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November 7, 2023

VIA ELECTRONIC MAIL AND HAND DELIVERY

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

Dear Ms. Massaro:

Re: Docket No. 23-35-EE – 2024-2026 Three Year Energy Efficiency Plan and 2024 Annual Energy Efficiency Plan
Responses to PUC Data Requests – Set 1 (Full Set)

On behalf of The Narragansett Electric Company d/b/a Rhode Island Energy ("Rhode Island Energy" or the "Company"), I have enclosed the Company's responses to the First Set of Data Requests (Full Set) issued by the Public Utilities Commission in the above-referenced docket.

Please contact me if you have any questions. Thank you for your attention to this matter.

Very truly yours,

Leticia Pimentel

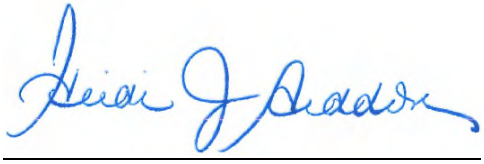
Leticia C. Pimentel

cc: Docket 23-35-EE Service List

Certificate of Service

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

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



Heidi J. Seddon

November 7, 2023
Date

Docket No. 23-35-EE – Rhode Island Energy's EE Plan 2024-2026 Three-Year Plan and 2024 Annual EEP
Service list updated 10/4/2023

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PUC 1-1
Federal funding coordination

Request:

Page 10 of pre-filed testimony sates "in designing the Plans, the Company considered the potential impacts of and synergies with the breadth of federal funding available to customers. Potential impacts that the Company planned for in the Plans include, but are not limited to, increases in program participation, workforce development needs for increased demand, and communication and outreach strategies to aid customer understanding. Potential synergies the Company has incorporated into its Plans include, but are not limited to, collaboration with other entities and processes to consider how incentives are layered." Regarding this statement, please explain the following:

a. How does the Company define "layered" incentives? What additional sources of funding does "layering" refer to? Please be specific.

b. With regards to the proposed Annual and Three-Year Plans, please explain whether the Company made any adjustments to incentive levels in response to the availability of federal efficiency funding. If the Company did not made any such adjustments, please explain why not.

Response:

a. In general, when the Company uses the phrase "layering incentives," the Company is referring to a circumstance in which a customer may receive more than one incentive for a single measure or behavior. For example, the Company works with CAPs to layer incentives for income-eligible customers for weatherization, where one incentive is funded through the Company's energy efficiency program budget and another incentive is funded through LIHEAP. In this example, the incentives are layered by simply adding them and making the aggregate incentive available to the customer.

   In the specific quote referenced, the Company used "layering" to refer to the combination of federal efficiency direct incentives that will be available through the Inflation Reduction Act (IRA) and incentives available through the Company's energy efficiency programs. The IRA funding offers direct incentives for several measures that are also eligible for incentives through the Rhode Island Energy programs. The Company will evaluate when, and if, such layering is appropriate under program guidelines.

Prepared by or under the supervision of: Toby Ast

PUC 1-1, Page 2
Federal funding coordination

b. The Company did not make any adjustments to incentive levels in response to the availability of federal funding in the Annual Plan or Three-Year Plan as filed because of the timing of federal incentives being available. The OER does not expect the federal funding to be available to Rhode Island customers until Q4 of 2024 at the earliest. In consultation with the OER and EERMC, the Company determined that it would be premature to adjust incentive levels until there is more clarity on how and when the federal funds will be administered and distributed. These developments can and will be addressed in future annual plans as appropriate.

Prepared by or under the supervision of: Toby Ast

PUC 1-2
Federal funding coordination

Request:

At the August 17, 2023 tech session regarding the coordination of federal funding for energy efficiency with utility energy efficiency programming, a representative from the RI Department of Human Services (DHS) stated that DHS will receive an additional $14.9 million from the Biden Infrastructure Law for weatherization, to be disbursed over 5 years. Please explain how the Company adjusted the Income Eligible Sector budgets in the Annual and Three-Year Plans to account for that incremental funding.

Response:

The Company did not adjust Income Eligible Sector budgets to account for this incremental funding in either the Annual Plan or Three-Year Plan as filed because of critical open questions about the eligibility, amount, timing, and deployment of the federal funding. The Company is in regular contact with DHS as to how this funding will be deployed. . The Company can and will account for federal funding for weatherization in subsequent annual plans at the appropriate time.

Prepared by or under the supervision of: Toby Ast

PUC 1-3
Federal funding coordination

Request:

On page 19 of pre-filed testimony, the Company describes preparing a "preliminary plan document by June 30, 2024 that outlines an approach and timeline for coordination with OER regarding IRA incentives." Regarding this "preliminary plan document," please explain the following:

a. How did the Company determine that June 30, 2024 is an appropriate deadline for the development of this preliminary planning document?

b. Please define the specific "IRA incentives" that will be addressed in this planning document. In your response, clarify whether the Company will consider the availability of energy efficiency-related federal tax credits as part of this coordination effort.

c. Will the planning document cover the incentives offered through the $25 million Clean Heat RI program? If yes, please explain why that coordination plan document will be released in June 2024 when the program was launched in September 2023. If no, please explain why such a significant pool of incentives that are already available today would not be covered by the coordination plan.

d. Please describe how the Company will develop the planning document by June 2024, working with what stakeholders.

e. Once the planning document is developed by June 2024, how will it be used to set the incentive levels to include in the 2025 Plan?

Response:

a. The Company determined that June 30, 2024, is an appropriate deadline for the development of this preliminary planning document through conversations with OER and experience with federal funding programs (such as those that supported the launch of Clean Heat RI). Specifically, OER anticipates that incentives from the IRA will be available to customers no sooner than the fourth quarter of 2024. By setting a deadline of June 30, 2024, the Company will have adequate time to incorporate additional guidance from OER regarding their program design and incorporate any

PUC 1-3, page 2
Federal funding coordination

changes, if necessary, to the Company's program offerings ahead of the distribution of federal funding and for the 2025 program planning process.

b. Generally, the planning document will identify all IRA incentives for measures that are included in the Company's efficiency programs. These IRA incentives include, but are not limited to, incentives for equipment such as electric clothes dryers, heat pump hot water heaters, air source heat pumps, and gas-fueled equipment. The Company will not consider the availability of energy efficiency-related federal tax credits as part of the coordination effort.

c. The Company has coordinated and will continue to coordinate with OER regarding Clean Heat RI since before the launch of Clean Heat RI. Prior to the launch of Clean Heat RI, the Company and OER collaborated regarding program design and implementation. The Company is in regular contact with Abode, the contractor retained by OER to administer Clean Heat RI, to coordinate on the distribution of incentives and support for Rhode Island residents. As an example, Abode refers customers interested in replacing existing electric resistance heat to Rhode Island Energy because Clean Heat RI does not support those customers. Rhode Island Energy, in turn, refers customers with natural gas heat to Abode.

   The Company will memorialize this coordination, update this coordination with lessons learned during the first months of Clean Heat RI, and update the coordination strategy to account for relevant IRA incentives within the planning document by June 30, 2024. In this manner, the planning document will cover the incentives offered through the Clean Heat RI program to the extent that IRA incentives affect the ongoing coordination with OER on that program. The Company's reasoning for the June 30, 2024, is further explained in the response to part a., above; the deadline for the planning document referenced in the pre-filed testimony does not imply a lost opportunity for coordination.

d. The Company will develop the planning document by working with stakeholders to identify key areas of overlap between Company and IRA incentives and building out the processes necessary to support customers. To do this, the Company has identified several key tasks that will need to be incorporated into the plan to ensure Company

PUC 1-3, page 3
Federal funding coordination

programs continue to function effectively once the IRA incentives are available in the RI market. These tasks include:

- Development of a customer outreach strategy that raises awareness of both Company and IRA incentives
- Identification of customer pathways for accessing IRA funds (both in addition and in lieu of Company incentives)
- Creation of projections for IRA incentive uptake
- Evaluation of financial implications for Company incentives for those measures eligible for both IRA and program incentives
- Suggestions for preliminary financing options
- Identification of resources for contractor education
- Establishing income verification pathways, where necessary
- Outline of methodology for savings attribution

The Company has been in communication with OER regarding initial steps in the development of the plan components listed above. In addition to OER, the Company will engage the EERMC, Energy Efficiency Technical Working Group, Department of Health and Safety, community action agencies, Equity Working Group, and relevant implementation contractors to solicit feedback throughout the plan development process. The Company will schedule regular check-ins with OER to monitor and support program design and share plan drafts with relevant stakeholders to gather feedback on how best to refine the Company's approach. The Company can engage the Public Utilities Commission ("Commission") in this process as desired by the Commission.

e. The planning document will be used to set incentives levels for the 2025 Annual Plan during the 2025 Annual Plan planning process and will inform potential adjustments to incentives and implementation costs for the impacted measures and programs to maximize program dollars and limit over-compensation of customers. That said, actual data on the impact of IRA funds will likely not be available during the 2025 planning period, so incentive levels might require further adjustment during the program year to account for unforeseen outcomes.

PUC 1-4
Federal funding coordination

Request:

On Bates page 80, the Company writes "for the Residential and IES Programs… the Company will prioritize electric resistance heat to air source heat pump conversions… The Company will coordinate and collaborate with OER on its Clean Heat RI Program to support supplemental measures, such as the aforementioned weatherization services." What, if any, incentives does the Clean Heat RI program make available to electric heating customers? For example, can an electric heating customer receive incentives to cover the cost of weatherization or electric panel upgrades from Clean Heat RI? Please be specific.

Response:

The Clean Heat RI program does not offer incentives for customers that currently have electric resistance heating. The Company's statement 'coordinate and collaborate… to support supplemental measures' was specific to non-electric measures.

Prepared by or under the supervision of: Toby Ast

PUC 1-5
Federal funding coordination

Request:

On Bates page 81, the Company writes "the Company will also work with OER to better understand electrification efforts being funded through state and federal programs, and to determine if synergistic measures could be deployed through the Company's Energy Efficiency Programs to advance electrification efforts. The Company anticipates these synergies would likely occur on projects relating to weatherization, ventilation, and controls." Please explain why the Company has identified these specific measure groupings as being ripe for "synergies" and explain the potential synergies in greater detail. Then, provide the following data:

a. The Company's proposed weatherization budget included in the 2024 Annual Plan

b. The Company's proposed ventilation-related budget included in the 2024 Annual Plan

c. The Company's proposed controls-related budget included in the 2024 Annual Plan

d. Over the course of the proposed 2024-2026 Three-Year Plan, the Company's proposed weatherization budget

e. Over the course of the proposed 2024-2026 Three-Year Plan, the Company's proposed ventilation-related budget

f. Over the course of the proposed 2024-2026 Three-Year Plan, the Company's proposed controls-related budget

Response:

As customers choose to electrify their homes and businesses, additional emphasis should be given to measures that help support a successful transition. In focusing on potential weatherization, ventilation, and controls synergies, the Company would help to advance energy efficiency measures that are often viewed as prerequisites to the efficient use of electric heating systems. More specifically, weatherization measures help to ensure the right-sizing of electric heating systems while mitigating heat losses. Ventilation measures would reduce cooling loads during the summer and help reduce the cost of heat ventilated during the winter. And control systems would help to optimize the efficient use of heating and cooling by adjusting to operational parameters and manufacturing/process requirements. For these reasons, the Company has identified those specific measure groupings as potential areas for synergies. Other potential

PUC 1-5, Page 2
Federal funding coordination

synergies also may include augmenting or supplementing electrifications efforts being funded through state and federal offerings, and cross promoting and marketing offerings by the Office of Energy Resources.

a. The Company's proposed weatherization budget included in the 2024 Annual Plan is $21,588,975.

b. The Company's proposed ventilation-related budget included in the 2024 Annual Plan is $1,463,832.

c. The Company's proposed controls-related budget included in the 2024 Annual Plan is $167,900.

d. See table below:

Year	Proposed Budget (Incentive Total)
2024	$21,588,975
2025	$23,043,706
2026	$24,477,475

e. See table below:

Year	Proposed Budget (Incentive Total)
2024	$1,463,832
2025	$1,535,055
2026	$1,518,601

Prepared by or under the supervision of: Toby Ast

PUC 1-5, Page 3
Federal funding coordination

f. See table below:

Year	**Proposed Budget (Incentive Total)**
2024	$167,900
2025	$188,400
2026	$211,974

PUC 1-6
Federal funding coordination

Request:

On Bates page 82, the Company writes "OER will administer $64 million in funding designated for a variety of home improvements from the federal IRA." What is the Company's understanding of whether or not OER has secured that funding from the federal government and when it will start disbursing it locally.

Response:

The Company's understanding is that OER has partially secured the federal funding referenced on Bates page 82. The Company understands that OER received approval from the United States Department of Energy (DOE) on September 21, 2023 for its administrative funding for the Home Energy Efficiency Rebate (Inflation Reduction Act Section 50121) and the High-Efficiency Electric Home Rebate (Inflation Reduction Act Section 50122) Programs. OER will be receiving up to $800,153 for the Home Energy Efficiency Rebate Program and up to $795,501 for the High-Efficiency Electric Home Rebate Program for early administrative support. The Company understands that OER has applied for rebate funding associated with these two programs and is anticipating a determination from DOE in mid-2024.

The Company's understanding is that OER will begin dispersing federal funds no sooner than Q4 2024. The Company also understands that the timeline is subject to change based on OER's finalization of implementation plans, DOE review and approval of the application materials, and the timing of state requests for proposals and procurement (if pursued) for implementation.

Prepared by or under the supervision of: Toby Ast

PUC 1-7
Federal funding coordination

Request:

On Bates page 97, the Company writes "the Company will also participate in NEEP's IRA attribution working group to focus on that issue and determine the best path forward." Please provide a description of the working group's scope of work, a status update on the Company's participation in that working group, and an expected timeline of when the Company will develop a savings attribution proposal for IRA funding.

Response:

The NEEP IRA Attribution Working Group's overall goal is to "establish common guiding principles for attributing savings to IRA rebate programs when run alongside utility ratepayer programs."[1] Objectives include identifying how IRA and ratepayer-funded programs interact, investigating ways to address attribution in differing regulatory landscapes, and ensuring that NEEP's guidance on attribution is shared with regulators to assist them in their decision making.

As a member of the Working Group, the Company (and the EERMC represented by their consultant team) has participated two of three prior meetings and plans to participate in the fourth and final meeting. The Company has reviewed NEEP's proposed methodologies, asked questions concerning general and RI-specific aspects, and provided recommendations to improve/enhance the models and process.

The Working Group has met three times and plans to meet one more time this November. The draft IRA Attribution Framework will be presented at that meeting. The Company anticipates NEEP to release its draft IRA Attribution Framework in November 2023 and issue its final IRA Attribution Framework in December 2023.

The Company plans to consider the information presented by NEEP and develop its own savings attribution proposal for IRA funding by Q2 2024, depending on the timing of the OER's plan for the IRA funding, in consultation with OER and EERMC.

[1] NEEP IRA Attribution Working Group Meeting #3 presentation, October 13, 2023.

PUC 1-8
Federal funding coordination

Request:

On Bates page 102, the Company writes "the Company also anticipates additional savings [in the HVAC program] from OER's Clean Heat RI Program." Please explain what, specifically, the Company means by "additional savings" in the context of this sentence and describe how the OER Clean Heat RI Program will deliver those "additional savings."

Response:

In the context of this sentence, "additional savings" refers to the energy savings achieved by incremental participation in the Company's HVAC program. The Company anticipates incremental participation via three mechanisms: (1) The Company expects that the marketing for Clean Heat RI will raise public awareness of the resources available for energy-efficient home heating system retrofits. (2) The referral of customers with electric resistance heating from OER to Rhode Island Energy will also contribute to an increase in program participation and therefore energy savings. (3) Most customers that participate in Clean Heat RI will be eligible to receive an incentive for cooling efficiency from the Company for the HVAC equipment that is installed. These customers might not have participated otherwise, and the Company can now offer them, in addition to HVAC incentives, an introduction to the other Company programs that might be relevant to them (e.g., weatherization, appliance programs, etc.), further increasing energy savings.

Prepared by or under the supervision of: Toby Ast and Spencer Lawrence

PUC 1-9
Building Energy Code

Request:

Please clarify the Company's expectation of when the new building code standard will be implemented in Rhode Island.

Response:

Based on conversations the Company has had with staff at the International Code Council (ICC), the Company expects the final version of the 2024 International Energy Conservation Code (IECC) to be released in Q2 or Q3 of 2024. Legislation requires Rhode Island to adopt the 2024 IECC as the state building energy code within three months of its release. Therefore, we expect Rhode Island to adopt the 2024 IECC in Q3 or Q4 of 2024.

Prepared by or under the supervision of: Michael O'Brien Crayne

PUC 1-10
Building Energy Code

Request:

Page 11 of pre-filed testimony sates "the Company, in these Plans, emphasized training specific to compliance with the new building code within its proposed workforce development efforts." Please specify how much funding the Company is proposing through the 2024 Annual Plan Regarding for this compliance-related training and explain the content(s) of this training activity in greater detail.

Response:

The Company is proposing $255,600 for codes and standards training through the 2024 Annual Plan.

Rhode Island Energy will offer training and support for educating and improving compliance with the new energy code to all industry stakeholders throughout the state including building inspectors, builders, developers, designers, engineers, contractors, building owners and energy specialists through its Codes & Standards Technical Support program (CSTS).

