

2024 Evaluation, Measurement, and Verification Plan

Table of Contents

| | |
|---|-----------|
| SECTION ONE: INTRODUCTION | 1 |
| EVALUATION STUDIES APPLICABLE TO 2024 | 2 |
| OVERVIEW | 2 |
| RECENT RHODE ISLAND-SPECIFIC STUDIES | 3 |
| RECENT STUDIES ADOPTED FROM OTHER JURISDICTIONS | 4 |
| 2024 PLANNED EVALUATION STUDIES | 4 |
| OVERVIEW | 4 |
| SUMMARY | 4 |
| COMMERCIAL AND INDUSTRIAL PLANNED STUDIES..... | 6 |
| RESIDENTIAL AND INCOME-ELIGIBLE PLANNED STUDIES | 8 |
| CROSS-SECTOR OR OTHER PLANNED STUDIES | 9 |
| HISTORIC EVALUATION STUDIES | 10 |
| 2023 EVALUATION STUDY FINDINGS | 23 |
| RHODE ISLAND-SPECIFIC STUDIES | 23 |

Section One: Introduction

Evaluation, Measurement, and Verification (EM&V) is an integral and required part of Rhode Island Energy's (RI Energy or the Company) energy efficiency program planning process. EM&V provides independent verification of impacts to ensure that savings and benefits claimed by the Company through its 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 are not limited to:

- **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 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 follow each study closely and are involved in planning, work plan development, and a review of interim work products and study results.

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

Section Two: 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 evaluations, 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

¹ Visit [EERMC Efficiency Planning in Rhode Island](#), 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.

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

2.2.1 Commercial Studies

- 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)

2.2.2 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)
- Participation Study Dashboard Update (RI-23-RX-Dashboard, in progress)
- EnergyWise PY 2021 Impact Evaluation Study (RI-23-RX-EWisePY21, in progress)

2.2.3 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.

Section Three: 2024 Planned Evaluation Studies

3.1 Overview

This section describes planned studies that focus on areas of interest to the Company’s energy efficiency programs and build on the deep history of evaluation studies commissioned by RI Energy 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 \$2.7 million (\$2.2 million for electric and \$0.5 million for gas), including staffing costs. The proposed budget for EM&V comprises approximately 1.5 percent 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 | R = residential | E = electric | |
| | 22 | C = commercial | G = gas | |
| | 23 | X = cross sector | 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 |
|--------------|---------------------------|---------|-------------------|---|
| C&I | RI-24-CE-Lighting | Impact | C&I Elec | Impact Evaluation of Upstream or Downstream Prescriptive C&I Lighting |
| C&I | RI-24-CX-CustProcessEval | Process | C&I | Process Evaluation of Custom Approach |
| C&I | RI-23-CG-CustGasPY22 | Impact | C&I Gas | Impact Evaluation of Custom Gas Installations |
| C&I | RI-23-CE-CustElecPY22 | Impact | C&I Elec | Impact Evaluation of Custom Electric Installations |
| | | | | |
| Cross-sector | RI-23-XX-AESC24 | Value | All Elec; All Gas | 2024 Avoided Energy Supply Component Study 2024 |
| Residential | RI-24-RX-IncEligible | Impact | Residential | Impact Evaluation of Income Eligible Single-Family Program |
| Cross-sector | RI-24-XX-StandardsSavings | Impact | All Elec; All Gas | Appliance Standards Gross Savings Review |
| C&I | RI-24-CX-CINCPProcess | Process | C&I | Process Evaluation of C&I New Construction Program |
| C&I | RI-24-CX-ISPResearch | Impact | C&I | Commercial and Industrial Industry Standard Practice Research |
| Cross-sector | RI-24-XX-MultiFamCustom | Impact | All Elec; All Gas | Impact Evaluation of Multifamily Custom Approach |
| Residential | RI-24-RX-MarketResearch | Market | Residential | Residential Market Research |
| C&I | RI-24-CX-MarketResearch | Market | C&I | Commercial and Industrial Market Research |
| C&I | RI-24-CX-SBDashboard | Market | Residential | Small Business Data Dashboard |
| Cross-sector | RI-24-XX-MeasureLife2 | Impact | All Elec; All Gas | Comprehensive Measure Life Review, Phase II |

The evaluation pathway for demonstrations, pilots 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 planning stage for all demonstrations, pilots 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 demonstrations, pilots 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 demonstrations, pilots, 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 a 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 the Company will evaluate roughly one-third 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

⁴ EERMC website, [Plans and Reports](#).

