates, in-service rates, and net-to-gross ratios for the EnergyWise Multi Family program.	Res
Cadeo, Impact and Process Evaluation of Income Eligible Multi Family Program, September 2020.	This study updated gross savings, realization rates and in-service rates for the Income-Eligible Multi Family program.	Res
Cadeo, Impact Evaluation of Home Energy Reports Program 2017-2019, September 2020.	This study updated realization rates for the Home Energy Reports program.	Res

NMR, Lighting Hours of Use Study, March 2020. (Leveraged study from MA)	This study reviewed and updated the HOU used to calculate the lighting savings measures in MA. Rhode Island adopted the results to update savings assumptions for the lighting measures in RI.	Res
NMR, LED Delta Watts Update, March 2020. (Leveraged study from MA)	This MA study updated delta watts for lighting measures. Rhode Island adopted the results to update gross savings calculation for its Residential Lighting measures.	Res
Guidehouse, Residential Wi-Fi Thermostat DR Evaluation, April 2020. (Leveraged study from MA)	This study reviewed and updated the savings being used In MA for the Wi-Fi DLC program offering. Rhode Island adopted the results to update savings for Wi-Fi DLC offering in RI.	Res
Guidehouse, 2019/2020 Residential Energy Storage Demonstration, February 2020. (Leveraged study from MA)	This study reviewed and verified the savings being used In MA were accurate for the Residential demand response battery storage offering. Rhode Island adopted the results for residential battery storage demand response offering in RI.	Res
ERS, Evaluation of 2019-2020 Cross-State DR Program, February 2020. (Leveraged study from MA)	This study reviewed and updated the summer demand realization rate being used In MA for the C&I targeted dispatch program offering. Rhode Island adopted the results for the C&I targeted dispatch demand response offering in RI.	C&I
DNV GL, Impact Evaluation of 2017 Small Business Electric Installations, March 2020.	The study updated electric non-lighting impact factors for the Small Business initiative. RI leveraged the MA study of this initiative.	C&I
DNV GL, C&I Measure Life Study, March 2020.	This study informed Effective Useful Lives and Remaining Useful Lives for key C&I energy efficiency measures, updating the commercial boiler EUL. RI leveraged the MA study of this initiative.	C&I
Tetra Tech, C&I Free-Ridership and Spillover Study, September 2020.	This study updated free-ridership and spillover rates for the C&I program	C&I
The Brattle Group, The Road to 100% Renewable Energy by 2030 in Rhode Island, December 2020.	This study provided a high-level economic analysis of the key factors that will guide RI to meet 100% of the state's electricity demand by 2030. The study updated economic impact multipliers to quantify the benefits of future EE programs in the Rhode Island economy.	All
2019		

Study	Impact Descriptions	Sector
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.	Res
Navigant, Wi-Fi 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 Wi-Fi thermostats. Rhode Island adopted these results to update savings assumptions for Wi-Fi thermostats in HVAC and residential retrofit programs.	Res
2018		
Study	**Impact Descriptions**	**Sector**
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.	C&I
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.	C&I
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.	C&I
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.	C&I
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.	C&I
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.	C&I

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.	C&I
NMR, Rhode Island Residential Appliance Saturation Survey. October 2018	This study developed an inventory of residential end-uses, including appliances, consumer electronics, heating and cooling equipment, thermostats, water heating, and building characteristics. Findings from this study will be used to inform program planning and support future potential studies in Rhode Island.	Res
Cadeo, Rhode Island Impact Evaluation of Income Eligible Services Single Family Program, August 2018	This study deemed savings values and realization rates for electric and gas participants using billing and engineering analysis. The Company adopted the deemed savings values in the 2019 program plan.	Res
Navigant, MA Residential Electric Loadshape and Baseline Study (Heating and Cooling Season report). July 2018. (Leveraged study from MA)	This study collected saturation, penetration, and usage behavior data for all major electric and gas appliances in Massachusetts. Rhode Island adopted the end use load shapes determined by this study.	Res
NMR/Tetra Tech, TXC34 Massachusetts Residential HVAC Net-to-Gross and Market Effects Study. July 2018. (Leveraged study from MA)	This study yielded recommended net-to-gross ratios for selected heating, cooling, and water heating measures that will receive Mass Save® Standard rebates in 2019-2022. Rhode Island adopted the result from this study to inform savings for measures offered through Residential HVAC/HEHE programs.	Res
NMR/DNV GL, TXC29 Market-Rate Rental Property NEI Study (Phase 1), March 2018	This study identified and analyzed NEIs associated with market-rate multifamily properties.	Res