Training is offered through in-person events across the state, live and recorded webinars, on-site project tours and hands-on trainings. Content will include overview of changes to the code as well as deep dives into specific components of the new energy code such as envelope, HVAC, lighting, and compliance pathways. CSTS will offer additional resources and tools such as FAQs and technical bulletins that will be shared during trainings and made available through email and on Rhode Island Energy's website.

Through its "circuit rider" services CSTS offers a toll-free number and email to handle questions about the energy code and will visit project sites and work directly with project teams seeking customized assistance with meeting the new energy code.

CSTS has a longstanding and well-established network of partners and works closely with the Building Commissioner's office to develop and deliver training for building inspectors and code officials, and with associations such as the Rhode Island Builders Association (RIBA), Rhode Island Building Officials Association (RIBOA), Rhode Island Plumbing and Mechanical Inspectors Association (RIPMIA), American Institute of Architects-RI (AIA-RI), Rhode Island Association of Realtors (RIAR) as well as partners such as Viessmann, Taco, Arnold Lumber, Northeast Energy Efficiency Partnerships (NEEP) and the Residential Construction Workforce Partnership to reach a broad audience of stakeholders.

Prepared by or under the supervision of: Brett Feldman

PUC 1-11
Building Energy Code

Request:

On Bates page 89, the Company states that it has "begun the process of scheduling mandatory trainings for building officials. The Company and its third-party code support contractor will augment code update trainings for all industry professionals." Regarding this statement, please explain the following:

a. Do these mandatory trainings fall within the scope of the compliance-related trainings described on page 11 of pre-filed testimony? If no, please explain the difference and specify how much funding the Company is proposing through the 2024 Annual Plan Regarding for this additional training activity.

b. Does the Company anticipate this training activity will occur entirely in program year 2024 or into the second and third years of the 2024-2026 Three-Year Plan? If the later, please specify how much funding the Company is proposing in program years 2025 and 2026 of the Three-Year Plan Regarding for these trainings.

Response:

a. Yes, these mandatory trainings fall within the scope of the compliance-related trainings described in the Company's pre-filed testimony.

b. The Company anticipates that this training activity will occur in 2025 as well as 2024, depending on the timing of the code adoption. The Company does not anticipate that training will occur in 2026. The same level of funding proposed for 2024 is also proposed for 2025, although it may end up being split differently depending on the timing of code adoption.

Prepared by or under the supervision of: Brett Feldman

PUC 1-12
Building Energy Code

Request:

On Bates pages 102-103, the Company provides a set of tables showing the "anticipated per unit percent savings reductions [for electric measures] that are likely to occur after the adoption of a new code standard." Regarding this, please explain the following:

a. What code or standard is this section referring to? Please be specific.

b. Confirm whether or not the effects of these savings reductions have been incorporated into the proposed 2024 Annual Plan and the 2024-2026 Three-Year Plan. In other words, were the proposed savings goals adjusted down according to the percentages included in these tables?

c. Explain how the Company derived these savings reductions estimates.

d. Please add a column to each of the tables on Bates pages 102-103 listing the percentage of total annual electric savings to be delivered by the proposed 2024 Annual Plan from each specific measure.

e. Regarding the HVAC table on Bates page 103, please explain which specific heat pump measure offerings are expected to experience a 40% reduction in savings as a result of the code update and the corresponding programs through which they are offered.

Response:

a. For the kitchen equipment related measures presented in Tables 1 and 2, the standard this section is referring to is the Appliance and Equipment Energy and Water Efficiency and Standards Act of 2021 (R.I. Gen. Laws § 39-27). For the HVAC measures presented in Table 3, the code this section is referring to is the 2021 International Energy Conservation Code (IECC 2021). IECC 2021 is not being adopted in Rhode Island and IECC 2024 is expected to be adopted sometime in 2024. Since final details for IECC 2024 are not yet available, for planning purposes, the Company elected to incorporate the provisions of IECC 2021.

b. The effects of the standards and codes savings reductions were incorporated into the proposed 2024 Annual Plan and the 2024-2026 Three-Year Plan. Thus, the proposed

PUC 1-12, Page 2
Building Energy Code

savings goals were adjusted down according to the percentages included in the tables below.

c. The savings reduction estimates for Tables 1 and 2 were derived from the RI 2023 Commercial Food Service Equipment Industry Standard Practice (ISP) Study results compared to the 2023 savings values. This study is summarized in Attachment 3 of the Company's 2024 Annual Plan.

The savings reductions estimated for Table 3 were derived from updating the baseline assumptions based on the IECC updates and calculating the percent savings reduction with the updated baseline relative to the 2023 baseline.

d. Please see Tables 1-3 below.

Table 1

Electric Measures	Per Unit % Savings Reduction	Percentage of Total Annual Electric Savings from 2024 Annual Plan
2023 Fryer	32%	0.0026%
2023 Convection Oven	46%	0.0257%
2023 Combination Oven	73%	0.0163%
2023 Steamer	89%	0.0245%
2023 ½ size Hot Food Holding Cabinet (HFHC)	45%	0.0211%
2023 ¾ size HFHC	25%	0.0035%
2023 Full Size HFHC	81%	0.0088%

Table 2

Dishwasher Measures	Per Unit % Savings Reduction	Percentage of Total Annual Electric Savings from 2024 Annual Plan
Low Temp Under Counter	35%	0.0012%
Low Temp Stationary Single Tank Door	91%	0% (Not planned)
Low Temp Single Tank Conveyor	67%	0.0031%

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PUC 1-12, Page 3
Building Energy Code

Low Temp Multi Tank Conveyor	66%	0% (Not planned)
High Temp Under Counter	37%	0.0133%
High Temp Stationary Single Tank Door	82%	0.0033%
High Temp Single Tank Conveyor	59%	0.0046%
High Temp Multi Tank Conveyor	76%	0.0022%
High Temp Pot, Pan, and Utensil	58%	0.0012%

Table 3

HVAC	Per Unit % Savings Reduction	Percentage of Total Annual Electric Savings from 2024 Annual Plan
Unitary Air Conditioning Units	~40%	0.136%
Heat Pumps	~40%	0.445%

e. The heat pump measures that are experiencing the ~40% reduction in savings both fall under the Large Commercial New Construction Program. These measures are:

- Variable Refrigerant Flow Heat Pumps ranging from sizes: 0 to 5.4 tons (T), 5.4 to 11.25 T, 11.25-20 T, and over 20T.
- Air-Source Heat Pumps ranging from sizes: single package to 5.4 T, 5.4 to 11.25 T, 11.25-20 T, and over 20T.

PUC 1-13
Building Energy Code

Request:

On Bates page 105, the Company provides a set of tables showing the "anticipated per unit percent savings reductions [for gas measures] that are likely to occur after the adoption of a new code standard." Regarding this, please explain the following:

a. What code or standard is this section referring to? Please be specific.

b. Confirm whether or not the effects of these savings reductions have been incorporated into the proposed 2024 Annual Plan and the 2024-2026 Three-Year Plan. In other words, were the proposed savings goals adjusted down according to the percentages included in these tables?

c. Explain how the Company derived these savings reductions estimates.

d. Please add a column to the table listing the percentage of total annual gas savings to be delivered by the proposed 2024 Annual Plan from each specific measure.

Response:

a. The standard this section is referring to is the Appliance and Equipment Energy and Water Efficiency and Standards Act of 2021 (R.I.Gen. Laws 39-27).

b. The effects of the code standards savings reductions were incorporated into the proposed 2024 Annual Plan and the 2024-2026 Three-Year Plan. Therefore, the proposed savings goals were adjusted down according to the percentages included in these tables.

c. These savings reductions estimates were derived from the RI 2023 Commercial Food Service Equipment Industry Standard Practice (ISP) Study results compared to the 2023 savings values. This study is summarized in Attachment 3.

Prepared by or under the supervision of: Brett Feldman

PUC 1-13, Page 2
Building Energy Code

d.

Gas Measures	Per Unit % Savings Reduction	Percentage of Total Annual Gas Savings from 2024 Annual Plan
2023 Fryer	80%	0.51%
2023 Convection Oven	46%	0.30%
2023 Combination Oven	92%	0.86%
2023 Steamer	91%	0.07%

PUC 1-14
Market Potential Study and EERMC Three-Year Targets

Request:

On page 13 of pre-filed testimony, the Company writes "the Company worked with the EERMC during the process of developing the MPS and offered feedback to help better align the MPS with the Rhode Island market." Please provide a copy of such feedback provided by the Company to the EERMC.

Response:

This feedback was provided by the Company in various forms including written, verbally at EERMC meetings, and verbally on calls with the MPS vendor (Dunsky). Please reference the following attachments:

- Attachment PUC 1-14-1 (Email from the Company to the EERMC Consulting team with suggestions and attachments)
- Attachment PUC 1-14-2 (Word document that lists relevant codes and standards updates and EM&V studies completed since 2020)
- Attachment PUC 1-14-3 (Impact Evaluation of Income Eligible Services)
- Attachment PUC 1-14-4 (Spreadsheet of measures, savings, and sources)
- Attachment PUC 1-14-5 (Dunksy MPS Refresh memo with Rhode Island Energy comments/questions)
- Attachment PUC 1-14-6 (Dunksy MPS Refresh draft results presentation with Rhode Island Energy comments/questions)

It is worth noting that based on the questions the Company asked about Commercial and Industrial Lighting measure lives, Dunsky noted that "Relative to draft results, the most significant change is C&I lifetime lighting savings, which have been updated to reflect the average adjusted measure lives in the 2022 lighting study. This reduced claimable lifetime savings resulting in roughly a 10% decrease in overall (res and non-res) achievable lifetime electric kWh savings relative to draft results."

Prepared by or under the supervision of: Brett Feldman

Seddon, Heidi

From: Feldman, Brett (RI Energy)
Sent: Thursday, January 12, 2023 9:57 PM
To: Adrian Caesar; Chybowski, Steven (DOA)
Cc: Samuel Ross; Craig Johnson
Subject: RE: [EXTERNAL] RE: EM&V/Code Updates List for MPS Refresh
Attachments: NG RI - IES Impact Evaluation Report_FINAL_30AUG2018.pdf; 2023.01.03_Codes Standards and EMV Updates List jk.docx

Hi Adrian, see attached and below. Here are some suggestions:

- Updates to avoided costs – AESC2021
- Updates to reflect recent program performance – If timing permits, sharing with them preliminary 2022 YE data
- Resi HVAC evaluation data- we can provide recent data
- Better mapping of Dunsky results by measure name or groups of measure names to RI Energy program/measure name combinations in BC model and TRM to facilitate use of potential estimates
- Including updated (i.e., inflated) measure costs in the potential analysis
- Is there any measure of Market Saturation included? We can do our own analysis.

Appreciate the opportunity to provide input, look forward to discussing further!

Brett

From: Adrian Caesar <Adrian.Caesar@nv5.com>
Sent: Wednesday, January 11, 2023 2:43 PM
To: Chybowski, Steven (DOA) <Steven.Chybowski@energy.ri.gov>; bsfeldman@rienergy.com
Cc: Samuel Ross <Samuel.Ross@nv5.com>; Craig Johnson <Craig.Johnson@nv5.com>
Subject: [EXTERNAL] RE: EM&V/Code Updates List for MPS Refresh

Hi Brett and Steve,

Attached is a slightly updated version of the Codes/Standards/EM&V document I shared last week, which now includes links to the PY2020 Custom Electric/Gas reports and one page summaries. We are planning to share the list with Dunsky this week, so **please provide any feedback by 12PM this Friday**.

Thanks!
Adrian

From: Adrian Caesar
Sent: Friday, January 6, 2023 4:17 PM
To: Chybowski, Steven (DOA) <Steven.Chybowski@energy.ri.gov>; bsfeldman@rienergy.com
Cc: Samuel Ross <Samuel.Ross@nv5.com>; Craig Johnson <Craig.Johnson@nv5.com>
Subject: EM&V/Code Updates List for MPS Refresh

Hi Brett & Steve,

The C-team has taken a first pass at assembling a list of materials to help jumpstart the MPS Refresh efforts that Dunsky will be leading. Presently, the list includes all relevant Codes & Standards and EM&V studies completed since 2022, though other types of updates and additional material can be added as well (e.g. changes in customer count, changes in costs/inflation values, updated BC Models and recent TRM drafts, etc.). If you could give this a review and add anything that is missing to the list, that would be great. For some documents that we would plan to provide as attachments, they can just be added to the list.

For next steps, we were envisioning working as a group to prioritize key changes/updates, so we can provide Dunsky with guidance regarding where impactful changes are likely to have occurred, so they can start their updates there. If you have questions or if finding a time to touch base on this would be helpful, please let us know.

Enjoy the weekend!
Adrian
--

Adrian Caesar
Senior Analyst
Optimal ENERGY – NV5
(802)482-5640 (Direct)
Adrian.Caesar@NV5.com

This document lists relevant codes and standards updates and EM&V studies completed since 2020. For impact evaluations, only results from the latest program year are linked.

Appliance Standards

In 2021, the State of Rhode Island passed the Appliance and Equipment Energy and Water Efficiency Standards Act of 2021, updating the state's previous appliance standards from 2005. The energy and water efficiency standards apply to 15 products.

More information about these standards can be found here: https://energy.ri.gov/energy-efficiency/appliance-and-equipment-efficiency-standards

An associated guidance document for each of the 15 products can be accessed from the link above, or directly here: https://risos-apa-production-public.s3.amazonaws.com/OER/12776/ADDDOC_12776_20220606131237260.pdf

State Energy Conservation Codes

In 2022, the State of Rhode Island updated its energy code to the 2018 IECC. More information about this update is available here: https://rules.sos.ri.gov/Regulations/part/510-00-00-8. A concise explanatory statement of the update that took place can be found here: https://risos-apa-production-public.s3.amazonaws.com/BCC/11400/CON_11400_20211102102932.pdf

It is possible that Rhode Island legislature could adopt the 2021 IECC model code in 2023, but that is not certain at this time.

C&I EM&V Studies

- C&I Lighting Market Characterization and Adjusted Measure Life Study | One Page Summary
- Impact Evaluation of PY2020 Custom Electric Installations in Rhode Island
- Rhode Island Cannabis Production Industry Standard Practice
- Impact Evaluation of PY2019 Custom Gas Installations in Rhode Island | One Page Summary (TO BE UPDATED WITH PY2020)
- 2021 Rhode Island Commercial and Industrial Gas Load Shapes | One Page Summary
- 2019 Commercial and Industrial Programs Free-Ridership and Spillover Study | One Page Summary
- Rhode Island C&I Market Characterization Data Collection Study | One Page Summary

Residential EM&V Studies

- National Grid Rhode Island Appliance Recycling Program Impact Study | One Page Summary
- National Grid Rhode Island Gas End-Use Consumption Study | One Page Summary
- National Grid Rhode Island EnergyWise Single Family Program Impact and Process Evaluation | One Page Summary
- National Grid Rhode Island EnergyWise Multifamily Program Impact and Process Evaluation | One Page Summary
- National Grid Rhode Island Home Energy Reports Program Impact Evaluation | One Page Summary

Commented [KJ(E1]: I'd call this highly probable. It's in state law that it needs to happen!
My be challenging to determine exactly how this will impact savings.

Commented [KJ(E2]: Potentially disappearing measures:
- **CHP** – Still allowed, but requirements very stringent/difficult to meet.
- **ISP's** – Some measures known to be going away in 2024 (certain lighting and food service equipment).

Commented [KJ(E3]: Streetlights: Adrian asked for a list of streetlight projects completed. We have a list of which communities have completed streetlights projects to date, which we'd be happy to share.

Before we share it, we should make sure anyone with access to the data signs an NDA to keep it confidential.

Commented [KJ(E4]: Lighting: Assume measure lifetimes decrease by 1 year per year hereafter. (For example, a measure with a 7-year measure life in 2023 would have a 6-year life in 2024.)

- 2019 Rhode Island Shelf Stocking Study | One Page Summary

Income Eligible EM&V Studies

- National Grid Rhode Island Income Eligible Multifamily Impact and Program Process Evaluation | One Page Summary

Cross Sector EM&V Studies

- Rhode Island Participation and Multifamily Census Study | Executive Summary
- Rhode Island Nonparticipant Market Barriers Study | Executive Summary
- Rhode Island 2020 Strategic Electrification Evaluation Final Report
- New England Regional Lighting Sales Data Analysis | One Page Summary

Other Reference Materials

- 2023 Plan BCR Electric and Gas Models
- RI Technical Reference Manual
- 2023 Plan Final RI TRM Database

Commented [KJ(E5]: C&I Gas Retrofit:
Revise TRC's. Already revised for C&I Electric Retrofit but took longer to get cost data for Gas. Approach would be to mirror analysis conducted for Electric. (We managed to track down the data but not in time for the filing.)

cadeo

AUGUST 30, 2018

Impact Evaluation

National Grid Rhode Island Income Eligible Services

Developed For
National Grid
40 Sylvan Road
Waltham, MA 02451

Developed By
Cadeo Group
107 SE Washington Street, Suite 450
Portland, OR 97214

CONTENTS

Introduction

This report details the findings from Cadeo's impact evaluation of National Grid's 2015 and 2016 Income Eligible Services (IES) program for single family customers in Rhode Island.