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 the Company will evaluate roughly one-third 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.

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. A downstream study could focus on baseline fixture types and controls, while a midstream study could assess in-service rates.

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-CINProcess - Process Evaluation of C&I New Construction Program

The C&I 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. There are two potential areas of investigation: One area is 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. The second 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. The Company will determine the specific area for investigation in late 2023 or early 2024.

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

This research will focus on one or more of the following areas: it may focus on the lighting market to understand more concretely how much fluorescent lighting is still installed, and how much lighting is still without controls. 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 to understand the 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 Single-Family Impact Evaluation

Rhode Island 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. This study will conduct an impact evaluation of the Income Eligible Single-Family Program.

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. The Company will determine the specific area for investigation in late 2023 or early 2024.

3.5 Cross-sector or Other Planned Studies

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

RI 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. The Company 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 update electric and natural gas baselines 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 savings 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 and update baselines and savings estimates as necessary.

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 programs' prescriptive measures and did not include custom measures, which given the programs' position at the nexus of the residential and commercial sectors, 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 percent 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 depends on an accurate assessment of measure lives. Because RI Energy expanded the number of measures in its model, the 2023 study was not able to review the measure lifetimes for all the measures. This proposed study will complete the research.

Section Four: 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 in Table 3 shows the studies by program, followed by the more detailed Table 4 summarizing the relevant studies.

Table 3. Historic Evaluation Studies

| Sector | Study Type | Program | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 Planned | |
|------------------|------------------|----------------------|------|------|------|------|-----------|------|------|------|------|-----------------|--|
| Residential | Impact | EnergyWise SF | | | | | | | | | | | |
| | | Income Eligible SF | | | | | | | | | | | |
| | | EnergyWise MF | | | | | | | | | | | |
| | | Income Eligible MF | | | | | | | | | | | |
| | | Home Energy Reports | | | | | | | | | | | |
| | | ENERGY STAR Products | | | | | | | | | | | |
| | | HVAC | | | | | | | | Demo | HP | | |
| | Impact / Market | ENERGY STAR Lighting | | | | | | | | | | | |
| | Impact / Process | ConnectedSolutions | | | | | | | | | | | |
| | Market | EnergyWise SF | | | | | | | | | | | |
| | | EnergyWise MF | | | | | | | | | | | |
| | Process | EnergyWise SF | | | | | HEAT Loan | | | | | | |
| | | Income Eligible SF | | | | | | | | | | | |
| | | EnergyWise MF | | | | | | | | | | | |
| | | Income Eligible MF | | | | | | | | | | | |
| | | Home Energy Reports | | | | | | | | | | | |
| Process / Market | HVAC | | | | | | | | | | | | |

| Sector | Study Type | Program | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 Planned | |
|-------------------------|--------------------|------------------------------|--------------------|------|----------|------|------|------|------|------|------|-----------------|---|
| Cross-Cutting / Special | Benefits | Avoided Cost | █ | | █ | | █ | | █ | | | | |
| | | Economic Impacts | | | | | | █ | | | █ | | |
| | Impact | Lifetime | | | | | | | | | | █ | █ |
| | | C&I NEIs | | | | | | | | █ | | | |
| | | Gas Peak Demand | | | | | | | █ | █ | | | |
| | | C&I Cooking | | | | | | | | | | █ | |
| | Impact / Market | Workforce | | █ | | | | █ | █ | █ | | | |
| | Market | ES Homes / Codes & Standards | | █ | █ | | | | █ | | █ | | █ |
| | | Potential Study | | | | | | | █ | | | | |
| | | Participation | | | █ | | | | | █ | █ | █ | |
| | | Non-Participant | | | █ | | | | | █ | █ | █ | |
| | | RASS | | | | | | | | | | | |
| | | Heat Pumps Study | | | | | | █ | █ | | | | |
| | | Legislated M&V Study | | | | | | █ | █ | █ | █ | | |
| | | Free Ridership / Spillover | | | | | | | | | | █ | |
| | | Process | Piggybacking Study | | | | | | █ | █ | | | |
| | | Value | All | | | | | | | | | | █ |
| C&I Electric | Impact | Custom | | | | █ | █ | █ | █ | █ | █ | █ | █ |
| | | HVAC | | | █ | █ | █ | █ | █ | █ | █ | █ | █ |
| | | Industrial Process | | | █ | █ | █ | █ | █ | █ | █ | █ | █ |
| | | CAIR | | | | █ | █ | █ | █ | █ | █ | █ | █ |
| | | Refrigeration, Motors, Other | | | | █ | █ | █ | █ | █ | █ | █ | █ |
| | | Custom Lighting | | | | █ | █ | █ | █ | █ | █ | █ | █ |
| | | Street Lighting | | | | █ | █ | █ | █ | █ | █ | █ | █ |
| | | CDA | | | █ | █ | | | | | | | |
| | | CHP | | | | | | | | | | | |
| | | Prescriptive Lighting | | | | | | | | | █ | | █ |
| | | Upstream Lighting | | | | | █ | █ | | █ | █ | | █ |
| | | Prescriptive HVAC | | | Chillers | | | | | | | █ | |
| | | Prescriptive VSD | | | | | | | | | | | |
| | | Prescriptive CAIR | | █ | | | | | | | | | |
| | ConnectedSolutions | | | | | | | | | | | | |
| | All | | | | | | | | | | | █ | |
| | Market | All | | | | | | | | | | | █ |
| NTG | All | | | █ | | | | █ | | █ | █ | | |
| Process | Upstream Lighting | | | | | | | | | | | | |
| | All | | | | | | | | | | | █ | |