2017		
Study	**Impact Descriptions**	**Sector**
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	Res
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.	Res
NMR, 2017 Rhode Island Code Compliance	The study found residential and commercial attribution factors of 23% and 46, respectively, which were used along	C&I

Enhancement Initiative Attribution and Savings Study	with study results on average savings as well as construction activity projections to calculate the CCEI's projected savings from 2018-2020.	
DNV-GL, MA C&I Steam Trap Evaluation Phase 2, Feb, 2017	This study updated steam trap savings estimates.	C&I
DNV-GL, Gas Boiler Market Characterization Study Phase II: Final Report, March 2017	This study updated C&I condensing boiler savings estimates.	C&I
DNV-GL, MA45 Prescriptive Programmable Thermostats, March 2017	This study updated programmable thermostat deemed gas savings for C&I programs.	C&I
2016		
Study	**Impact Descriptions**	**Sector**
DNV-GL, Impact Evaluation of 2014 RI Prescriptive Compressed Air Installations Final Report, July 2016	This study yielded an energy realization rate for prescriptive compressed air compressors, dryers, and EE accessories.	C&I
DNV-GL, Impact Evaluation of 2012 National Grid-Rhode Island Prescriptive Chiller Program Final Report, July 2016	This study yielded an energy realization rate for prescriptive chillers.	C&I
Cadmus Group; Large Commercial and Industrial On-Bill Repayment Program Evaluation, September, 2016	National Grid commissioned this study to evaluate the financing component of the large commercial and industrial (LCI) 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.	C&I
DNV GL, Stage 2 Results—Commercial and Industrial New Construction Non-Energy Impacts Study—Final Report, prepared for the Massachusetts Program Administrators, March 2016	The purpose of this study was to quantify the dollar value of participant NEIs for C&I NC projects completed in 2013, and to estimate gross NEIs per unit of energy savings resulting from NC electric and gas measures separately.	C&I
2015		

Study	Impact Descriptions	Sector
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.	C&I
2014		
Study	**Impact Descriptions**	**Sector**
DNV GL, 2014, Impact Evaluation of National Grid Rhode Island C&I Prescriptive Gas Pre-Rinse Spray Valve Measure	The evaluation examined the gas and water savings associated with the installation of 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.	C&I
2012		
Study	**Impact Descriptions**	**Sector**
TetraTech, Final Report – Commercial and Industrial Non-Energy Impacts Study, (prepared for Massachusetts Program Administrators), June 29, 2012	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.	C&I
2011		
Study	**Impact Descriptions**	**Sector**
KEMA, Inc., C&I Unitary HVAC Loadshape Project Final Report, Prepared for the Regional Evaluation, Measurement, and Verification Forum, June 2011.	This study produced updated diversity and equivalent full load hours for unitary HVAC measures using end use metering.	C&I
NMR/TetraTech, MA Special and Cross Sectors Studies Area, Residential and Low-Income NEI Evaluation, August 2011	This study quantified NEIs that apply to residential and low-income programs.	Res

2010		
Study	**Impact Descriptions**	**Sector**
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.	Res

5 2023 Evaluation Study Findings

5.1 Rhode Island-Specific studies

RI-21-RX-CSNC - Residential New Construction and Code Compliance Study

Type of Study: Impact/Market
Evaluation Conducted by: Cadeo/NMR
Date Evaluation Conducted: May 2023

Evaluation Objective and High-Level Findings:
The primary objectives of this study included:

- Updating the baseline efficiencies for measures included in the UDRH.
- Estimating average code compliance for homes built under the Rhode Island State Building Code – 8 Energy Conservation Code.
- Comparing non-program on-site data to program home data, as well as comparing those to results from previous baseline studies.
- Understanding the extent to which building departments keep thorough and accurate records that could inform baseline efficiencies.