About Income Eligible Services

National Grid Rhode Island offers IES to help low income families and individuals reduce their electric and gas bills by insulating their homes, replacing inefficient appliances and products, and providing energy efficiency education. The IES program provides eligible customers with home energy assessments and energy saving measures to improve the efficiency and comfort of their homes, free of charge.

Income eligible single family customers are those who live in one- to four-unit buildings and those who are enrolled in National Grid's fuel discount rate plans (A-60 Electric Low-Income rate and/or 1301 Low-Income Heat rate). Customers who qualify for the Low-Income Home Energy Assistance Program (LIHEAP), also known as "fuel assistance" are also eligible to participate in IES.

Program participants are offered home energy assessments with educational materials and direct installation of energy-saving measures such as efficient lighting, smart power strips and room AC timers. Program participants may also qualify to receive weatherization measures (regardless of their heating fuel—gas, electric or delivered duels), as well as heating system replacement, the removal or replacement of inefficient appliances, and domestic hot water measures.

The IES program is delivered by Rhode Island's territory-based Community Action Agency Program agencies and local contractors. The IES program works in close collaboration with the State of Rhode Island Department of Human Services weatherization program and LIHEAP, overseen by the federal Department of Energy and Department of Human Services, respectively.

Program Summary

In 2015 and 2016, IES completed approximately 4,600 home energy assessments and installed more than 130,000 energy efficiency measures. Table 1 lists the number of each measure installed by IES during these two years, as well as the per-unit ex ante savings associated with each measure. For almost all measures, National Grid's ex ante savings come from the previous IES impact evaluation[1], which was completed in 2014 and assessed savings for program years 2011 and 2012. Notable exceptions to this trend are the program's lighting measures. For lighting measures, National Grid used the results of a residential lighting Market Adoption Model (MAM) to develop ex ante values for IES.

[1] http://rieermc.ri.gov/wp-content/uploads/2018/03/national-grid-rhode-island-income-eligible-services-impact-evaluation-volume-ii.pdf

Table 1. 2015 and 2016 Participation and Per-Measure Ex Ante Savings

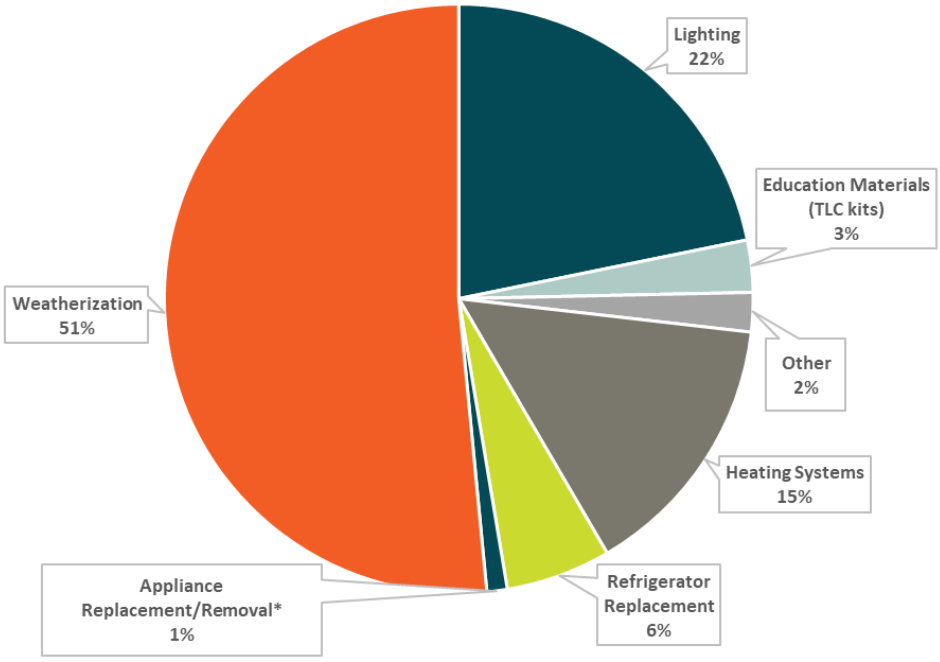
	Electric (kWh)		Natural Gas (Therms)		Oil (MMBTU)		Propane (MMBTU)	
IES Measure	**n**	**Savings**	**n**	**Savings**	**n**	**Savings**	**n**	**Savings**
AC Replacement (Window Unit)	925	100						
AC Timer	196	0						
Appliance Removal (Refrigerator or Freezer)	16	1,180						
Domestic Hot Water (Aerators or Showerheads)	13	134	36	9	4	0.7		
Education Materials (TLC kits)	4,603	138						
Freezer Replacement	285	484						
Heat Pump Water Heaters	1	1,775						
Heating Systems			362	184	241	18.4	5	18.4
CFL	21,846	45						
LED Bulbs	77,183	39						
LED EISA EXEMPT	11,147	52						
LED Reflectors	5,082	57						
Refrigerator Replacement	3,336	384						
Smart Strip	6,264	75						
Waterbed	3	872						
Weatherization	48	1,616	846	188	670	28.1	23	28.1

To understand how each of these measures contributed to IES' overall savings, Cadeo (also referred to as the evaluation team) applied the program's per-unit ex ante savings to the 2015–16 IES measure counts. To add clarity, the team also aggregated the 16 measures in Table 1 into the following 7 different measure groups:

- **Weatherization**
- **Lighting**. CFL, LED Bulbs, LED EISA EXEMPT, and LED Reflectors
- **Heating Systems**
- **Refrigerator Replacement**
- **Appliance Replacement/Removal (other than refrigerators).** AC Replacement, Appliance Removal, and Freezer Removal
- **Education Materials/TLC Kits**
- **Other**. Domestic Hot Water, Heat Pump Water Heaters, Smart Strips, Waterbed, AC Timer

Figure 1 compares the total ex ante savings generated by each measure category in 2015–16. To enable comparison savings across fuels, the team converted all savings into MMBTU. Based on the program's per-unit ex ante savings and reported participation, IES saved 75,742 MMBTU in 2015 and 2016.[2]

Figure 1. Savings by Measure Category (MMBTUs in 2015 and 2016)

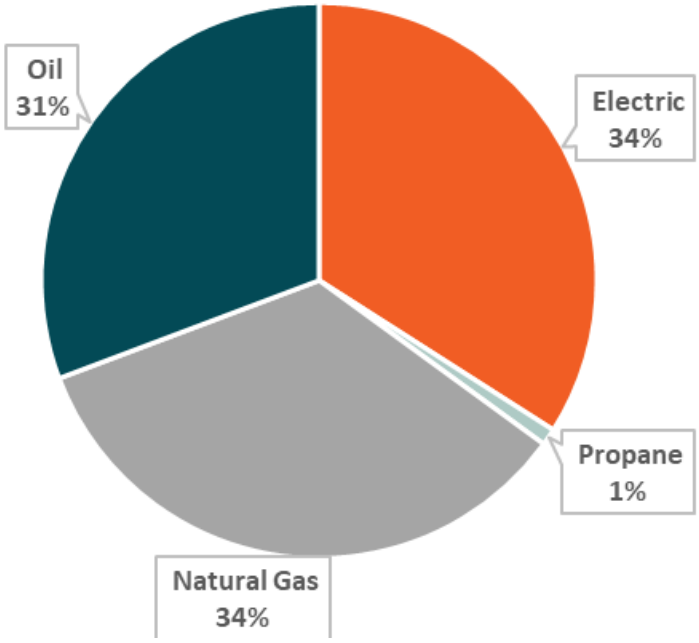


As shown above, just over half of the program's savings came from weatherization alone. In total, weatherization, lighting, heating systems, and refrigerator replacement constituted 94% of IES' total ex ante savings in these two years. Consequently, the evaluation team focused its efforts on these measure categories.

The team also investigated how each fuel type served by IES—electricity, natural gas, oil, and propane—contributed to the program's overall savings. As evident in Figure 2, IES' electric, natural gas, and oil savings contributed relatively equally to the program's overall ex ante savings.

[2] This total represents the primary savings associated with each measure. That is, the total does not include additional savings generated by some measures, such as the electric furnace fan savings resulting from weatherization.

Figure 2. Savings by Fuel (MMBTUs in 2015 and 2016)



Study Objectives

National Grid established three objectives for the 2015 and 2016 IES impact evaluation:

- Estimate the overall average energy savings attributable to the IES program
- Provide credible energy savings and realization rates for each electric, natural gas, propane and heating oil measures and/or measure groups
- Report findings and observations and provide recommendations on program design to help improve the effectiveness of the program

To meet these three objectives, Cadeo used a combination of billing analysis, technical reference manual-based (TRM) engineering algorithms and building simulation modeling.

Key Terminology

The evaluation team uses the language defined in Table 2 throughout the report to explain key impact evaluation concepts.

Table 2. Summary of Key Evaluation Terminology

Term	Definition
Participant	An individual or household (also identified by a unique account number) who receive at least one IES measure (such as a TLC kit, CFL or LED lighting, a refrigerator replacement, and/or a heating system replacement).
Ex Ante Savings	Savings assumed by National Grid prior to an evaluation, usually based on the prior IES impact evaluation and/or the Rhode Island TRM.
Ex Post Savings	Savings determined through this evaluation.
Treatment Group	The IES participants for whom the team estimated ex post savings: customers who received IES measures in program year 2015 or 2016. The treatment group for the billing analysis was limited to IES participants prior to October 2016, to ensure a full heating season in the post-installation period after accounting for a blackout period around the measure installation date.[3]
Control Group	The set of customers used in a billing analysis to serve as a counterfactual for estimating the program's impact. The control group accounts (or controls) for exogenous factors such as moves and rate changes that can otherwise obscure program-generated savings. In the context of this evaluation, the team used future IES participants (i.e., IES participants in 2017) as the control group.
Weatherization	A general term used to describe air sealing and/or insulation (one of more of attic, wall, or floor insulation). References to air sealing or insulation in the report are specific to that measure, whereas weatherization refers to one or both measures.

[3] For the billing analysis, the team began each participant's post-installation period with the second full billing cycle after the participant's final measure installation date, which allows for at least one full month of "transition time" between pre- and post- period.

How to Use the Results of this Evaluation

We present the results of this evaluation in three parts: An **Evaluation Summary,** a **Supporting Documentation workbook,** and an **Appendix**.

The **Evaluation Summary,** which this section is part of, summarizes the results of the evaluation and briefly outlines the evaluation methodologies used. For key IES measures, such as lighting, refrigerator replacement, weatherization and heating system replacement, the Evaluation Summary includes a more detailed explanation of how the team calculated ex post savings. The Evaluation Summary does not, however, include details such as the engineering algorithms and the specific primary and secondary data used to develop ex post savings for other measures.

For these types of details, users of this evaluation should rely on the second evaluation output: **Supporting Documentation workbook**. This Excel workbook includes additional details about all aspects of this evaluation. Specifically, the workbook includes the detailed regression results (parameters, coefficients, and standard errors) for both the natural gas and electric billing analyses. It also includes a tab for each IES measure that was evaluated using an engineering approach (algorithms or building simulation). For measures assessed using an algorithmic approach, the workbook details the Rhode Island TRM engineering algorithm used to evaluate that measure and the values (and sources) for all inputs used in that algorithm. Each measure-specific worksheet also includes a direct comparison of ex ante and ex post savings. Each of these tabs link to common participant, housing stock, and engineering assumptions to ensure consistency across measures and transparency. Readers interested in accessing the Supporting Documentation Workbook should request access from the IES evaluation manager.

The third and final part of this evaluation is the **Appendix,** which contains the original work plan (Appendix A) and the data review and analysis plan (Appendix B) deliverables that the evaluation team created as part of this study.

Methodology

Overview

The evaluation team relied on three complementary evaluation methodologies: billing analysis, engineering algorithms, and building simulation. Table 3 briefly summarizes each methodology. The analysis plan (Appendix B) describes each methodology in greater detail.

Table 3. Summary of Evaluation Methodologies

Methodology	Details
Billing Analysis	• Used to report ex post savings when measure-specific billing analysis results met pre-determined threshold of better than ±25% precision at the 90% confidence level • Combined customer billing records with weather and measure installation data (for both IES and non-IES funded measures) to get a complete perspective of each customer's energy consumption drivers • Conducted a structured screening process to ensure that the model uses only those customers with sufficient billing data and without spurious billing records • Matched each treatment group customer to a control group (future IES participants) customer with a similar, monthly, preinstallation period energy consumption pattern • Specified and refined a monthly post-program regression (PPR) model • Generated results, which were weather-normalized (where applicable) using 30-year historical weather data from three different weather stations across Rhode Island; each IES participant was mapped the closest weather station
Engineering Algorithms	• Relied primarily on the algorithms documented in 2018 Rhode Island TRM[4] • Relied on recent studies from other jurisdictions (notably Massachusetts and Ontario) where the Rhode Island TRM did not specify a savings algorithm or specific input value • Leveraged detailed IES program data to calculate baseline and efficient cases for each measure • Relied on regionally appropriate secondary data sources and other relevant studies when IES program data was not collected or unavailable (sources included the most recent low income impact evaluation in Massachusetts5, Residential Energy Consumption Survey, ENERGY STAR® standards, Building America Benchmark Program Database, etc.) • Included a literature review of recent studies, relevant US Department of Energy appliance standards, other state TRMs, and similar evaluations in other states

[4] http://www.ripuc.org/eventsactions/docket/4755-NGrid-2018-TRM-RI.pdf
[5] http://ma-eeac.org/wordpress/wp-content/uploads/Low-Income-Single-Family-Program-Impact-Evaluation_Part-of-the-Massachusetts-Residential-Retrofit-Low-Income-Program-Area-Evaluation.pdf

Methodology	Details
Building Simulation	• Modeled using BEopt (Building Energy Optimization) software developed by the National Renewable Energy Laboratory • Constructed baseline home geometry and building characteristics based on IES data; inputs like square footage, number of floors and bathrooms, and weather profile were all informed by IES program data • Leveraged a similar building model used during the 2018 MA Home Energy Services impact evaluation for inputs that could not be estimated through program data • Simulated ten different scenarios reflecting various building types (e.g., one-story detached, low-rise multi-unit), heating fuels, heating system combinations, and cooling scenarios • Calibrated each model using IES participant billing data • Disaggregated billing data into specific end uses (heating, water heating, and baseload) • Weighted the result of the ten models into a statewide average using the building type, heating fuels, heating type, and cooling type characteristics of 2015 and 2016 IES customers

Data Sources

To inform the evaluation team's analysis, National Grid provided four data sources that characterized the IES program energy-efficiency improvements and other characteristics of the program's participants.

- **IES Measure Data**. Included basic customer information (account number, ZIP code, heating fuel type) and measure (measure type, quantity, and ex ante savings) for 2015, 2016, and 2017 participants, the latter of whom we used as a control group in the billing analysis.
- **Supplemental Participant Data**. Provided additional information regarding the number of units in participating buildings, as well as the type (central or room), size (number of BTUs), and number of cooling systems present in participating customers' homes. In a separate file, National Grid also provided detailed information (e.g., age, size, configuration) about the inefficient appliances that were removed or replaced through IES.
- **Non-IES Measure Data.** Contained information regarding the energy efficiency measures, as well as health and safety improvements, made in IES customer homes that were not funded by National Grid. These measures and/or improvements were funded by one of the following sources: Department of Energy Weatherization Assistance Program (DOE WAP) or Health & Human Service Weatherization Assistance Program (HHS WAP).
- **Billing Data**. Provided electric and natural gas energy consumption data for customers between January 2014 to April 2018. The raw dataset includes energy usage of both program participants and future program participants, along with other variables such as billing cycle dates, customer type, and billing rate type. The team did not attempt to gather any information regarding delivered fuels (i.e., heating oil and propane).

In addition to the four data sources already listed, the evaluation team acquired weather data from NOAA (National Oceanic and Atmospheric Administration):

- **Weather Data**. The evaluation team assigned weather data to each National Grid participant based upon the NOAA weather station closest to the participant's ZIP code. Thus, each participant's heating and cooling degree days used in the analysis are specific to the area for which their billing data is associated. The evaluation team used Providence, Block Island[6], and North Central State Airport weather stations for this analysis.

[6] The Block Island weather station is not in National Grid's service territory, but it is the closest weather station to a small amount of IES participants.

Results Summary

Table 4 presents the ex post results for each evaluated IES measure. The table also indicates which methodology the evaluation team used to estimate ex post savings.

The team used engineering algorithms to evaluate most measures, while the billing analysis was limited to a small subset (i.e., lighting, refrigerator replacement, natural gas weatherization, and natural gas heating system replacement), where the evaluation team could report savings at better than ±25% precision at the 90% confidence all level.

As noted previously, several of the measures listed in Table 4 were not offered by National Grid in 2015 and 2016. The evaluation team included these measures as part of this study, at National Grid's request, to inform IES planning efforts.