| | | | | | | | | | | | | | |
|---------|--|--|--|--|--|--|--|--|--|--|--|--|--|
| C&I Gas | | | | | | | | | | | | | |
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These studies are available through the EERMC, the PUC and RI 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 | 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 |
| Cadeo , EnergyWise Single Family Weatherization Impact Evaluation, August 2023 (Draft) | The study updated the gross energy savings for EWSF’s weatherization measures, for both primary and secondary heating and cooling. The evaluation accounted for energy savings associated with natural gas, electricity and/or delivered fuels (oil, propane, and wood). | Res |
| DNV, Impact Evaluation of PY2021 Custom Gas Installations, August 2023 (Draft) | The study updated realization rates for custom gas projects, as part of a rolling effort that incorporated results from PY2019, PY2020, and PY2021. | C&I |
| DNV, Impact Evaluation of PY2021 Custom Electric Installations, August 2023 (Draft) | The study updated realization rates for custom electric projects, as part of a rolling effort that incorporated results from PY2019, PY2020, and PY2021. | C&I |
| DNV, Rhode Island Commercial Food Service Equipment ISP, August 2023 (Draft) | The study characterized industry standard practice in RI for commercial kitchen equipment by incorporating the 2023 appliance standards and prevalence of used equipment in the marketplace. | C&I |
| Cadeo, Small Business Program Process Evaluation, August 2023 | The study assessed program activities and identified opportunities for program enhancement for the small business program. | C&I |
| BW Research Partnership, Rhode Island Energy Workforce Development, August 2023 | The study quantified the current energy efficiency workforce in RI, identified needs and opportunities for the future, highlighted workforce development gaps and potential solutions, and identified potential roles for RI Energy in supporting energy efficiency workforce development in Rhode Island. | Cross-Cutting |

Table 5. Completed Evaluation Studies Applicable in 2022

| 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 |
| 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 |

Table 6. Completed Evaluation Studies Applicable in 2021

| 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 |
| NMR, 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, 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 |

| 2021 | | |
|--|--|--------|
| Study | Impact Descriptions | Sector |
| 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 Measurement, 2021 (Leveraged study from MA) | This study established Net to Gross Ratios for six technologies supported by the Upstream HVAC Initiative. | C&I |
| 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 |

| 2021 | | |
|--|--|--------|
| Study | Impact Descriptions | Sector |
| 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, September 2021 (Leveraged study from MA) | 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 thermostat measures in the residential HVAC and retrofit programs. | 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 |

Table 7. Completed Evaluation Studies Applicable in 2020

| 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 |
| 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 |

| | | |
|---|--|------------|
| <p>The Brattle Group, The Road to 100% Renewable Energy by 2030 in Rhode Island, December 2020.</p> | <p>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 energy efficiency programs in the Rhode Island economy.</p> | <p>All</p> |
|---|--|------------|