The key findings from the study include:

- Non-program HERS scores have only improved slightly since the previous 2017 baseline study (2017 Baseline HERS score = 73 vs 2022 Baseline HERS score = 71).
- A majority of measure level efficiencies have improved since the previous 2017 baseline including all building shell R-values; however, some measures have decreased in efficiency (measure level percent improvements shown in *Table 5* below).
- Program homes continue to outperform non-program homes, but the margin is decreasing. (program homes HERS score = 61 vs non-program homes HERS score = 71).
- Overall code compliance has increased since the previous study among non-program homes, and it is higher among custom built homes than spec homes (code compliance for custom homes = 90%, spec homes = 85%, and statewide homes = 87%).
- Windows and air leakage had the highest rate of code compliance, and duct leakage the lowest (measure level code compliance is illustrated in *Table 6*.
- The recommended UDRH update inputs are highlighted below in *Table 7.*

Table 5. Measure Level Percent Improvement

Measure	% Improvement
Conditioned foundation wall	57%
Frame floor	29%
Vaulted ceiling	20%
Air leakage	13%

Flat ceiling	7%
Cooling efficiency	7%
Above grade wall	7%
Duct leakage to outside	3%
Heating efficiency	-1%
Total duct leakage	-19%
DHW efficiency	-35%

Table 6. Measure Level Code Compliance

Measure	% Compliant
Windows	97%
Air leakage	95%
Foundation walls	94%
Above grade walls	91%
Slabs	89%
Total	87%
Frame Floors	82%
Ceiling	81%
Duct leakage	68%

Table 7. Recommended UDRH Inputs

	Units	Recommended URDH Input
Above grade wall	R-value	21.3
Above grade wall	U-value	0.062
Flat ceiling	R-value	39.0
Flat ceiling	U-value	0.039
Vaulted ceiling	R-value	36.9
Vaulted ceiling	U-value	0.035
Frame floor	R-value	28.1
Frame floor	U-value	0.070

Conditioned foundation wall	R-value	18.2
Duct leakage to outside	CFM25/ 100 sq. ft.	8.3*
Total duct leakage	CFM25/ 100 sq. ft.	24.6*
Air leakage	ACH50	4.6
Heating efficiency (fossil fuel)	AFUE	91.4
Heating Efficiency (electric)	HSPF	10.3
Cooling efficiency	SEER	14.8
DHW efficiency (fossil fuel)	EF	0.89
DHW efficiency (electric)	EF	1.35

*Two outliers identified and removed. No other outliers identified for other measures.

Programs to which the Results of the Study Apply:
The results of this study are applicable to Residential New Construction (RNC) measure savings and results may inform RNC program strategy.

Evaluation Recommendations included in the Study:
Cadeo/NMR recommends the following:

- Focus code compliance training activities on measures with the lowest levels of compliance, specifically duct leakage. Compliance has dropped for duct leakage since the previous baseline from 72% to 68% and a majority (93%) of homes sampled in this study had ducts, presenting a large opportunity to increase compliance. Ceilings and frame floors continue to have lower compliance so should continue to be a focus in these trainings as well.
- The program should consider increasing the stringency of program requirements to increase the overall performance of program homes over the general market, otherwise program savings may decrease. This may involve increasing the minimum % savings thresholds for program Tiers or adopting a pay for performance type model similar to the Massachusetts program.
- Increase incentives outside of the RNC program (downstream or midstream) for heat pump water heaters above the level of gas tankless models, or drop gas tankless incentives entirely, to drive adoption in new homes. While a builder or homeowner may not decide to participate in the RNC program for the whole home, they may decide to purchase an incentivized piece of equipment. Decreasing the upfront cost of HPWHs through incentives will make them a competitive choice for water heating.
- Focus code official trainings on consistently collecting third party verification of energy code compliance such as prescriptive checklists, blower door and duct blaster results, IECC certificates, or HERS ratings. Collecting building department data to inform UDRH values in future RNC baseline studies is still a worthwhile endeavor, but data from third party verified sources should be prioritized.