Table 4. IES PY 2015-2016 Ex Post Savings by Measure and Fuel

IES Measure	Electric (kWh)	Natural Gas (Therms)	Oil (MMBTU)	Other (MMBTU)
AC Replacement (Window Unit)	71	N/A	N/A	N/A
AC Timer	0	N/A	N/A	N/A
Appliance Removal (Refrigerator or Freezer)	1,036	N/A	N/A	N/A
Clothes Washer and Dryer**	Various (See Workbook for Details)			
Dehumidifiers Replacement**	1,106	N/A	N/A	N/A
Domestic Hot Water (Aerators or Showerheads)	160	8	0.9	0.8
Education Materials (TLC kits)	21	N/A	N/A	N/A
Freezer Replacement	333	N/A	N/A	N/A
Heat Pump Water Heaters	814	N/A	N/A	N/A
Heating Systems	N/A	79	7.8	7.9
Furnace Fan (due to heating system replacement), **kWh**	N/A	16	10	16
CFL	18*	N/A	N/A	N/A
LED Bulbs		N/A	N/A	N/A
LED EISA EXEMPT		N/A	N/A	N/A
LED Reflectors		N/A	N/A	N/A
Programmable Thermostats**	232	34	3.4	3.4
Electric savings (Fan savings and cooling savings for CAC), **kWh**	18.8	11.2	8.7	11.2
Refrigerator Replacement	467	N/A	N/A	N/A
Smart Strip	75	N/A	N/A	N/A
Waterbed	872	N/A	N/A	N/A
Weatherization	1,201	124	12.6	12.4
Furnace Fan Savings, **kWh**	N/A	63	65	63
Cooling Savings, **kWh**	78	30	30	30

*Note: 18 kWh represents the average per-bulb savings estimate for all lighting measures

**Added to IES after 2016 or under consideration for future inclusion; not offered as part of IES during 2015 and 2016

Key

- Billing Analysis
- Engineering Algorithm
- Building Simulation

Table 5 and Table 6 compare the ex post savings presented in the previous table with the program's ex ante savings. Table 5 focuses on electric measures, while Table 6 compares natural gas, oil, and propane measures. Both tables include a brief explanation of why ex ante and ex post savings may differ. Also, both tables are limited to the measures installed in 2015 and 2016 and focus on the primary savings associated with each measure. Information about changes in the savings associated with measure's other energy impacts (e.g., electric furnace fan savings resulting from weatherization) is provided in the Supporting Documentation workbook.

Table 5. Comparison of Ex Ante and Ex Post Savings – Electric Measures (kWh/year)

IES Measure	Ex Ante	Ex Post	Realization Rate	Details
AC Replacement (Window Unit)	100	71	71%	Updated effective full loads hours reduced savings relative to ex ante (previous estimate based on central air conditioner usage, not a window unit). However, a lower baseline efficiency (to reflect in situ conditions) offset overall decrease.
Appliance Removal (Refrigerator or Freezer)	1,180	1,036	88%	Applying the Uniform Methods Protocol appliance recycling protocol, using IES-specific appliance characteristics, yielded similar - but somewhat lower - savings relative to ex ante, which was a leveraged value from Massachusetts.
Domestic Hot Water (Aerators or Showerheads)	134	160	120%	The evaluation weighted the number of installs based on program data; showerhead savings increased the average significantly, as they were the more prevalent DHW measure in 2015-2016
Education Materials (TLC kits)	138	21	15%	The ex ante savings were based on the previous evaluation's finding that whole-home electric savings (via billing analysis) were above and beyond the aggregated measure-specific savings for electric measures. The current evaluation did not produce a similar finding so the ex post savings reflect savings associated with kit contents alone.
Freezer Replacement	484	333	69%	Applying the Uniform Methods Protocol appliance recycling protocol, using IES-specific freezer characteristics, yielded similar - but somewhat lower - savings relative to ex ante, which was a leveraged value from Massachusetts.
Heat Pump Water Heaters	1,775	814	46%	The ex ante savings are based on a hot water savings engineering algorithm. The ex post savings estimate was determined using a building simulation, weights for the mix of IES customers in single family detached and multi-unit (2-4) homes, and accounts for additional consumption from home HVAC system.
CFL	45	18	40%	Through billing analysis, the evaluation team found much lower per-unit savings for lighting compared to the ex ante savings, which are based on National Grid's residential lighting Market Adoption Model. However, the team was unable to estimate lighting type-specific (e.g., LED Bulbs, LED EISA EXEMPT) savings through the billing analysis.
LED Bulbs	39		47%	
LED EISA EXEMPT	52		34%	
LED Reflectors	57		31%	
Refrigerator Replacement	384	467	122%	Both the ex ante and ex post savings are billing analysis results. The point estimates from the two evaluation differ by 22%, although the two values are not statistically different; the billing analysis from the current evaluation has the better precision associated with its estimate.
Smart Strip	75	75	100%	The evaluation team confirmed that the ex ante savings relies on the best and most regionally appropriate estimate of smart strips savings. The team does note, shown later in the Recommendations, that National Grid gather information about installation location in the future. This will allow future evaluations to tailor savings estimates for IES.
Waterbed	872	872	100%	Due to limited participation for waterbeds (n=3), the team accepted the ex ante savings as ex post without further analysis.
Weatherization	1,616	1,201	74%	The ex ante savings were based on a leveraged Massachusetts evaluation. The ex post evaluation also leverages a Massachusetts study, albeit a more recent one. It also relies on IES-specific electric heating loads, as determined through the billing analysis.

Table 6. Comparison of Ex Ante and Ex Post Savings – Natural Gas (therms/year), Oil (MMBTU/year), and Propane Measures (MMBTU/year)

	Natural Gas			Oil			Propane			
IES Measure	Ex Ante	Ex Post	RR	Ex Ante	Ex Post	RR	Ex Ante	Ex Post	RR	Details
Domestic Hot Water (Aerators or Showerheads)	9	8.3	93%	0.7	0.9	127%				Results are generally similar to ex ante. Similar to the electric DHW analysis, the evaluation team weighted the overall DHW savings to reflect the mix of aerators and showerheads reported in the program data.
Heating Systems	184	79	43%	18.4	7.8	42%	18.4	8	43%	The natural gas billing analysis completed as part of the current evaluation yielded much lower savings than the previous evaluation. The results are statistically different between studies, with the current evaluation exhibiting much better precision around its estimate (±11% versus ±33%, primarily due to a larger sample sizes - 235 versus 29). The evaluation team does not have any information about changes to program delivery that would result in much lower average savings.
Weatherization	188	124	66%	28.1	12.6	45%	28.1	12	44%	Similarly, the natural gas billing analysis completed as part of the current evaluation yielded lower and statistically significantly different savings than the previous evaluation. As with heating system replacements, the current evaluation's results are more precise (±5% versus ±33%) and relied on a considerably larger sample of IES participants (785 versus 162). Again, the evaluation team does not have any information about changes to program delivery that would result in lower average weatherization savings.

Using the information above, the evaluation team determined the total ex post savings generated by IES in 2015 and 2016, and recalculated the contribution of each measure category toward the program's total ex post savings (Table 7). The lower per-unit ex post savings shown in the preceding tables for the program's three most important measures – weatherization, lighting, and heating systems – resulted in lower overall savings for IES (41,393 MMBTU/year) relative to the program's ex ante assumptions (75,742 MMBTU/year).

Table 7. Comparison of Ex Ante and Ex Post Savings – Measure Categories and Program Overall (MMBTU)

Measure Category	Ex Ante	Ex Post	Difference	Realization Rate
Weatherization	39,008	21,648	(17,360)	55%
Lighting	16,504	7,074	(9,430)	43%
Heating Systems	11,187	4,769	(6,418)	43%
Refrigerator Replacement	4,368	5,312	944	122%
Education Materials (TLC kits)	2,166	330	(1,836)	15%
Appliance Replacement/Removal*	850	605	(245)	71%
Other	1,660	1,656	(4)	100%
Total**	**75,742**	**41,393**	**(34,349)**	**55%**

*Excluding refrigerator replacement

**Reflects the primary savings associated with each measure. That is, total does not include additional savings generated by some measures, such as the electric furnace fan savings resulting from weatherization or the interactive effects that lighting retrofits have on heating usage for participants that heat with natural gas or delivered fuels.

The following report section (Key Measure-Specific Results) provides more information regarding the four measures - weatherization, lighting, heating systems, and refrigerator replacement – that generate the majority of IES' savings. Additional details regarding all other measures can be found in the evaluation's Supporting Documentation workbook.

Key Measure-Specific Results

This section presents details for key measures within each fuel type.

- **Natural Gas:** Heating Systems and Weatherization
- **Electricity:** Lighting and Refrigerator Replacement
- **Delivered Fuels:** Heating Systems and Weatherization

Natural Gas: Heating Systems and Weatherization

The team used billing analysis to evaluate energy savings for heating system replacement and weatherization in natural gas-heated homes.

The evaluation team conducted a screening process that removed natural gas participants without sufficient billing records or whose bills exhibited extreme or counter-intuitive energy consumption (Table 8). Our billing analysis uses a total of 904 National Grid natural gas-heated households that either received a new heating system or were weatherized through IES. The table below focuses on the treatment group (Program Year 2015–2016 participants), but the evaluation team filtered potential control group customers using similar filters.[7]

Table 8. Billing Analysis Sample Attrition – Natural Gas

Reason for Exclusion	Removed	%	Remaining
All Homes			1,176
Could not be mapped to Billing Data	31	3%	1,145
Insufficient (less than 10 months) Pre- and/or Post-Participation Billing Data	149	13%	996
Energy Consumption Outliers (<1th and >99th Percentile)	24	2%	972
Vacancies (No Billed Consumption for More than 8 Months)	15	1%	957
Extreme Changes in Consumption (±>80% Change between Pre and Post)	17	1%	940
Installed Before February 2015 or After October 2016	36	3%	904
Overall	**272**	**23%**	**904**

[7] See Supporting Documentation workbook for additional details

The team began by specifying a whole-home regression model, where we determine the average energy savings per participant regardless of whether they installed a heating system, were weatherized, or both. After determining average, whole-home savings for this subset of IES participants, the team used the PRR model specification, below, to estimate natural gas savings at a measure level:

$$ADC_{ct} = \sum_{month\ i} b_{1i}Month_{it} + b_2 LagADC_{ct} + b_3 NonIES_c + b_4 PostHDD_{ct} + b_5 HeatSys_c * PostHDD_{ct} + b_6 Wx_c * PostHDD_{ct} + e_{ct}$$

Where:

- ADC_{ct} = average, daily energy consumption for customer c at calendar month t
- $Month_{it}$ = 1 when index i = calendar month t, 0 otherwise. We include this series of 12 terms to capture month-specific effects in our analysis.
- $LagADC_{ct}$ = average daily consumption from customer c during calendar month t of the pre-program period
- $nonIES_c$ = 1 if customer c received non-IES measures[8]
- $PostHDD_{ct}$ = average, daily HDD for customer c in calendar month t using a base temperature of 65° F
- $HeatSys_c$ = 1 if customer c received heating system, 0 otherwise
- $Weatherization_c$ = 1 if customer c received weatherization, 0 otherwise
- e_{ct} is the error term from the regression model

The results of the evaluation team's billing analysis of weatherized natural gas-heated IES households follows in Table 9. Using a whole-home model, we determined that the IES participants in natural gas-heated homes averaged 128 therms in savings, or 14% of pre-participation household energy consumption. Heating system replacement and weatherization saved 79 and 124 therms, respectively.

It is important to note that the program did not install many other types of natural gas measures in 2015 and 2016. In fact, other than the heating system replacement and weatherization measures specified in the model, IES only installed a small number (n=36) of domestic hot water measures (i.e., showerheads and aerators) that impacted participants' natural gas usage. As a result, the team was not concerned about the measure-specific regression above associating savings from other gas measures to heating systems and weatherization.

[8] Before arriving at the binary (1 or 0) variable for non-IES participation, the team explored two methods for controlling for the savings associated with non-IES measures. First, the team included the estimated household-level energy savings estimate from the Hancock system, and noted that the regression coefficient was not statistically significant. The team also transformed the Hancock savings estimate into a categorical High/Low/No energy savings variable, which also did not produce a meaningful result.

Table 9. 2015–16 Natural Gas Billing Analysis Results

Measure	Billing Analysis Sample N	Energy Savings (Therms)	Precision* (% +/-)	Normalized Annual Consumption (Therms)	% of NAC
Heating System Replacement	235	79	11%	926	9%
Weatherization	785	124	5%	926	13%
Whole Home	**904****	**128**	**5%**	**926**	**14%**

*The precision above represents the width of the confidence interval. We have used 90% confidence interval in our analysis
**Some customers received both a heating system replacement and weatherization

A comparison of the team's whole home savings with the measure-specific savings—accounting for how many participants received each measure—confirmed the reliability of the team's measure-specific estimates. As shown in Table 10, the participation-weighted measure-specific household savings (127 therms/year) is nearly identical to the whole home model results presented in Table 9 (128 therms/year).

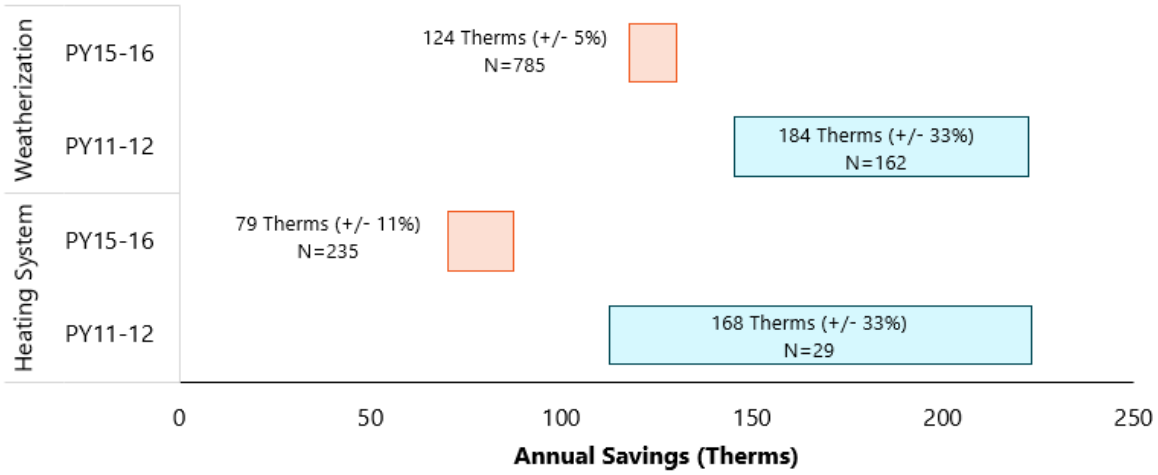
Table 10. Comparison of Whole Home and Measure-Specific 2015–16 Natural Gas Billing Analysis Results

Measure	% Receiving Measure	Energy Savings (Therms)
Heating System Replacement	26%	79
Weatherization	86%	124
Weighted Average Measure-Specific Household Savings		**127**

The evaluation team's analysis yielded ex post savings that are meaningfully and statistically significantly lower than the savings estimated for the same measures through the previous IES impact evaluation, which informed the program's ex ante assumption for these measures. Figure 3 compares the heating system replacement and weatherization savings estimates, as well as the analysis sample sizes and confidence intervals associated with each estimate, from both evaluations. While both evaluations relied on billing analysis to estimate savings, sample sizes and precision estimates for the current evaluation (2015–2016) are much more robust.

Outside of these statistical metrics, the evaluation team did not have access to any information (e.g., changes in average heating system efficiency or insulation r-values) that offered quantitative insight into differences in how IES delivered these measures in 2016 and 2016 relative to the previously evaluated years (2011 and 2012).

Figure 3. Comparison: 2015–2016 and 2011–2012 Billing Analysis Results (Natural Gas)[9]



[9] Note: Previous evaluation adjusts 2011-2012 billing analysis results to derive final savings estimate.

Electricity: Lighting and Refrigerator Replacement

During 2015 and 2016, National Grid Rhode Island IES participants could receive up to four different types of lighting measures through the IES program: compact fluorescent lamps (CFL), EISA-compliant light-emitting diode (LED) lamps, non-EISA compliant LED lamps, and LED reflector lamps. On average, IES participants who received lighting measures received an average of 25.8 bulbs (across all four lighting measures). Due to the high number of lighting measures installed, it was possible for the evaluation team to detect the impact of lighting at the household level through a billing analysis.

Similar to the process used for the natural gas weatherization and heating system replacement measure, the evaluation team conducted a screening process that removed participants with insufficient billing records or whose bills exhibited extreme or counter-intuitive energy consumption (Table 11). At the end of this process, a total of 2,819 treatment group customers remained in our billing analysis sample.

Table 11. Electric Billing Analysis Sample Attrition

Reason for Exclusion	Removed	%	Remaining
All Homes			**4,661**
Could not be mapped to Billing Data	55	1%	4,606
Insufficient (less than 10 months) Pre- and/or Post-Participation Billing Data	1,108	24%	3,498
Energy Consumption Outliers (<1th and >99th Percentile)	86	2%	3,412
Vacancies No Billed Consumption for More than 3 Months	11	0%	3,401
Extreme Changes in Consumption (>80% Change between Pre and Post)	45	1%	3,356
Weatherization or Select Equipment Replacement*	24	1%	3,332
Installed Before February 2015 or After October 2016	513	11%	2,819
Overall	**1,842**	**40%**	**2,819**

*To allow the team to detect lighting savings, the team excluded the small number of electrically heated households that were weatherized through IES, as well as those that received freezer replacement, or appliance removal. Excluding these customers from the billing analysis sample minimized variance and allowed the team to isolate lighting-related savings.