Table 8. Completed Evaluation Studies Applicable in 2019

| 2019 | | |
|---|--|------------|
| Study | Impact Descriptions | Sector |
| <p>NMR, RLPNC 17-3 Advanced Power Strip Metering Study (Revised). March 2019. (Leveraged study from MA)</p> | <p>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.</p> | <p>Res</p> |
| <p>Navigant, Wi-Fi Thermostat Impact Evaluation Secondary Research Study. September 2018. (Leveraged study from MA)</p> | <p>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.</p> | <p>Res</p> |

Table 9. Completed Evaluation Studies Applicable in 2018

| 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 |
| 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/DNV GL, TXC29 Market-Rate Rental | This study identified and analyzed NEIs associated with market-rate multifamily properties. | Res |

| Property NEI Study (Phase 1), March 2018 | | |
|---|---|--------|
| 2017 | | |
| Study | Impact Descriptions | Sector |
| 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 Enhancement Initiative Attribution and Savings Study | The study found residential and commercial attribution factors of 23% and 46%, respectively, 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. | C&I |
| 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 | 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 |

| | | |
|--|--|---------------|
| Impacts Study—Final Report, prepared for the Massachusetts Program Administrators, March 2016 | | |
| 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 | kWh and kW savings figures for the installation of efficient residential CAC systems. | Res |

| | | |
|---|--|--|
| Regional Evaluation, Final Report, October 2009 | | |
|---|--|--|

Section Five: 2023 Evaluation Study Findings

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).
- Most 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 Efficiencies 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 | 2017 Baseline | Recommended URDH Input |
|------------------------------------|--------------------|---------------|------------------------|
| Above grade wall | R-value | 19.8 | 21.3 |
| Flat ceiling | R-value | 36.1 | 39.0 |
| Vaulted ceiling | R-value | 29.4 | 36.9 |
| Frame floor | R-value | 20 | 28.1 |
| Conditioned foundation wall | R-value | 7.9 | 18.2 |
| Duct leakage to outside | CFM25/ 100 sq. ft. | 8.6 | 8.3* |
| Total duct leakage | CFM25/ 100 sq. ft. | 20.6 | 24.6* |
| Air leakage | ACH50 | 5.3 | 4.6 |
| Heating efficiency | AFUE | 92.1 | 91.4 |
| Heating efficiency (fossil fuel) | AFUE | NA | 91.4 |
| Heating efficiency (electric) | HSPF | NA | 10.3 |
| Cooling efficiency | SEER | 13.7 | 14.8 |
| DHW efficiency | EF | 1.38 | 1.02 |
| DHW efficiency (fossil fuel) | EF | NA | 0.89 |
| DHW efficiency (electric) | EF | NA | 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 appliance 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. The table below contains the measure life value recommendations.

Table 8. Measure Life Value Recommendations

| Measure Name | Fuel | Sector | Existing ML | New ML |
|------------------|---------------|-------------------------------|-------------|--------|
| Wi-Fi Thermostat | Electric, Gas | Income Eligible & Residential | 15 | 11 |

| Measure Name | Fuel | Sector | Existing ML | New ML |
|---------------------------------|---------------|-----------------|-------------|--------|
| Electric Resistance to MSHP | Electric | Residential | 18 | 17 |
| Replacement Refrigerator | Electric | Income Eligible | 19 | 15 |
| Heat Pumps | Electric | Income Eligible | 18 | 20 |
| Mini-Split Heat Pump | Electric | Income Eligible | 18 | 17 |
| Programmable Thermostat | Gas | C&I | 15 | 11 |
| Refrigerator Recycling | Electric | C&I | 8 | 4 |
| ERV | Gas | C&I | 20 | 15 |
| Refrigerator | Electric | Residential | 12 | 15 |
| MSHP | Electric | Income Eligible | 18 | 17 |
| Clothes Washer Most Efficient | Electric | Residential | 11 | 14 |
| HP Water Heaters | Electric | Income Eligible | 10 | 13 |
| Refrigerated Air Dryer | Electric | C&I | 15 | 13 |
| Faucet Aerator | Gas | C&I | 7 | 3 |
| VSD Compressor (15<=HP<=75) | Electric | C&I | 15 | 13 |
| Furnace | Gas | C&I | 18 | 23 |
| Water Heater | Gas | C&I | 20 | 17 |
| Early Retirement Clothes Washer | Electric | Income Eligible | 12 | 14 |
| VRF HP | Electric, Gas | C&I | 15 | 17 |
| Duct Insulation_MF | Gas | C&I | 25 | 20 |

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 an approximate 0.3% lifetime savings increase across all sectors and fuels, using 2023 savings estimates.