Explain Whether or Not Rhode Island Energy (RIE) Decided to Adopt Recommendations from the Study:

RIE is considering the recommendations for implementation into the RNC program and have adopted the savings impacts from the updated UDRH.

Savings Impact:
The RNC measures savings decreased by 2.37% for heating measures, 2.76% for cooling measures, 2.72% for hot water savings, and 2.50% for lights and appliances measures based on the updated UDRH.

RI-23-XX-Lifetime – Comprehensive Measure Life Review
Type of Study: Policy
Evaluation Conducted by: Cadeo
Date Evaluation Conducted: August 2023

Evaluation Objective and High-Level Findings:
The primary objectives of this study included:

- Ensure all measure life assumptions align with the most recent research and evaluation efforts in Rhode Island and industry best practices for prescriptive measures.
- Recommend updated measure life values for prescriptive measures, when appropriate and possible.

The key findings from the study include:

- Cadeo categorized measures into high, medium, and low based on lifetime savings to prioritize which measures to review. Cadeo identified a total of 68 measures to review.
- Cadeo recommended a new measure life source for six measures (1 high priority, 1 medium priority, and 4 low priority measures) which resulted in no impact to the measure life value.
- Cadeo recommended a new measure life source and value for 22 of the 68 measures. This consisted of the following measures by priority: high – 2 of the 8, medium – 7 of the 15, and low – 13 of the 45. Half of the measures resulted in an increase in the measure life and the other half a decrease in measure life.

Programs to which the Results of the Study Apply:
The results of the study are applicable to all prescriptive measures in Residential, Income Eligible, and C&I programs.

Evaluation Recommendations included in the Study:
Cadeo recommends updating the measure life source and value for 22 measures and the measure life source for six measures. Please see Table 1 for the measure life value recommendations.

Table 1. Measure Life Value Recommendations

Measure Name	Fuel	Sector	Existing ML	New ML	Prioritization
Wi-Fi Thermostat	Electric, Gas	Income Eligible & Residential	15	11	High
Electric Resistance to MSHP	Electric	Residential	18	17	High
Home Energy Report, Existing Dual Fuel	Electric, Gas	Residential	1	2	Medium
Replacement Refrigerator	Electric	Income Eligible	19	15	Medium
Heat Pumps	Electric	Income Eligible	18	20	Medium

Mini-Split Heat Pump	Electric	Income Eligible	18	17	Medium
Programmable Thermostat	Gas	C&I	15	11	Medium
Refrigerator Recycling	Electric	C&I	8	4	Medium
ERV	Gas	C&I	20	15	Medium
Refrigerator	Electric	Residential	12	15	Low
MSHP	Electric	Income Eligible	18	17	Low
Clothes Washer Most Efficient	Electric	Residential	11	14	Low
HP Water Heaters	Electric	Income Eligible	10	13	Low
Refrigerated Air Dryer	Electric	C&I	15	13	Low
Faucet Aerator	Gas	C&I	7	3	Low
VSD Compressor (15<=HP<=75)	Electric	C&I	15	13	Low
Furnace	Gas	C&I	18	23	Low
Water Heater	Gas	C&I	20	17	Low
Early Retirement Clothes Washer	Electric	Income Eligible	12	14	Low
VRF HP	Electric, Gas	C&I	15	17	Low
Duct Insulation_MF	Gas	C&I	25	20	Low

Explain Whether or Not Rhode Island Energy (RIE) Decided to Adopt Recommendations from the Study:
RIE is adopting all the measure life source updates and is generally adopting all the measure life value updates.

Savings Impact:
Overall, there is a 0.3% lifetime savings increase across all sectors and fuels.