Before arriving at the final model specification below, the evaluation team began by specifying a single PPR model that would produce savings estimates for each of the four lighting measures and for refrigerator replacements—the IES energy-efficiency measures that the team believed would have the largest impact on household electric consumption. However, the team encountered two issues when attempting to quantify savings at this level of resolution. First, the model was unable to estimate statistically significant savings for each the four individual lighting measures (CFL, EISA-compliant LED, non-EISA compliant LED, and LED reflector). Second, due to the high correlation between lighting and refrigerator replacement (over 90% of participants who received refrigerator replacement also received lighting), the model struggled to differentiate between, and assign savings to, each measure.

Ultimately, the team took four actions to obtain a reliable result from our billing analysis model for lighting:

1. Used a single, aggregated variable that indicates whether the customer received any of the four IES lighting types
2. Split lighting and refrigerator replacement into separate models
3. Filtered out any participant that received another IES measure with substantial electric energy savings. Specifically, we:
    - **Both models**: removed weatherized participants (electric-heated homes only), appliance removal, freezer replacement, or air conditioner replacement
    - **Lighting model only**: removed participants that also received refrigerator replacement
    - **Refrigerator replacement model only**: removed participants that also received lighting
4. Limited the terms in the final model specification to only those with statistically significant coefficients. In particular, the team did not include a term for smart strips in the final model specification because it did not have a significant coefficient (i.e., p-value > 0.01).

The decisions above resulted in the team employing the following PPR model specification to estimate electric savings:

$$ADC_{ct} = \sum_{month\ i} b_{1i} Month_{it} + b_2 LagADC_{ct} + b_3 NonIES_c + b_4 Treatment_c + e_{ct}$$

Where:

- ADC_{ct} = average, daily energy consumption for customer c at calendar month t
- $Month_{it}$ = 1 when index i = calendar month t, 0 otherwise. We include this series of 12 terms to capture month-specific effects in our analysis.
- $LagADC_{ct}$ = average daily consumption from customer c during calendar month t of the pre-program period
- $nonIES_c$ = 1 if customer c received non-IES measures[10]
- $Treatment_c$ = 1 if customer c received lighting/refrigerator replacement, 0 otherwise
- e_{ct} is the error term from the regression model

[10] Similar to the natural gas analysis, the evaluation team assessed potential non-IES savings using multiple approaches; none of which produced statistically significant results.

Table 12 shows ex post savings for the IES lighting and refrigerator replacement measures. As shown below, the team estimated that participants who received lighting measures through IES saved, on average, 458 kWh. Since billing analyses are based on a home's total usage, this savings value reflects the household's total lighting-related savings. The team then estimated per-bulb savings (18 kWh/year) by dividing the total savings by 25.8—the average number of bulbs installed in participant's homes.[11]

Table 12. 2015–16 Electric Billing Analysis Results

Measure	Billing Analysis Sample N	Energy Savings (kWh)	Precision (% +/-)	Normalized Annual Consumption (kWh)	% of NAC
Refrigerator Replacement	197	467	25%	6,862	7%
Lighting	985	458	13%	6,707	7%
Whole Home*	**2,819**	**595**	**11%**	**6,838**	**9%**

*Includes customers that installed both lighting and had their refrigerator replaced; these customers were excluded from the refrigerator and lighting-only models.

The team also compared the whole home savings with the measure-specific savings. As shown in Table 13, the weighted sum of refrigerator replacement (63% of participants) and lighting (93% of participants) savings in the 2015–2016 billing analysis sample (720 kwh) is higher than the savings estimate from the evaluation team's whole home model (595 kWh). Ideally, these results are identical; however, because the measure-level billing analysis models used mutually exclusive sets of customers (i.e., separate models for lighting and refrigerator replacement), the difference is not surprising. Also, because the magnitude of the disparity is relatively small (21%), the team did not adjust the measure-level savings estimates to calibrate to the whole-home savings.

Table 13. Comparison of Whole Home and Measure-Specific 2015–16 Electric Billing Analysis Results

Measure	% Receiving Measure	Energy Savings (Therms)
Refrigerator Replacement	63%	467
Lighting	93%	458
Weighted Average Measure-Specific Household Savings		**720**

The evaluation team notes that the savings estimates shown in Table 12 represent something between gross and net energy savings. The precise location of the team's estimate on the spectrum between gross and net energy savings is not knowable given the data that were available during this evaluation—the evaluation scope did not include participant surveys for deriving net-to-gross ratios.

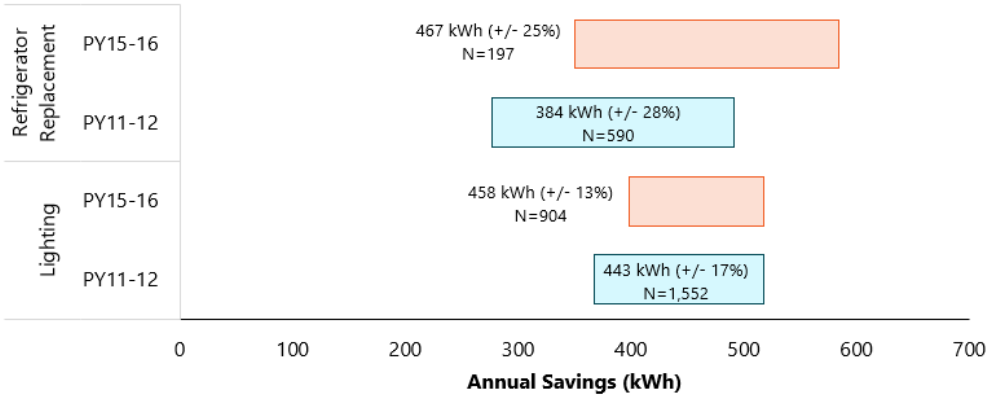
[11] The average number of lamps installed by IES participants included in the lighting-only electric billing analysis (25.8) was almost identical (25.7) to the program's overall average. Therefore, the team did not conduct any subsequent weighting to ensure the sample average was similar to the program average.

However, for lighting measures, which are readily available and relatively affordable, it's possible—even likely—that some customers in our control group of future IES participants installed some number of LEDs themselves prior to participating. If this assertion were true, we assume that our savings estimate is closer to net due to the free-ridership implied by self-funded lighting replacements in the control group.

It is also important to note that the electric billing analysis results above account for any cooling-related impacts (due to post-participation reduced lighting waste heat), as well as heating impacts for the subset of participants that heat with electricity. However, the results do not reflect the impact of IES lighting retrofits on space heating for participants that heat with natural gas or delivered fuels. Future evaluation should consider accounting for these lighting-related interactive effects for these heating fuel types. To enable this analysis as part of future evaluations, IES should track whether lamps are installed in conditioned space.

Similar to the natural gas billing analysis, the evaluation team compared the results and associated confidence intervals determined through the current electric billing analysis to the previous evaluation. The team found the results were not statistically different, although the precision associated with the 2015–2016 result was better for both electric measures.

Figure 4. Comparison: 2015–2016 and 2011–2012 Billing Analysis Results (Electric)



The evaluation team also conducted an additional analysis of lighting savings, segmented by the number of IES bulbs given to each participant. The previous IES evaluation, conducted for program years 2011 and 2012, noted that per-bulb savings decreased as the number of IES bulbs per home increased. Table 14 shows a similar trend, where the homes that received 10 or fewer bulbs through IES saved an average of 82 kWh per bulb, while homes that received more than 40 saved an average of 7 kWh per bulb. While this analysis cannot make any statements about causation (i.e., program bulbs were installed in low-use areas of the home), this finding supports the previous hypothesis of diminishing returns for each incremental bulb.

Table 14. 2015–16 Per-Bulb Savings by Quantity of IES Bulbs Received

Number of Bulbs	Relevant Participants in Billing Analysis Sample N	Per Bulb Energy Savings (kWh)	Precision (% +/-)
1–10	89	82	23%
11–20	416	28	18%
21–30	253	14	25%
31–40	148	19	16%
40 or More	79	7	26%
All	**985**	**18**	**13%**

Delivered Fuels: Heating Systems and Weatherization

Since a billing analysis is not possible for delivered fuels, the evaluation team leveraged the results of natural gas billing analysis to estimate ex post savings for both heating oil and propane heating system replacements.

Applying the evaluation team's natural gas savings to heating oil and propane customers implies similarity between the customers heating with these different fuels. The team assumed that participants who received weatherization and heating system replacements through IES live in similarly sized homes, regardless of heating fuel (natural gas, heating oil, or propane)[12]. Other, implicit similarity assumptions—such as natural gas, heating oil, and propane customers heating their home to similar temperatures in the winter—are not possible to test.

For heating oil, the evaluation team adjusted the total savings determined for weatherized customers heating with natural gas to reflect that heating oil systems are slightly less efficient at converting heating oil into heat. As a result, it takes more heating oil for a customer to heat their home to their desired heating temperature setpoint than it does a natural gas customer. For this reason, the ex post savings associated with weatherized heating oil participants is slightly higher than weatherized natural gas-heated customers (when comparing both savings in similar units, i.e., MMBtus).

For propane, the team directly applied the natural gas savings (converting therms to MMBtu). Propane and natural gas heating systems are comparably efficient when converting their respective fuels into heat. Consequently, it is possible to leverage the natural gas billing result directly.

Table 16 presents ex post savings for both heating oil and propane. Unlike Table 9, which presents the billing analysis-based ex post savings for natural gas heated participants, this summary table does not

[12] Based on audit data from Massachusetts' Home Energy Services program during a concurrent time period (calendar year 2015 and 2016).

include precision estimates; the engineering adjustments and assumptions made for heating oil and propane do not facilitate a measurement of statistical significance.

Table 15. 2015-16 Ex Post Heating System Savings – Heating Oil and Propane

Heating Fuel	Measure	PY15-16 # Participants	Ex Post Savings (MMBTU / Year)
Oil	Heating System Replacement	471	7.8
	Weatherization	670	12.6
Propane	Heating System Replacement	12	7.9
	Weatherization	23	12.4

Recommendations

The evaluation team offers the following recommendations related to the findings of this study, as well as to inform future evaluations.

1. **Use the billing analysis-based lighting savings from this evaluation as prospective savings for future IES program years**. As mentioned previously, National Grid relied on outputs from a residential lighting market adoption model (or MAM) to develop ex ante savings for IES for 2015 and 2016. Using the model for IES is intuitive as the lighting market is experiencing rapid annual change and because other National Grid residential programs rely on the model. However, this evaluation (18 kWh) – like the last IES evaluation (22 kWh) – produced billing analysis-based estimates of per-unit lighting savings much lower than the program's ex ante assumptions, which range from 38.7 to 57.2 kWh depending on the lamp type. Given the large number of lamps installed in the average IES participants' home (25+) and consistent evaluation results showing lower savings through billing analysis, the evaluation team recommends that National Grid use this evaluation's ex post results – and not the MAM – as prospective, ex ante lighting savings for future IES program years. It is important to also note this recommendation may cause a disconnect between the savings IES claims for a specific lamp and the savings claimed for the same lamp by another National Grid program. It is also important to note that the billing analysis results determined through evaluation are likely more reflective of net savings (due to the use of a control group) than gross savings.
2. **Collect and provide future evaluators with more detailed IES data.** Throughout this study, the evaluation team worked closely with National Grid to obtain the most granular program data possible. In most cases, National Grid was able to provide the information the team requested. In some instances, however, additional information that National Grid was unable to provide would have aided the evaluation process. To benefit future evaluations, the team recommends National Grid ensure these additional data fields (which are enumerated in the evaluation's Supporting Documentation workbook) are available to inform future studies.
3. **Monitor changes in measure offerings.** The current evaluation focused its efforts on the measures responsible for the majority of IES' 2015 and 2016 savings. While the team evaluated all measures from these program years, as well as several additional measures that IES has started to offer since 2016 or plans to offer in the future, the bulk of the team's efforts were on evaluating these key and impactful measures. If other measures, such as heat pump water heaters (only one was installed in 2015 and 2016) play a larger role in future program years, the team recommends assigning greater importance to them as part of future ad hoc or full-scale IES evaluations.

Appendix A: Evaluation Workplan

To: Romilee Emerick, National Grid
From: Doug Bruchs, Cadeo
Date: May 25, 2018
Re: IES Impact Evaluation Work Plan

This document details Cadeo's plan for completing an impact evaluation of National Grid's 2015 and 2016 Income Eligible Services (IES) program in Rhode Island. This document, which will serve as the work plan for the evaluation, consists of the following sections:

4. Introduction
5. Billing Analysis
6. Engineering Algorithms
7. Building Simulation Modeling
8. Deliverables and Schedule
9. Evaluation Team
10. Project Management
11. Data Request

Introduction

National Grid established three objectives for the 2015 and 2016 IES impact evaluation:

1. Estimate the overall average energy savings attributable to the IES program
2. Provide credible energy savings and realization rates for each electric, natural gas, propane and heating oil measures and/or measure groups
3. Report findings and observations and provide recommendations on program design to help improve the effectiveness of the program

As outlined in our proposal, our team will meet these three objectives using a combination of billing analysis, technical reference manual-based (TRM) engineering algorithms and building simulation modeling. We believe these complementary evaluation approaches will yield the credible measure-specific savings National Grid seeks and offer insight National Grid can use to inform IES program planning in 2019 and beyond.

At this point in time, we cannot definitively state which approach our team will use to evaluate each specific IES measure. Whenever possible, our preference is to rely on billing analysis. This is because billing analysis, using a well-matched control group and informed by robust program data, best reflects the actual change in energy usage within participating homes. However, billing analysis is not a viable option for all IES measures; the per-measure savings expected from many IES measures is not large enough to detect via billing analysis given the level of program participation in 2015 and 2016. In

addition, it is challenging for billing analysis to accurately attribute overall observed savings to specific measures when many measures are installed simultaneously, especially when the sets of measures received by participants is similar.

Currently, we anticipate using the approach listed in Table 16 to report savings for each IES measure. However, the actual approach our team uses may change after we review the program and billing data requested at the end of this workbook.

Table 16. Anticipated Impact Methodology by IES Measure and Fuel*

	Electric	Natural Gas	Heating Oil	Propane
AC Replace	Algorithm	N/A	N/A	N/A
AC Timer	Algorithm	N/A	N/A	N/A
Appliance removal	Algorithm	N/A	N/A	N/A
CFL	Billing Analysis	N/A	N/A	N/A
Clothes Washer and Dryer**	Algorithm	N/A	N/A	N/A
Dehumidifier**	Algorithm	N/A	N/A	N/A
Domestic Hot water	Algorithm	Algorithm	Algorithm	N/A
Education materials	Algorithm	N/A	N/A	N/A
Freezer	Algorithm#	N/A	N/A	N/A
Heat Pump Water Heaters	Simulation	N/A	N/A	N/A
Heating Systems, Boiler	N/A	Billing Analysis	Simulation	Simulation
Heating Systems, Furnace	Simulation (Fan)	Billing Analysis	Simulation	Simulation
LED Bulbs	Billing Analysis^	N/A	N/A	N/A
LED EISA EXEMPT	Billing Analysis^	N/A	N/A	N/A
LED Reflectors	Algorithm	N/A	N/A	N/A
Programmable Thermostat	N/A	Algorithm	Algorithm	Algorithm
Refrigerator rebate	Algorithm#	N/A	N/A	N/A
Showerhead	Algorithm	Algorithm	Algorithm	Algorithm
Smart Strip	Algorithm	N/A	N/A	N/A
Waterbed	Algorithm	N/A	N/A	N/A
Weatherization	Simulation	Billing Analysis	Algorithm	Algorithm

*The team listed measure/fuel combinations as "N/A" if National Grid did not report savings for the measure and fuel type in Table 1 or 2 in the IES impact evaluation RFP. The team anticipates reviewing this list of measures and fuel types, and updating as necessary, as part of the evaluation's kick-off meeting.

**New measures added for 2017 and 2018, not part of the 2015 and 2016 program years being evaluated.

^The previous IES impact evaluation used an engineering approach to estimate savings for LEDs since, at the time, LEDs were relatively new to IES and not installed in sufficient numbers to support billing analysis.

#The previous IES impact evaluation used billing analysis to estimate savings for appliance rebates. However, the precision associated with these estimates were not robust.

In most cases, our team will rely exclusively on the approach identified in Table 17. However, for certain measures and fuel type combinations, the team will employ multiple approaches to generate the most

reliable savings estimate and/or gain additional insight into program design and delivery. These measure and fuel combinations include:

- **Weatherization and Heating Systems (Heating Oil and Propane).** The team expects our billing analysis of natural gas weatherization and heating systems to result in statistically significant savings (confidence and relative precision of 90/10 and 90/15, respectively). Since a comparable billing analysis is not possible for these delivered fuels, the team will leverage the billing analysis-based results for natural gas to calculate weatherization and heating system savings for heating oil and propane. Specifically, the team will use engineering calculations to account for differences in the average heating system efficiencies across fuels and, if necessary, adjust for any known differences in the size of natural gas heated participants' home relative to participants heating with oil and propane.
- **Lighting Measures.** The team will estimate CFL and LED savings using the algorithm specified in the Rhode Island TRM, as well as using billing analysis. Sometimes the team uses multiple methods to better estimate savings. In other instances, such as with these screw-in lighting measures, our team uses a secondary method to gain insight into program delivery. In the case of lighting, our team's previous work in New England has found that billing analysis can reveal meaningful differences in per-bulb savings depending on the total number of bulbs installed in a given home. This information can provide insight into the optimal number of bulbs to install as part of future program cycles.