RI-23-RX-EWisePY21– EnergyWise Single Family PY 2021 Weatherization Impact Evaluation Study (Draft)

Type of Study: Impact

Evaluation Conducted by: Cadeo

Date Evaluation Conducted: August 2023

Evaluation Objectives and High-Level Findings:

The primary objectives of this study included:

- Evaluating the energy consumption change in natural gas, electric, and delivered fuels associated with weatherization regarding primary heating usage, secondary heating use, and cooling.
- Comparing the evaluated savings to the previous evaluation from 2017-2018 and programs in neighboring states.

The key findings from the study include:

- Higher weatherization savings for participants that heat their homes with natural gas or delivered fuels in comparison to the 2017-2018 evaluation.
- Slightly lower weatherization savings for participants that electrically heat their home.
- Participants reduced their use of secondary heating fuels after weatherizing their home.

Programs to which the Results of the Study Apply:

The results of the study are applicable to the EnergyWise Single Family Program.

Evaluation Recommendations included in the Study:

The evaluation recommends the following updates to weatherization savings:

| Type of Savings | Natural Gas | Electric | Delivered Fuels |
|--------------------------------|-------------|------------|-----------------|
| Primary Heating (MMBtu/year) | 13.1 | - | 12.2 |
| Primary Heating (kWh/year) | - | 732 | - |
| Secondary Heating (MMBtu/year) | 0.3 | 0.1 | 0.2 |
| Cooling (kWh/year) | 23 | 24 | 21 |
| Furnace Fan (kWh/year) | 47 | 9 | 43 |
| Total (MMBtu/year) | 13.6 | 2.7 | 12.6 |

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

RIE is adopting the recommendations from the evaluation report.

Savings Impact:

Overall, gas weatherization savings increased by 42%, electric weatherization savings decreased by 6.9% and delivered fuel weatherization savings increased by 27% relative to the prior study.

RI-22-CG-CustGasPY21 – Impact Evaluation of PY2021 Custom Gas Installations (Draft)

Type of Study: Impact

Evaluation Conducted by: DNV

Date Evaluation Conducted: August 2023

Evaluation Objectives and High-Level Findings:

The objective of this impact evaluation was to provide verification or re-estimation of energy (therms) savings for a sample of custom gas projects through site-specific inspections, end-use monitoring, and analysis. The site-specific results were aggregated to determine realization rates for Rhode Island Energy’s custom gas installations.

Table 9. Custom Gas Installation Results

| Parameter | PY2019 | PY2020 | PY2021 | PYs 2018+2019+2021 |
|----------------------------------|-----------|-----------|-----------|--------------------|
| Tracking Savings (therms) | 1,944,204 | 1,280,693 | 1,075,499 | 4,300,346 |
| Non-Operational Sample Size | 10 | 8 | 4 | 22 |
| Operational Sample Size | 6 | 6 | 4 | 16 |
| Realization Rate (RR)* | 80.8% | 84.5% | 90.6% | 84.4% |
| Relative Precision @ 80% CI (%)* | ± 48.3% | ± 8.9% | ± 15.3% | ± 18.0% |

*Only non-steam trap realization rates are shown.

As a three-year rolling scheme is used to determine custom realization rates, the overall realization rate from this study combines results from PY2019, PY2020, and PY2021 studies.

In PY2021, all sites were completed as full measurement and verification with on-site metering and verification as it was found that customers and facilities have normalized post-COVID operations.

In this evaluation, steam trap sites were kept in the overall population so that they are included in the expanded results but were not included in the sample.

Programs to which the Results of the Study Apply:

Gas – Large Commercial New Construction

Gas – Large C&I Retrofit

Evaluation Recommendations included in the Study:

DNV GL recommends the following:

- Apply the combined result of 84.4% RR
- Assess whether to continue evaluating team trap sites in upcoming custom evaluations or continue to forgo the evaluation of steam trap sites.
- Assess whether to implement the new MA steam trap results or determine an alternate approach to vetting RI steam trap sites which may involve developing a tool.
- Perform more site-specific adjustments on the calculation models for energy savings.
- Ensure baseline inputs used for the savings analysis are accurate.

DNV GL proposes the following considerations:

- Update the Steam Trap Tool for RI using RI specific data.
- Separate steam trap and non-steam trap results.

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

RIE is adopting the combined result of 84.4% RR for custom gas and is assessing the approach to steam traps.

Savings Impact:

The study will result in an increase in claimable savings for Large C&I Custom Gas projects as the realization rate slightly increased from the previous year.

RI-22-CE-CustElecPY21 – Impact Evaluation of PY2021 Custom Electric Installations (Draft)

Type of Study: Impact

Evaluation Conducted by: DNV

Date Evaluation Conducted: August 2023

Evaluation Objective and High-Level Findings:

The objective of this impact evaluation was to provide verification or re-estimation of energy (kWh) savings for a sample of custom electric projects through site-specific inspections, end-use monitoring, and analysis. The site-specific results were aggregated to determine realization rates for Rhode Island Energy’s custom electric installations for non-lighting.

Table 10. Custom Electric Installation Results

| Non-Lighting | PY2019 | PY2020 | PY2021 | PYs 2018+2019+2021 |
|-----------------------------|------------|------------|------------|--------------------|
| Tracking Savings (kWh) | 12,804,067 | 10,676,671 | 26,073,183 | 49,552,921 |
| Sample Size (n) | 15 | 10 | 10 | 39 |
| Realization Rate (RR) | 104.1% | 68.6% | 88.4% | 89.1% |
| Relative Precision @ 90% CI | ± 18.4% | ± 28.4% | ± 15.8% | ± 11.9% |

The PY2018 study was scheduled to be completed in 2020, but due to onsite restrictions resulting from COVID-19, onsite work did not begin until late 2020. Due to this delay, the PY2019 study was completed in 2021. As a three-year rolling scheme is used to determine custom realization rates, the overall realization rates from this study combine results from PY2019, PY2020, and PY2021 studies.

For the beginning of 2021, collecting metered data at some sites was not possible due to pandemic-related changes in facility operation or site access. For these sites, assessment of non-operational factors was performed, and a historical operational adjustment factor was used to estimate the site operation.

Programs to which the Results of the Study Apply:

Electric – Large C&I Retrofit

Electric – Large Commercial New Construction

Evaluation Recommendations included in the Study:

DNV recommends applying the combined results of 89.1% Energy RR, 73.8% Summer kW RR, 105.3% Winter kW RR, and 78% on-peak kWh RR for non-lighting.

DNV also recommends the following:

- RIE conduct a thorough review of baseline assumptions and calculations for measures involving dust collection systems.
- RIE perform post inspections for all projects regardless of savings.
- RIE field staff and implementers interview customers on their type of network security anytime a measure involves network and/or Wi-Fi control to understand compatibility.
- RIE ensure proper commissioning protocol are followed to ensure key measure components are installed and generating savings.
- RIE continue to evaluate lifetime savings and report them at the site level in all future cost electric evaluations.

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

RIE is adopting the combined results of 89.1% Energy RR, 73.8% Summer kW RR, 105.3% Winter kW RR, and 78% on-peak kWh RR for non-lighting.

Savings Impact:

The study will result in an increase in claimable savings for non-lighting Custom Large C&I Electric projects as the realization rate increased from the previous year.

RI-23-CX-CommCook – Commercial Food Service Equipment Industry Standard Practice Study (Draft)

Type of Study: Impact

Evaluation Conducted by: DNV

Date Evaluation Conducted: August 2023

Evaluation Objective and High-Level Findings:

The objective of this ISP study was to research and understand what industry standard practice is for commercial kitchen equipment installed in replace on failure (ROF) and new construction (NC) applications. The primary focus of this study included commercial fryers, ovens, steam cookers, hot food cabinets, ice making and dishwashers.

DNV found that used equipment accounts for about 14% of commercial kitchen equipment sales and distributors indicated it accounts for about 12%. DNV did not find any difference between ROF versus NC projects. The weighted baselines are presented in Table 8.

Table 11. Commercial Food Service Equipment New Baselines

| Measure | % New Equipment | % Used Equipment | % Used Standard |
|----------------------------------|-------------------------|------------------------|------------------------------------|
| Fryer | 87% Energy Star V2.0 | 2% Energy Star V2.0 | 11% Energy Star V2.0 – baseline |
| Oven | 83% Energy Star V2.2 | 2% Energy Star V2.2 | 15% Energy Star V2.2 – baseline |
| Commercial dishwasher | 83% Energy Star V2.0 | 0% N/A | 17% Energy Star V2.0 – baseline |
| Hot food holding cabinets | 86% Energy Star V2.0 | 0% N/A | 14% Energy Star V2.0 – baseline |

| | | | |
|---------------------|--------------------------|-----------|-----------|
| Steam cooker | 100% Energy Star V1.2 | 0% N/A | 0% N/A |
|---------------------|--------------------------|-----------|-----------|

DNV recalculated deemed electric and gas energy and demand savings using the new (2024) version of the Savings Calculator for ENERGY STAR Commercial Food Service Products. Inputs to the tool included a mix of CA DEER workpaper sources, ENERGY STAR standards, RI appliance standards and findings from this study. The recalculated savings using the weighted baseline are presented in Table 12.