The following three sections offer more details about the specific methodology our team will use for each of the three impact evaluation approaches identified in Table 17.

Billing Analysis

To generate more robust savings estimates, the team plans to combine 2015 and 2016 participants into a pooled model and estimate average savings across both years (versus estimating separate savings for each year). At this time, our team is not aware of any changes in IES delivery between 2015 and 2016 that would suggest that aggregating participants across years for evaluation purposes inappropriate. Our team will confirm this understanding at the evaluation's kick-off meeting. For the remainder of this work plan, we refer to this aggregated group of 2015 and 2016 IES participants as the treatment group.

Our team will use a monthly Post Program Regression (PPR) model to estimate average measure-specific savings for the measure and fuels shown in Table 17. The general form of a Post Program follows[13]:

$$\mathrm{ADC_{ct}} = \mathrm{b_1 Treatment_c} + \mathrm{b_2 LagADC_{ct}} + \sum_{\text{month i}} \mathrm{b_{3i} Month_{it}} + \sum_{\text{month i}} \mathrm{b_{4i} Month_{it} * LagADC_{ci}} + \mathrm{e_{ct}}$$

Where

12. ADC_{ct} = average, daily energy consumption for customer *c* at calendar month *t*
13. $Treatment_c$ = 1 if customer c is in treatment group, 0 if customer c is in control group.
14. $LagADC_{ct}$ = average daily consumption from customer *c* during calendar month t of the pre-program period

[13] If we need to estimate savings for more than one weather-sensitive or base load measure, we add the appropriate terms for each measure.

15. $Month_{it}$ = 1 when index i = calendar month t, 0 otherwise. We include this series of 12 terms to capture month-specific effects in our analysis.
16. e_{ct} is the error term from the regression model.

In the model above, we derive annual, measure level savings from the coefficient b_1, which represents the average daily savings (kWh for electric, therms for natural gas) due to the program. As we learn more about the IES program data that are available and wrap up our concurrent work with the Home Energy Services evaluation in Massachusetts, we will make a final decision about the model specification. We will communicate and vet the final model specification with the IES evaluation stakeholder group via the analysis plan our team will distribute in mid-June.

In the model above, in addition to the treatment group customers, we also use a set of control group customers to account for the impact of various macroeconomic factors and other influences on pre- and post-program energy consumption that are unrelated to the installation of program measures. These factors include, but are not limited to, macroeconomic trends, the movement of people in and out of homes, and fluctuations in per-unit energy costs.

It's critical that the control group be as similar, in terms of both the customer profiles and energy usage, to the treatment group as possible. Our team will ensure comparability between the treatment and control group in two ways.

1. **Making use of "future" IES participants.** Consistent with our team's previous evaluations for National Grid in Massachusetts, we will use the set of customers that participated in IES in 2017 for our control group. Since these customers also participated in IES, we can assume that they are similar (in terms of housing stock, income eligibility, and consumption habits) and therefore offer a reasonable counterfactual for participants in 2015 and 2016. Although these specific customers later received measures through IES, our team will only make use of their energy consumption data prior to that time.
2. **Matched pre-program energy consumption.** To identify the most relevant 2017 IES participants for the control group, we will use the quasi-experimental matched control group (MCG) method. The MCG method matches each participant in the treatment group (i.e., a 2015 or 2016 IES participant) with a specific "best match" from a pool of potential control group customers (i.e., a 2017 IES participant) based on pre-program energy usage. The team's MCG approach will use a nearest-neighbor algorithm to match each treatment customer to a specific control group customer. In other words, the MCG approach results in a one-to-one match between a specific treatment and a specific control group customer based on both customers' energy consumption pattern over the 12 pre-participation months prior to the treatment customer's participation in IES. The MCG approach does allow for one-to-many mapping, that is, a customer in the control group can potentially be the "best match" for more than one customer in the treatment group. Given the number of customers that participate in IES each year, it is likely this will occur as part of our team's matching process. Our team will also explore alternative control group approaches such as a matching approach that would allow our team to map more than one many customers in the control group to each treatment group customer.

In our proposal, we raised another issue related to accurate billing analysis: the conflation of savings generated by IES measures and measures installed by participating Community Action Agencies (CAAs)

using non-National Grid funding. Identifying the specific savings attributable to National Grid is possible if our team has access to complete and robust information about both National Grid and non-National Grid measures installed in IES customers' home. According to our early discussions with National Grid, we anticipate such data will be available for our analysis. If not, the team will need to revisit the approach outlined in this work plan. Assuming such information is available, we will include a variable in our model that controls for the savings generated by measures not funded by National Grid.

Some of the improvements made using non-National Grid funding are made to improve the health and safety of a customer's home. In some cases, these improvements can impact the energy consumption of the customer's home. Once our team reviews the available IES and non-IES measure data, we will make a determination about how we will account for these non-energy efficiency health and safety improvements.

In addition to using the billing analysis to provide National Grid with measure-specific savings for a subset of IES measures, our team will also use the billing analysis to estimate total average household savings. This customer-level level assessment of IES' savings captures the program's total impact on participating homes. It also provides an important quality assurance check when combining measure-specific savings from different methodologies. Specifically, it's important that the sum of the various measure-specific savings associated with the average customer are in-line with the total household savings. If not, it's possible a specific methodology is over or underestimating actual savings or that the evaluation is not sufficiently accounting for the interactive effects generated by IES' measures.

Engineering Algorithms

Concurrent with the billing analysis described above, our team will estimate savings using technical reference manual-based engineering algorithms, available IES tracking data, and the most relevant secondary data sources.

The engineering analysis will, in general, build on the RI TRM algorithms and savings estimates to update and improve certain inputs in developing ex post savings estimates. The research team will rely, primarily on detailed and program-specific audit information that provides the best estimate of savings for the specific population of program participants being evaluated. Where detailed primary data is not available or is insufficient, the team will review and develop secondary sources for certain inputs from other existing studies, literature, or data sources. Much of these secondary sources already exist in the Massachusetts LI or HES evaluation workbooks or are known to the research team based on previous work. As such, the research team anticipates being able to generate reliable and robust estimates for ex post inputs based on available primary or secondary data. In certain cases, the research team may need to rely on ex ante estimates or other assumptions developed in collaboration with the National Grid team.

In addition to generating reliable and precise savings estimates based on the best available data, such a detailed algorithm-based approach will allow the research team to disaggregate savings estimates for each measure into their component parts to understand the contributions of the primary measure and any measure interactions.

As noted in our proposal, the team will start with engineering algorithm workbooks that Cadeo created as part of the ongoing HES impact evaluation in Massachusetts for time, cost, and consistency reasons. These workbooks are an ideal starting point since we developed them for National Grid and many of the more than two dozen IES measures are also part of National Grid's HES initiative in Massachusetts.

The EXCEL workbook will contain a tab for each IES measure. Each measure-specific tab in the workbook will include:

- The savings algorithm from the RI TRM
- A list of all inputs and input values, includes detailed source information
- A clear comparison of the TRM and evaluation inputs
- Calculation of savings according to the algorithm specified in the TRM
- A succinct explanation for why any assumptions or inputs differ from the TRM and impact the realized savings

These tabs allow for an easy way to understand the basis of each savings estimate, as well as the source of any differences between the ex ante and ex post estimates. In addition to these measure-specific tabs, the workbook will also include a centralized tab for inputs and assumptions that are common across measures. Maintaining these values (and the relevant sources) in a centralized location ensures that an update to a common input impacts all affected measures (i.e., preserving internal consistency). Setting up the workbook this way will also facilitate planning and lower the cost of future evaluation updates.

Building Simulation

For IES measures known to generate (or be subject to) interactive effects or that do not readily lend themselves to engineering algorithms or billing analysis, we plan to estimate average, measure-specific energy savings using building simulation modeling. Specifically, the team will use BEopt, modeling software created by the National Renewable Energy Laboratory that utilizes the Department of Energy's EnergyPlus as its simulation engine. As with the other aspects of our work plan, this approach and modeling software is consistent with our team's current evaluations for National Grid in Massachusetts and leverages previous models that were developed for the Massachusetts HES evaluation.

However, in this case, the team will generate a series of simulations that are representative of the population of National Grid IES participants. We will determine the exact number of scenarios that we will simulate following our review of program data. Currently, we expect to model at least 2 prototype buildings: one reflecting participants living in single-family detached homes and one for participates in multi-unit residences. The team will develop unique building simulation results for each specific fuel type. For each fuel type, we will develop simulations that are as representative of the specific program participants and fuel-specific housing characteristics.

To do this, Cadeo will rely on detailed program participant information to develop building simulation inputs, consistent with the engineering analysis. That is, we plan to use the program, dwelling, and demographic data gathered as part of the previous task to create models that are Rhode Island- and IES-specific. Should the National Grid, CLEAResult, or the community action agencies be unable to provide a critical data element, our team will work with National Grid to identify the best possible secondary source (e.g., Rhode Island-specific Census data).

In addition, to ensure accurate results and consistency with the billing analysis, Cadeo will calibrate each simulation model using participant energy consumption data. Specifically, we will calibrate the models based on the average total pre-program energy consumption and average heating-related energy consumption. These efforts will ensure that the building simulation is as consistent as possible with the billing analysis and engineering analysis.

If National Grid is interested in assessing the relative savings associated with the various components of its weatherization jobs (i.e., air sealing and different insulation types, such as attic, wall, and basement), our team can also leverage the building simulation to disaggregated the overall billing analysis result into these constituent elements.

Deliverables and Schedule

The three impact evaluation methodologies detailed above will result in numerous draft and final deliverables. Table 17 lists these deliverables and the date our team will submit each to National Grid.

Our team anticipates revisiting the schedule below as part of the kick-off meeting and, if necessary, making updates to meet National Grid's reporting needs and expectations. We will document the official schedule in the final work plan. Until then, reviewers should consider the deliverable dates below as tentative.

Table 17. Tentative Evaluation Deliverables and Schedule

Deliverable/Event	Date	Notes
Data Request (**Submitted**)	April 26th	
Work Plan (**Draft**)	May 1st	
Kick-Off Meeting	May 14th	
Data Request (**Fulfilled**)	May 18th	
Work Plan (**Final**)	May 23rd	
Data Review Memo	June 8th	
Analysis Plan Memo (**Draft**)	June 15th	
Analysis Plan Memo (**Final**)	June 29th	Assumes one week for National Grid and stakeholder review, followed by one week for the evaluation team to make final changes
Preliminary Results Presentation	Week of July 16th	
Evaluation Report, including engineering algorithm workbooks (**Draft**)	July 27th	
Evaluation Report, including updated engineering algorithm workbooks (**Revised**)	August 10th	Assumes one week for National Grid and stakeholder review, followed by one week for the evaluation team to make revisions.
Evaluation Report, including engineering algorithm workbooks and copies of all building simulation files (**Final**)	August 24th	Assumes one week for National Grid and stakeholder review, followed by one week for the evaluation team to make final changes.

It is also imperative to note that the timeline in Table 18 is contingent on the timely delivery of program and billing data. If National Grid provides these data later than specified in the table, our team will adjust the deadlines associated with each deliverable above accordingly.

Evaluation Team

Our evaluation team is unchanged from our proposal, which we created to form a small number of dedicated staff members to quickly and cost-effectively complete the IES evaluation. Our entire team is actively working, in nearly identical roles, on Cadeo's evaluation of National Grid's HES initiative in Massachusetts. Since the HES evaluation is nearly finished, our entire team will be available to transition directly to the IES evaluation.

Figure 5. Evaluation Team

Each team member will have a specific role and set of responsibilities:

- **Doug Bruchs** will be the project manager and serve as National Grid's day-to-day contact. In addition to keeping the evaluation on schedule and budget, Doug will share his experience working with National Grid specifically, and in Massachusetts more generally, with the team to make sure the team's work products are consistent with past and ongoing evaluations.
- **Dr. Sarah Widder** will be the technical lead for both the building simulation and engineering algorithm tasks. She's serving in a similar role on the current HES impact evaluation in Massachusetts and will bring that experience, as well as her time as a Principal Investigator at Pacific Northwest National Laboratory, to bear on this project.
- **Jonah Hessels** is an Massachusetts Institute of Technology engineer. He's currently creating Cadeo's algorithm workbook and building simulation models for the HES evaluation in Massachusetts. His familiarity with those resources will allow him to accurately and efficiently update them to reflect IES and Rhode Island's TRM.
- **Fred Schaefer** leads Cadeo's team of quantitative consultants and will advise on the billing analysis task. He's worked closely with CLEAResult data and led many billing analyses.
- **Bilsay Varcin,** will conduct the billing analysis and any associated data preparation activities. He, like the rest of our team, has worked on the HES impact evaluation in Massachusetts.

Project Management

The team recommends scheduling a half hour to one-hour recurring project management call every two weeks between Doug Bruchs, our project manager, and Romilee Emerick, National Grid's evaluation manager. These meetings will allow our team to provide informal updates on our progress, as well as triage any issues that arise during the evaluation in a timely fashion.

Per National Grid's request, our team will also submit an official status report each month, along with our invoice, by the first Tuesday of every month. The status reports will summarize our recent accomplishments, outlined the activities our team will undertake next, and offer updates regarding the evaluation's schedule and budget.

Data Request

This memo also includes the data request Cadeo previously submitted to support this evaluation. Our data request includes two components – program data and billing data – each detailed below.

Program Data

Our analysis approach can accommodate a wide variety of data structures and formats. Consequently, we ask that National Grid provide our team with the most granular program data available for IES participants in 2015 and 2016.

While flexibility exists, we ask that the data include – at a minimum – the following information:

- National Grid Account Number
17. Customer ZIP code
- Owner/Renter Indicator
- Audit Date
- Primary Heating Fuel Type (e.g., natural gas, electricity, heating oil, propane, other)
- Any information about the home, including
    - Type (e.g., single family detached, 2-4 units
    - Number of Stories (single or multi-story)
    - Size (square footage)
    - Relevant information regarding the existing conditions in the home prior to participation (e.g., existing attic insulation R-value prior weatherization)
- Information regarding all measures installed using National Grid funds, including:
    - Quantity and efficiency level (e.g., the amount of insulation, in terms of square footage and change in R-value, added in a weatherized attic)
    - Measure-specific installation date
    - Measure-specific estimated (also known as ex ante) savings

Please also provide similar information – whether part of the same dataset or via a separate – for any energy efficiency measures installed in IES participating homes using non-National Grid funding. If provided separately, include the participant's account number so our team can combine this information with National Grid funded measure installations.

In addition, please provide a list of the customers that participated in IES in 2017 and 2018, as well as the date of each customer's initial audit. We do not need any additional information about the specific measures these customers installed through IES. (We will use these "future" participants as the control group in our billing analysis so less detail is sufficient.)

Billing Data

Please provide the following fields for all customers that participated in IES in either 2015, 2016 and 2017. If National Grid does not currently have a list of these customers, our team can develop and provide such a list after receiving the program data requested above.

Since our billing analysis requires a year's worth of pre- and post-participation energy consumption records, please provide the billing data for the customer's identified above from January 1st, 2014 through December 31, 2017.

At a minimum, we need the following fields:

- National Grid Account Number
- Customer ZIP code
- Billing period dates: start date and end date
- Billing period consumption (kWh consumed for electric, therms consumed for gas)

Regarding format for billing data, if possible, please provide the data as a SAS dataset (sas7dbat file). If not possible, please provide the data in a pipe ("|") delimited text file.

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Appendix B: Data Review and Analysis Plan

To: Romilee Emerick, National Grid

From: Doug Bruchs, Cadeo

Date: July 20, 2018

Re: IES Impact Evaluation Data Review and Analysis Plan

This document summarizes Cadeo's review of the data provided by National Grid in support of our ongoing impact evaluation of the 2015 and 2016 Income Eligible Services (IES) program in Rhode Island. Based on our review of the available data, we have developed the analysis plan outlined in this document, which expands upon the higher-level evaluation proposal communicated in our team's May 25th work plan.

This document consists of the following sections:

18. Data Sources
19. Results of Data Review
20. Billing Analysis Details
21. Engineering Algorithms Details
22. Building Simulation Modeling Details
23. Updated Deliverables and Schedule

Data Sources

To date, National Grid has provided our team with the following datasets:

- **IES Measure Data**. Included basic customer (account number, ZIP code, heating fuel type) and measure (measure type, quantity, savings) information for 2015, 2016, and 2017 participants (the latter of which we will use as a control group in the billing analysis).
- **Supplemental Participant Data**. Provided additional information regarding the number of units in participating buildings, as well as the type (central or room), size (number of BTUs), and number of cooling systems present in participating customers' homes.
- **Non-IES Measure Data.** Contained information regarding the energy efficiency measures, as well as health and safety improvements, made in IES customer homes that were not funded by National Grid. These measures and/or improvements were funded by one of the following sources: Department of Energy Weatherization Assistance Program (DOE WAP) or Health & Human Service Weatherization Assistance Program (HHS WAP).
- **Billing Data**. Provided energy consumption data for customers between January 2014 to April 2018. The raw dataset includes energy usage of both program participants and program future participants, along with other variables such as billing cycle dates, customer type, and billing rate type.

Apart from data above, we acquired weather data from NOAA (National Oceanic and Atmospheric Administration) weather stations based on ZIP code locations:

- **NOAA Weather Data**. Weather data for each National Grid customer was developed using the weather station closest to the customer's zip code. This allowed for each customer's heating and cooling degree days used in the analysis to be specific to the area for which their billing data is associated. Providence, Block Island[14], and North Central State Airport weather stations were used for this analysis.

Results of Data Review

We began our review by assessing the IES measure data, which will underly all aspects of our evaluation. Specifically, we assessed the number of unique participants provided (9,980), total measure installations (61,989), and range of IES participation (2015–early 2018).

Table 19 summarizes our findings and compares them to the measure participation rates National Grid included in its request for proposal. As evident below, our analysis of the IES measure data did not match National Grid's reported value but exhibited a similar magnitude of participation for key impact evaluation measures such as LEDs, heating systems, and weatherization.

Does it matter that these counts do not match?

Ideally our analysis of the provided data would match National Grid's reporting exactly. However, since National Grid has charged our team with developing measure-specific ex post savings—not calculating total IES savings (i.e., per measure savings multiplied by participation counts in 2015 and 2016) — it is not imperative that our participation counts match National Grid's.

[14] The Block Island weather station is not in National Grid's service territory, but it is the closest weather station to some IES participants.

Table 18. 2015–16 IES Participation Comparison: RFP vs. Provided Program Data*

	RFP				Program Data			
	Electric	**Natural Gas**	**Oil**	**Other**	**Electric**	**Natural Gas**	**Oil**	**Other**
AC Replacement (Window Unit)	925	N/A	N/A	N/A	862	N/A	N/A	N/A
AC Timer	196	N/A	N/A	N/A	196	N/A	N/A	N/A
Appliance removal	16	N/A	N/A	N/A	17	N/A	N/A	N/A
CFL	21,846	N/A	N/A	N/A	21,825	N/A	N/A	N/A
Clothes Washer and Dryer**	-	N/A			-	N/A		
Dehumidifier**	-	N/A	N/A	N/A	-	N/A	N/A	N/A
Domestic Hot Water (Aerators or Showerheads)	13	36	4	-	10	36	4	-
Education Materials (TLC kits)	4,603	N/A	N/A	N/A	4,597	N/A	N/A	N/A
Freeze Replacement	285				286			
Heat Pump Water Heaters	1	N/A	N/A	N/A	-	N/A	N/A	N/A
Heating Systems	-	362	241	5		362	471	12
LED Bulbs	77,183	N/A	N/A	N/A	86,037	N/A	N/A	N/A
LED EISA EXEMPT	11,147	N/A	N/A	N/A	2,389	N/A	N/A	N/A
LED Reflectors	5,082	N/A	N/A	N/A	5,085	N/A	N/A	N/A
Programmable Thermostats**	-	-	-	-	-	-	-	-
Refrigerator Replacement	3,336	N/A	N/A	N/A	3,329	N/A	N/A	N/A
Smart Strip	6,264	N/A	N/A	N/A	6,265	N/A	N/A	N/A
Waterbed	3	N/A	N/A	N/A	3	N/A	N/A	N/A
Weatherization	48	846		693	46	1,018	670	23

* The team anticipated some discrepancies between the RFP participation totals and the provided IES data due to potential differences in reporting (e.g., using payment vs installation data).

**Added in 2017/2018 or under consideration for future inclusion; not offered as part of IES during 2015 and 2016 program years.

The measure-specific participation counts in the provided IES measure data are important for determining which evaluation approach—billing analysis, engineering algorithm, or building simulation—our team will use to estimate ex post savings for each measure.

As stated in our work plan, our preference is to rely on billing analysis when possible. We believe billing analysis (when employing a well-matched control group) best reflects the actual change in energy usage within participating homes. However, as also noted in the work plan, billing analysis is not a viable option for all IES measures. Measures are not appropriate for billing analysis for two common reasons: 1) the anticipated per-measure savings for that measure is not large enough to detect via billing analysis, and/or 2) too few 2015 and 2016 participants received the measure.

Based on the participation rates shown in Table 19, above, our team revisited our proposed evaluation approach for each measure in the work plan. In general, the similarity between the provided IES measure data and the RFP measure-specific reporting confirmed our proposed approach is viable.

Table 19. Updated Impact Methodology by IES Measure and Fuel*

	Electric	Natural Gas	Heating Oil	Propane
AC Replacement (Window Unit)	Algorithm	N/A	N/A	N/A
AC Timer	Algorithm	N/A	N/A	N/A
Appliance removal	Algorithm	N/A	N/A	N/A
CFL	Billing Analysis	N/A	N/A	N/A
Clothes Washer and Dryer**	Algorithm	N/A	N/A	N/A
Dehumidifier**	Algorithm	N/A	N/A	N/A
Domestic Hot Water (Aerators or Showerheads)	Algorithm	Algorithm	Algorithm	N/A
Education Materials (TLC kits)	Algorithm	N/A	N/A	N/A
Freezer Replacement	Algorithm	N/A	N/A	N/A
Heat Pump Water Heaters	Simulation	N/A	N/A	N/A
Heating Systems***,#	Algorithm	Billing Analysis	Algorithm	Algorithm
LED Bulbs	Billing Analysis	N/A	N/A	N/A
LED EISA EXEMPT	Billing Analysis	N/A	N/A	N/A
LED Reflectors	Billing Analysis	N/A	N/A	N/A
Programmable Thermostats**	N/A	Algorithm	Algorithm	Algorithm
Refrigerator Replacement	Billing Analysis	N/A	N/A	N/A
Smart Strip	Algorithm	N/A	N/A	N/A
Waterbed	Algorithm	N/A	N/A	N/A
Weatherization#	Algorithm	Billing Analysis	Algorithm	Algorithm

*The team listed measure/fuel combinations as "N/A" if National Grid did not report savings for the measure and fuel type in Table 1 or 2 in the IES impact evaluation RFP. The team anticipates reviewing this list of measures and fuel types, and updating as necessary, as part of the evaluation's kick-off meeting.

**Added in 2017/2018 or under consideration for future inclusion; not offered as part of IES during 2015 or 2016 program years.

***The work plan included separate line items for furnaces and boilers.

#Team will also use building simulation to estimate heating system fan and/or air conditioning savings

In most cases, our team will rely exclusively on the approach identified in Table 20. However, for certain measures and fuel type combinations, the team will employ multiple approaches to generate the most reliable savings estimate and/or gain additional insight into program design and delivery. These measure and fuel combinations include:

- **Weatherization and Heating Systems (Heating Oil and Propane).** Since a billing analysis is not possible for these delivered fuels, our team will leverage the billing analysis-based results for natural gas customer to evaluate weatherization and heating system savings for heating oil and propane customers. Specifically, we will apply the observed percentage of total heating consumption saved by natural gas participants as determined through the billing analysis to IES customers who heat with a delivered fuel. In doing so, the team will use engineering calculations to account for differences in the average heating system efficiencies across fuels and, if necessary, adjust for any known differences in the size of natural gas heated participants' homes relative to participants heating with oil or propane.
- **Lighting Measures, Smart Strips, and Refrigerators.** The team will assess several electric measures (lighting, smart strips, and refrigerator removal and replacement) using both billing analysis and engineering algorithms.[15] The team will officially report ex post savings using billing analysis, if that method yields reliable, statistically-significant results. If not, the team will report savings using the algorithms listed in the Rhode Island TRM. Regardless of the reporting approach the team uses, these complementary approaches will yield insight into program delivery for lighting. As evident in the previous IES evaluation, billing analysis can reveal meaningful differences in per-bulb savings depending on the total number of bulbs installed in a given home. This information can provide insight into the optimal number of bulbs to install in future program cycles.

Billing Analysis Details

This section describes our billing analysis process in detail.

- Applicable Measures
- Treatment Group Selection
- Control Group Selection
- Data Preparation
- Model Specification

Applicable Measures

As shown in Table 20, our team will use billing analysis to estimate savings for the following electric and gas measures. We anticipate the billing analysis will produce statistically significant results for these measures, which we have defined as results with greater than 20% precision at 90% confidence.

- **Electric**. CFLs, LEDs (general service, EISA EXEMPT, and reflectors), Refrigerator Replacement, and Smart Strips
- **Natural Gas.** Heating Systems and Weatherization

[15] While a similar measure, the number of freezer participants is likely too low to yield statistically viable results.

To ensure robust results, our team will use engineering algorithms to assess savings for each of the identified electric measures. We will compare the algorithmically derived results to the billing analysis results to validate their reliability.

Also, it is likely that the billing analysis will not produce statistically significant savings for each of the specific IES lighting measures listed above (CFLs, LEDs (general service, EISA EXEMPT, and reflectors). In this event, the team will aggregate these individual lighting measures and model savings for the group. This aggregation approach works well since billing analyses occurs at the household level anyway—making it difficult to differentiate savings between very similar measures.

Treatment Group Selection

For our electric and natural gas billing analyses, we define treatment groups as those customers who satisfy the measure installation criteria shown in Table 21.

Table 20. Billing Analysis Treatment Group Details

Savings Fuel	Measures	Installation Period
Electric	CFLs LEDs (All Types) Refrigerator Replacement Smart Strips	January 1, 2015 through October 31, 2016*
Natural Gas	Weatherization Heating System Replacement	February 1, 2015** through October 31, 2016

*We restrict the treatment groups to those IES customers who had measures installed by October 31, 2016 to ensure that each matched control customer has 12 months of data after the treatment customer's installation date.
** The gas measures included in the billing analysis are not direct-install; we assume a blackout period around the measure install date that does not allow January 2015 participants to have a full 12 months of pre-installation billing data.

Discussions at the kick-off meeting confirmed that no significant changes in IES delivery occurred between 2015 and 2016 that would render aggregating participants across years for evaluation purposes inappropriate. For the remainder of this analysis plan, we refer to the aggregated group of 2015 and 2016 IES participants as the treatment group.

Control Group Selection

In addition to the treatment group customers described above, we also use a set of control group customers to account for the impact of macroeconomic factors and other influences on pre- and post-program energy consumption that are unrelated to the installation of program measures. These factors include, but are not limited to, macroeconomic trends, the movement of people in and out of homes, and fluctuations in per-unit energy costs. For this analysis, we define our control group as the 3,547 IES participants from 2017 and early 2018 (Table 22). None of these customers also received measures in 2015 and 2016. It's important to note that, though these participants later received measures through IES, we will only make use of their energy consumption data prior to participation.

Table 21. Billing Analysis Control Group Details

Savings Fuel	Measures	Installation Period
Electric	Any IES Measure	January 1, 2017 through December 31, 2017
Natural Gas	Any IES Measure	January 1, 2017 through December 31, 2017

Creation of Pre- and Post-Periods

As mentioned above, the treatment group are customers who have installed at least one IES measures between 2015 and 2016. However, since treatment participation period is two years long and customers IES measures at various times, we will determine customer-specific pre and post periods. For each customer, the day before the earliest IES installation date (usually the date of the audit when direct install measures such as lighting and aerators are installed) is the latest day of pre-period. Conversely, the day after each customer's last installation date marks the first day if post period. We will not include customers' energy consumption between pre and post period in billing analysis. To further ensure a clear demarcation between the pre and post periods, we will use one month before pre-period, as well as one month after post-period as a holdout month. Since billing cycles do not perfectly align with monthly cycles, using a holdout month will ensure we have a clearly defined pre and post periods. Table 23 below tables provides an example of pre- and post- periods for a specific customer.

Table 22. Example of Pre-Post Period Determination

First Installation	12-month Pre-Period	Latest Installation	12-month Post-Period
February 8, 2015	January 2014 – December 2014	May 28, 2015	July 2015 – June 2016

Data Preparation

Before specifying the billing analysis models, we will conduct two data preparation steps:

- Weather Normalization
- Billing Data Screening
- Matched Control Group Selection

Weather Normalization

After mapping customers to the closest weather station, we will obtain daily temperature data for the period that matches the billing data period and calculate daily HDDs and CDDs using 65ºF as the base temperature. We calculate average daily degree days for the exact days in each billing cycle in the billing data.

Billing Data Screening

After identifying the treatment and control group customers, we will apply a set of billing data screening criteria to ensure that our billing analysis model uses clean and accurate consumption data for each time interval. We will exclude customers who meet one or more of the following criteria from our analysis:

- Unable to link billing data to program participation data

- Insufficient pre- or post-billing data (i.e., less than nine months of pre or post months)
- Billed consumption does not meet reasonable monthly values (outlier removal, i.e. remove 1st and 99th percentile)
- Large changes in pre- to post- installation period energy consumption (i.e., +/- 80%)

Matched Control Group Selection

After conducting the data screening process described above, we match each treatment group customer to a "future" (2017 and 2018) IES participants to develop a control group similar, in terms of both the customer profiles and energy usage, to the treatment group.

The control group customers also participated in IES; therefore, we assume that they are generally similar (in terms of housing stock, income eligibility, and consumption habits) and offer a reasonable counterfactual for participants in 2015 and 2016. We will include documentation in the final report comparing the pre-IES energy consumption and measure mix (i.e., the IES measures installed) of the treatment and control groups. It is also unlikely that many of these "future" IES participants made many of the energy efficiency improvements offered through the program prior to participating, which means the billing analysis results will be closer to gross than net savings (although the exact location on the gross-to-net savings continuum varies by measure, as described earlier in the plan).

Are billing analysis results gross or net?

The answer depends on the customers in the control group and the measure being analyzed. Since LEDs are readily available and relatively affordable, it's possible—even likely—that some customers in our control group of future IES participants installed some number of LEDs themselves prior to participating. As a result, the billing analysis results for LEDs is something between gross and net, albeit closer to gross (considering the substantial number of LEDs installed during most IES audits). Conversely, it's unlikely that many customers in our control group of future participants installed insulation outside IES. Therefore, that result can readily be interpreted as a gross savings value.

Our team will use the quasi-experimental matched control group (MCG) method to identify a specific "best match." The team's MCG approach will use a nearest-neighbor algorithm to match each treatment customer to a specific control group customer. In other words, the MCG approach results in a one-to-one match between a specific treatment and a specific control group customer based on both customers' energy consumption pattern over the 12 months prior to the treatment customer's participation in IES.

Our MCG approach does allow for one-to-many mapping, that is, a customer in the control group can potentially be the "best match" for more than one customer in the treatment group. As discussed during the kick-off meeting, our team will explore matching treatment group participants to more than one control customer and conduct a scenario analysis to determine whether model fit and/or estimated savings differ between the two matching scenarios.

Controlling for Non-IES Measures

At the kick-off meeting we also discussed another low-income-specific issue critical to accurate billing analysis results: accounting for the potential conflation of savings generated by IES measures and measures installed by participating Community Action Agencies (CAAs) using non-National Grid funding.

National Grid provided a file with detailed information about the actions taken at IES participating homes using non-National Grid funding. As anticipated, these actions include a mix of energy efficiency improvements (e.g., air sealing, heating system replacement, etc.), and health and safety-related improvements that do not impact a participant's energy consumption (e.g., ramps and dryer venting). In total, the provided file included information for 4,914 unique customers and 47,652 line items.

Our team mapped the customers in the non-National Grid funding file to the 2015 and 2016 IES participants. We found that 3,253 (33%) of the customers in our treatment group received at least one energy efficient measure using funding outside of IES. The team will include the dwelling-level savings in the billing analysis model to control for their presence and ensure they are not conflated with National Grid funded measures.

Model Specification

Our team will use a monthly Post Program Regression (PPR) model to estimate average measure-specific savings for the measure and fuels shown in Table 21. The general form of our PPR model follows[16]:

$$ADC_{ct} = b_1 Treatment_c + b_2 LagADC_{ct} + \sum_{month\ i} b_{3i} Month_{it} + \sum_{month\ i} b_{4i} Month_{it} * LagADC_{ci} + b_5 NonIES_c + e_{ct}$$

Where

- ADC_{ct} = average, daily energy consumption for customer *c* at calendar month *t*
- $Treatment_c$ = 1 if customer *c* is in treatment group, 0 if customer *c* is in control group.
- $LagADC_{ct}$ = average daily consumption from customer *c* during calendar month t of the pre-program period
- $Month_{it}$ = 1 when index i = calendar month t, 0 otherwise. We include this series of 12 terms to capture month-specific effects in our analysis.
- $NonIES_c$ = 1 if customer c received a non-IES energy-efficiency or health and safety-related improvement.
- e_{ct} is the error term from the regression model.

In the model above, we derive annual, measure level savings from the coefficient b_1, which represents the average daily savings (kWh for electric, therms for natural gas) attributed due to the program. We may augment the general model shown above with terms that characterize the dwelling (i.e. attached/detached, size) and characterize other IES measures that impact same-fuel consumption to augment the general model described above if those terms sufficiently improve how the model fits.

[16] If we need to estimate savings for more than one weather-sensitive or base load measure, we will add the appropriate terms for each measure.

To normalize energy savings that are weather sensitive, we will use customers' zip codes to capture customer specific TMY3 weather data. We will get an annual average HDD by using customers in the analysis and use that to extrapolate average daily savings to an annual level.

Engineering Algorithms Details

Concurrent with the billing analysis, our team will estimate savings for a subset of measures using the engineering algorithms from the Rhode Island technical reference manual (TRM). Since National Grid will use the results of this study prospectively (to inform IES program planning in 2019 and beyond), our team utilized the most recent TRM (2018).[17]

To begin, our team identified each IES measure within the TRM.