Table 12. Commercial Food Service Equipment Savings Values with Weighted Baseline

| Equipment Type | Equipment Size/ Category | Savings | Units |
|---|-----------------------------|---------|-------|
| Electric Fryer | Standard Vat | 2,017 | kWh |
| | Large Vat | 2,438 | kWh |
| Electric Oven | Convection Oven | 1,796 | kWh |
| | Combination Oven | 8,870 | kWh |
| Electric Steam Cooker | Std. size | 3,082 | kWh |
| High Temperature Commercial Dishwasher | Under Counter | 1,528 | kWh |
| | Door Type | 1,558 | kWh |
| | Single Tank Conveyor | 4,937 | kWh |
| | Multi Tank Conveyor | 8,587 | kWh |
| | Pot, Pan and Utensil | 1,159 | kWh |
| | Under Counter | 1,650 | kWh |

| | | | |
|--|----------------------|-------|-------|
| Low Temperature Commercial Dishwasher | Door Type | 2,082 | kWh |
| | Single Tank Conveyor | 5,709 | kWh |
| | Multi Tank Conveyor | 8,485 | kWh |
| Hot Food Cabinet | All sizes | 498 | kWh |
| Griddle | N/A | 2,639 | kWh |
| Ice Making – Batch | Head | 765 | kWh |
| | Split unit | 1,322 | kWh |
| | Self-contained | 563 | kWh |
| Ice Making – Continuous | Head | 1,574 | kWh |
| | Split unit | 3,235 | kWh |
| Gas Fryer | Standard Vat | 19 | MMBtu |
| | Large Vat | 23 | MMBtu |
| Gas Oven | Convection Oven | 23 | MMBtu |
| | Combination Oven | 30 | MMBtu |

| | | | |
|--------------------|------------------------|-----|-------|
| | Rack Oven -Single Rack | N/A | MMBtu |
| | Rack Oven -Double Rack | 33 | MMBtu |
| Gas Steamer | Std. size | 24 | MMBtu |
| Griddle | N/A | 15 | MMBtu |

Programs to which the Results of the Study Apply:

Electric – Large Commercial New Construction

Gas – Large Commercial New Construction

Evaluation Recommendations included in the Study:

DNV recommends adopting the updated baselines and savings values determined from this study as presented in Table 12. Specifically, for fryers, ovens, dishwashers, and hot food holding cabinets, DNV recommends using a weighted baseline that takes into account the appliance standard requirements along with the used equipment. For steam cookers, the baseline should be the appliance standard requirements. DNV does not recommend changes to the assumptions for ice machines or griddles since they are not applicable to the appliance standard.

DNV proposed considerations of continuing to monitor compliance to see how new and used equipment is impacting the market as the new appliance standard continues to take effects and investigating additional inputs that drive savings such as hours of use and pounds of food cooked per day.

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

RIE is adopting the updated baselines and savings values for fryers, ovens, dishwashers, hot food holding cabinets, and steam cookers.

Savings Impact:

The study will result in a decrease in claimable gas and electric savings for food service equipment.

RI-22-CX-Proc – Small Business Process Evaluation

Type of Study: Process

Evaluation Conducted by: Cadeo

Date Evaluation Conducted: August 2023

Evaluation Objective and High-Level Findings:

The objective of the process evaluation was to assess program activities and identify opportunities for program enhancement.

The main objectives are to assess how the program operates from customer outreach to on-bill repayment (OBR), assess the program delivery's strengths and weaknesses, gain insight into the current and future challenges and identify opportunities to overcome those challenges, recommend improvements for overall program effectiveness and recommend ways to better engage underserved small businesses, including woman- and minority- owned businesses.

Key findings included:

- The RIE Small Business Program operates effectively and has many features that can support the program as it adapts.
- RISE staff and RISE-affiliated contractors are successfully delivering the program, but customer directed projects need more attention.
- Main Street canvassing approaches can be effective for reducing the cost of serving very small businesses and may help the program engage underserved small businesses (including minority- and women-owned businesses).
- There are opportunities to customize marketing materials for small businesses and further support program contractors in outreach.

Programs to which the Results of the Study Apply:

Electric and Gas – Small Business Direct Install

Evaluation Recommendations included in the Study:

The study had the following recommendations:

- Promote on-bill financing to encourage wider adoption and overcome first cost barriers.
- Use financing to expand access to measures that offer energy savings and other benefits.
- Increase tracking and follow up on Customer Directed Option projects to ensure the project is on track.
- Review labor rates and reimbursement schedule to ensure it reflects recent cost increases.

- Deploy strategies that expand the effectiveness of Main Street outreach efforts, including advanced notification to community based/civic organizations, promoting the schedule several months before the program, and providing specific mailers to qualified businesses with links/call center support in different languages.
- Expand marketing and collateral tools to support a range of communications and promotion of measure packages.

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

RIE has generally adopted the recommendations from the Small Business Program Process Evaluation. These recommendations include the Main Street initiatives and Marketing and Outreach.

Savings Impact: N/A

RI-23-XX-WorkforceDev – Rhode Island Energy Workforce Development

Type of Study: Impact/Market

Evaluation Conducted by: BW Research Partnership

Date Evaluation Conducted: August 2023

Evaluation Objectives and High-Level Findings:

The four main objectives within the workforce needs assessment included:

1. Quantify the current energy efficiency workforce in Rhode Island.
2. Uncover the needs of and opportunities for energy efficiency businesses and workers as well as potential energy efficiency workers.
3. Highlight workforce development gaps and potential solutions in the state.
4. Identify potential roles for RI Energy in supporting energy efficiency workforce development in the state.

Key findings from the study are listed below:

- The Rhode Island energy efficiency workforce is diversified by technology but not by demography, and employment levels are recovering from COVID-19 impacts but stabilizing at 2016 levels.
- Energy efficiency businesses in Rhode Island have been hiring and expect to hire more workers with different skills sets to grow their businesses.
- Employers expect hiring to be difficult, at least in the near term, as it is taking place in a tight labor market with high competition for these workers.
- At present, there is not significant interest among future workers in filling energy efficiency job openings.
- Rhode Island may struggle to meet its energy efficiency workforce needs due to a lack of focus from key stakeholders and a need for greater coordination across the state's energy efficiency workforce ecosystem.
- The state has positive attributes that will be helpful in creating well-functioning energy efficiency workforce development programs.

Programs to which the Results of the Study Apply: N/A

Evaluation Recommendations included in the Study:

Near-term recommendations:

- Encourage workforce ecosystem coordination and leadership development by advocating for an increased emphasis on energy efficiency and workforce development within relevant state-wide entities and supporting emerging leadership efforts around energy efficiency workforce development in the state.
- Support marketing efforts and pipeline building by further leveraging its marketing and communications capacity with credible information resources and campaigns and partnering with groups, especially those serving underserved communities, to raise awareness about the value and opportunities of energy efficiency jobs.

- Champion energy efficiency-related programs at all levels of education by increasing support for specific programs in high schools and vocational-technical schools, including curriculum development, instructor recruitment, internships, and equipment needs.
- Partner with contractors to expand worker recruitment by communicating the benefits of energy efficiency careers, funding career navigators and wraparound supports, and educating contractors about opportunities in energy efficiency.

Additional recommendations:

- Prioritize increasing the pipeline of future energy efficiency workers through education, communications, and information sharing.
- Pursue a comprehensive approach that balances education, training, and certifications, while getting new workers the foundational, in-the-field experience they lack.
- Actively support efforts to secure initial energy efficiency employment.
- Strengthen educational institutions' emphasis on energy efficiency.
- Bring an equity-centered approach to further increase the pipeline of workers and bring higher-quality job opportunities to underserved communities.
- Encourage leadership and collaboration across the Rhode Island energy efficiency workforce development ecosystem.
- Leverage and scale successful programs and success stories in Rhode Island.

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

Rhode Island Energy has generally adopted the recommendations and strategies mentioned in the RIE Workforce Development study. These recommendations include upskilling workforce, multi-lingual outreach, existing employee retention, etc.

Savings Impact: N/A