Table 23. TRM Summary of IES Measures Included in Engineering Algorithm Analysis

		Annual Savings (TRM)**			
IES Measure Name	**TRM Name**	**Electric (kWh)**	**Natural Gas (therms)**	**Heating Oil (mmBTU)**	**Propane (mmBTU)**
AC Replacement (Window Unit)	Window AC Replacements	100	N/A	N/A	N/A
AC Timer#	N/A	0	N/A	N/A	N/A
Appliance Removal	Appliance Removal	1,180	N/A	N/A	N/A
CFL*	N/A	N/A	N/A	N/A	N/A
Clothes Washer and Dryer**	EnergyStar Dryer	160	N/A	N/A	N/A
Dehumidifier**	Dehumidifier	239	N/A	N/A	N/A
Domestic Hot Water (Aerators or Showerheads)	DHWater Measure	134	0.9	0.7	N/A
Education Materials (TLC kits)	Basic Educational Measures	138	N/A	N/A	N/A
Freezer Replacement	Replacement Freezer	484	N/A	N/A	N/A
Heat Pump Water Heaters	HPWH 50 gallon (electric)	1,775	N/A	N/A	N/A
LED Bulbs*	Varies	38.7	N/A	N/A	N/A
LED EISA EXEMPT*	LED Bulbs (EISA Exempt)	52.4	N/A	N/A	N/A
LED Reflectors*	LED Reflector	57.2	N/A	N/A	N/A
Programmable Thermostats	Programmable thermostat	214.60	31	3.1	N/A
Refrigerator Replacement*	Refrigerator rebate	384	N/A	N/A	N/A
Smart Strip*	Smart Strips	75.10	N/A	N/A	N/A
Waterbed	Waterbed mattress replacement	872	N/A	N/A	N/A

[17] http://www.ripuc.org/eventsactions/docket/4755-NGrid-2018-TRM-RI.pdf

* Also included in the billing analysis
**Some of the savings values in the table reflect the savings IES is claiming in 2018 and do not match the current TRM value
#AC timers are not included in the TRM and the measure data indicates no savings were claimed

Next, our team reviewed the engineering algorithm associated with each measure. For nearly every measure, the TRM includes the same basic gross savings algorithm:

$$Gross_{kWh} = Qty\ x\ deltakWh$$

For more detail regarding how to calculate *deltakWh*, the TRM typically references a previous evaluation. For example, the showerheads measure in the TRM points the reader to the Massachusetts Low-Income Multifamily Initiative Impact Evaluation completed in 2015 by The Cadmus Group, for more details. Our team searched out these evaluations and identified the relevant information within to bring more detail to the deltakWh term in Rhode Island's TRM. In the case of showerheads, the aforementioned evaluation used the following algorithm to estimate savings:

Shower water energy saved = shower water use reduction (Temperature of shower - Temperature of incoming cold water) * conversion to energy/water heater recovery efficiency*

*Shower water use (gallons/year) = household members * showers per capita per day * shower length * proportion of showering activity affected by replacement * as-used water flow rate*

In other instances, the referenced evaluation does not include an algorithm, but rather an energy savings estimate developed using an alternative evaluation method, such as billing analysis or building simulation. In these instances, our team will utilize well-established industry engineering algorithms to estimate savings. Whenever possible, we will rely on the current Massachusetts TRM[18] if the Rhode Island TRM is insufficient.

After identifying the relevant algorithm, our team will search out the associated algorithm inputs in the IES measure data provided by National Grid. For the case of showerheads, we found the inputs for "household members" and "number of showerheads installed" in the provided data, but not baseline flow rate or hot water setpoint temperature. (Other inputs, such as shower length, are available through well-established secondary sources.)

In general, the measure data provided by National Grid did not include very much information regarding baseline (pre-program) conditions or about the characteristics of the participant's home beyond their space and water heating fuel types. Consequently, our team submitted an additional data request to National Grid for the following types of information.

- Square footage (of SF detached home or unit)
- Number of stories
- Pre- and post-program attic insulation r-values, as well as associated square footage
- Pre- and post-program wall insulation r-values, as well as associated square footage
- Pre- and post-program basement ceiling insulation r-values, as well as associated square footage
- Pre- and post-program measured CFMs

[18] http://ma-eeac.org/wordpress/wp-content/uploads/2016-2018-Plan-1.pdf

- Pre- and post-program measured duct leakage

National Grid is currently processing this request. If National Grid cannot provide the above information within the timeline of this study, our team will rely on secondary sources. As with the algorithms themselves, our team will look first to the most recent Low Income evaluation completed in Rhode Island[19], and then, if necessary, the most recent similar evaluation in Massachusetts.[20]

Building Simulation Details

The lack of specificity in the provided IES measure data and subsequent data request also has ramifications for the building simulation. As noted previously, our team will use building simulation on a small subset of IES measure that generate (or are subject to) interactive effects or that do not readily lend themselves to engineering algorithms or billing analysis

Ideally, we will populate our BEopt model (software created by the National Renewable Energy Laboratory that utilizes the Department of Energy's EnergyPlus as its simulation engine) with as much primary IES participant, household and measure data as possible. The extent to which our team can rely on IES-specific data, rather than secondary sources such as evaluation in Massachusetts, will depend largely on National Grid's ability to fulfil the request above.

Regardless, we expect to model at least two prototype buildings—single-family detached homes and multi-unit residences—to develop unique building simulation results for each specific fuel type. We will ensure accurate results and consistency with the billing analysis by calibrating each simulation model using participant energy consumption data, which National Grid has already provided. Specifically, we will calibrate the models based on the average total pre-program energy consumption and average heating-related energy consumption. These efforts will ensure that the building simulation is as consistent as possible with the billing analysis and engineering analysis.

Updated Deliverables and Schedule

[19] http://rieermc.ri.gov/wp-content/uploads/2018/03/national-grid-rhode-island-income-eligible-services-impact-evaluation-volume-ii.pdf
[20] http://ma-eeac.org/wordpress/wp-content/uploads/Low-Income-Single-Family-Program-Impact-Evaluation_Part-of-the-Massachusetts-Residential-Retrofit-Low-Income-Program-Area-Evaluation.pdf

Table 18 lists these deliverables and the date our team will submit each to National Grid. Due to IES data arriving later than anticipated, the deliverable schedule has shifted slightly since the workplan.

Table 24. Updated Evaluation Deliverables and Schedule

Deliverable/Event	Date
Data Request (**Submitted**)	April 26th
Work Plan (**Submitted**)	May 1st
Kick-Off Meeting **(Held)**	May 14th
Data Request (**Fulfilled**)	June 15th
Work Plan (**Final**)	May 23rd
Data Review and Analysis Plan Memo (**Draft**)	July 3rd
Data Review and Analysis Plan Memo (**Final**)	July 20th
Preliminary Results Presentation	Week of July 30th
Evaluation Report, including engineering algorithm workbooks (**Draft**)	TBD
Evaluation Report, including updated engineering algorithm workbooks (**Revised**)	TBD
Evaluation Report, including engineering algorithm workbooks and copies of all building simulation files (**Final**)	August 24th

Fuel	Program	Efficient Measure	Baseline Measure	End Use	Fossil Fuel Type #1	Gross Savings from Fuel Type #1 (MMBtu/Year)	Savings from Fuel Type #1 (MMBtu/Year) - Source/Notes	Fossil Fuel Type #2	Gross Savings from Fuel Type #2 (MMBtu/Year)	Savings from Fuel Type #2 (MMBtu/Year) - Source/Notes	Fossil Fuel Type #3	Gross Savings from Fuel Type #3 (MMBtu/Year)	Savings from Fuel Type #3 (MMBtu/Year) - Source/Notes	EE: Gross Annual kWh Saved
Electric	A02b Residential HVAC	HPWH > 55 gallon	The baseline efficiency case is a new, standard efficiency electric resistance hot water heater.	Hot Water		0.00	2022 BC Model		0.00	2022 BC Model		0.00	2022 BC Model	360.12834
Electric	A02b Residential HVAC	HPWH <= 55 gallon	The baseline efficiency case is a new, standard efficiency electric resistance hot water heater.	Hot Water	NG - Res Hot Water	-0.10	2022 BC Model	Fuel Oil - Residential Distil	-0.50	2022 BC Model	Propane	-0.07	2022 BC Model	1712.2944
Electric	A03b Energywise	THERMOSTATELEC	The baseline efficiency case is an HVAC system without a programmable thermostat.	HVAC		0.00	2022 BC Model		0.00	2022 BC Model				222.6
Electric	B03a Low Income Retrofit 1-4	THERMOSTATELEC	The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.	HVAC		0.00	2022 BC Model		0.00	2022 BC Model				251.7
Electric	A03b Residential Retrofit Multifamily	Thermostats	The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.	HVAC		0.00			0.00					278
Electric	B03b Low Income Retrofit Multifamily	Thermostats	The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.	HVAC		0.00			0.00					278
Electric	B03a Low Income Retrofit 1-4	WI-FI THERMOSTAT, AC ONLY	The baseline efficiency case is an HVAC system without a wifi thermostat.	HVAC		0.00	InDemand		0.00	InDemand				18
Electric	B03a Low Income Retrofit 1-4	WI-FI THERMOSTAT, OTHER	The baseline efficiency case is an HVAC system without a wifi thermostat.	HVAC		0.00	InDemand	Propane	2.79	InDemand				-1122
Electric	A03b Energywise	WIFI T-Stat - Electric	The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.	HVAC		0.00	2022 BC Model		0.00	2022 BC Model				222.6
Electric	A03b Residential Retrofit Multifamily	THERMOSTAT, Oil	The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.	HVAC	Fuel Oil - Residential Distilla	1.60	2022 BC Model		0.00	2022 BC Model				29
Electric	A03b Energywise	THERMOSTATOIL	The baseline efficiency case is an HVAC system without a programmable thermostat.	HVAC	Fuel Oil - Residential Distilla	2.07	2022 BC Model		0.00	2022 BC Model				27
Electric	B03a Low Income Retrofit 1-4	THERMOSTATOIL	The high efficiency case is an HVAC system providing space heating with a programmable thermostat installed.	HVAC	Fuel Oil - Residential Distilla	2.07	2022 BC Model		0.00	2022 BC Model				8.7
Electric	A03b Energywise	WI-FI THERMOSTAT, OIL	The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.	HVAC	Fuel Oil - Residential Distilla	2.79	2022 BC Model		0.00	2022 BC Model				27
Electric	B03a Low Income Retrofit 1-4	WI-FI THERMOSTAT, OIL	The baseline efficiency case is an HVAC system without a wifi thermostat.	HVAC	Fuel Oil - Residential Distilla	2.79	InDemand		0.00	InDemand				18
Electric	A02b Residential HVAC	Wi-Fi Tstat-cool and heat oil/propane	The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.	HVAC	Fuel Oil - Residential Distilla	2.79	InDemand		0.00	InDemand				64.4
Electric	A03b Energywise	THERMOSTATOTHER	The baseline efficiency case is an HVAC system without a programmable thermostat.	HVAC	Propane	2.07	2022 BC Model		0.00	2022 BC Model				27
Electric	B03a Low Income Retrofit 1-4	THERMOSTATOTHER	The baseline efficiency case is an HVAC system providing space heating without a programmable thermostat.	HVAC	Propane	2.07	2022 BC Model		0.00	2022 BC Model				11.2
Electric	A03b Energywise	WI-FI THERMOSTAT, OTHER	The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.	HVAC	Propane	2.79	2022 BC Model		0.00	2022 BC Model				27
Gas	A02b Energy Star Heating System	Cond Water Heater UEF 0.80	The baseline efficiency case is a standalone tank water heater with a medium draw of a UEF of 0.58 and high draw of 0.63.	Hot Water	NG - Res Hot Water	7.00	MA TRM Review Study and Calculations: RI_2022 Annual POlan_Gas_HVAC_WH_Calculations_2021-06-10.							-43
Gas	A02b Energy Star Heating System	ENERGY STAR ON DEMAND WATER HEATER 0.87 UEF	The baseline efficiency case is a high draw standalone tank water heater with an UEF of 0.63. For the early retirement portio	Hot Water	NG - Res Hot Water	7.00	MA TRM Review Study and Calculations: RI_2022 Annual POlan_Gas_HVAC_WH_Calculations_2021-06-10.							-43
Gas	A02b Energy Star Heating System	ENERGY STAR STORAGE WATER HEATER	The baseline efficiency case is a standalone tank water heater with a medium draw of a UEF of 0.58 and high draw of 0.63.	Hot Water	NG - Res Hot Water	2.50	MA TRM Review Study and Calculations: RI_2022 Annual POlan_Gas_HVAC_WH_Calculations_2021-06-10.							-43
Gas	A02b Energy Star Heating System	WATER HEATER - INDIRECT	The baseline efficiency case is a standalone tank water heater with an energy factor of 0.61.	Hot Water	NG - Res Hot Water	4.00	2018_Navigant_HES_Impact_Evaluation.pdf							0
Gas	A02b Energy Star Heating System	95% AFUE or greater forced-water boiler	The end of life baseline efficiency case is a boiler with a rated AFUE equal to 86.5% and an actual efficiency of 83.7%. For	HVAC	NG - Res Gas Heating	10.70	MA TRM Review Study and Calculations: RI_2022 Annual POlan_Gas_HVAC_WH_Calculations_2021-06-10.							0
Gas	B03a Single Family - Appliance Management	Boiler	The baseline is the existing heating system.	HVAC	NG - Res Gas Heating	7.90	back-calculated from 2021 YE Report							16
Gas	A02b Energy Star Heating System	COMBO CONDENSING 95	For heating, the end of life baseline efficiency case is a 86.5% rated with an actual efficiency of 83.7%. For the early retirem	HVAC	NG - Res Gas Heating	11.70	MA TRM Review Study and Calculations: RI_2022 Annual POlan_Gas_HVAC_WH_Calculations_2021-06-10.							0
Gas	B03a Single Family - Appliance Management	FURNACE	The baseline is the existing heating system.	HVAC	NG - Res Gas Heating	7.90	back-calculated from 2021 YE Report							16
Gas	A02b Energy Star Heating System	Furnace (forced hot air) w/ ECM >=95%AFUE	The end of life baseline efficiency case is a boiler with a rated AFUE equal to 89.0% and an actual efficiency of 90.1%. For	HVAC	NG - Res Gas Heating	6.80	MA TRM Review Study and Calculations: RI_2022 Annual POlan_Gas_HVAC_WH_Calculations_2021-06-10.							0
Gas	A02b Energy Star Heating System	Furnace 97% AFUE with ECM	The end of life baseline efficiency case is a boiler with a rated AFUE equal to 89.0% and an actual efficiency of 90.1%. For	HVAC	NG - Res Gas Heating	7.60	MA TRM Review Study and Calculations: RI_2022 Annual POlan_Gas_HVAC_WH_Calculations_2021-06-10.							0
Gas	A02b Energy Star Heating System	Furnace CombiAFUE97	The baseline efficiency case is an 80% AFUE boiler with a 0.594 EF water heater.	HVAC	NG - Res Gas Heating	26.91	back-calculated using SBM 2019-2021 ytd ACTUALS							0
Gas	Low Income Multifamily	THERMOSTAT_LI	For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to pro	HVAC	NG - Res Gas Heating	1.50								29
Gas	A03b EnergyWise Multifamily	THERMOSTAT_MF	For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to pro	HVAC	NG - Res Gas Heating	1.50								29
Gas	Energy Wise Single Family	Thermostats	For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to pro	HVAC	NG - Res Gas Heating	2.07	MA Smart Thermostat Impact Study (RES 24)							27
Gas	A02b Energy Star Heating System	Thermostats	The baseline efficiency case for cooling is a manual thermostat.	HVAC	NG - Res Gas Heating	2.07	MA Smart Thermostat Impact Study (RES 24)							0
Gas	Energy Wise Single Family	WiFi Thermostat	For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to pro	HVAC	NG - Res Gas Heating	2.79	MA Smart Thermostat Impact Study (RES 24)							27
Gas	A02b Energy Star Heating System	Wi-Fi Thermostat - Gas Cooling and Htg	For the installation of a programmable thermostat, the baseline efficiency case is an HVAC system using natural gas to pro	HVAC	NG - Res Gas Heating	2.79	MA Smart Thermostat Impact Study (RES 24)							104

Fuel	Program	Efficient Measure	Baseline Measure	End Use	2022 Actuals	2021 Actuals	2020 Actuals
Electric	A02b Residential HVAC	HPWH > 55 gallon	The baseline efficiency case is a new, standard efficiency electric resistance hot water heater.	Hot Water	186	50	151
Electric	A02b Residential HVAC	HPWH <= 55 gallon	The baseline efficiency case is a new, standard efficiency electric resistance hot water heater.	Hot Water	8	190	176
Gas	A02b Energy Star Heating System	Cond Water Heater UEF 0.80	The baseline efficiency case is a standalone tank water heater with a medium draw of a UEF of 0.58 and high draw of 0.63.	Hot Water	Not in InDemand	Not in InDemand	Not in InDemand
Gas	A02b Energy Star Heating System	ENERGY STAR ON DEMAND WATER HEATER 0.87 UEF	The baseline efficiency case is a high draw standalone tank water heater with an UEF of 0.63. For the early retirement portio	Hot Water	280	337	284
Gas	A02b Energy Star Heating System	ENERGY STAR STORAGE WATER HEATER	The baseline efficiency case is a standalone tank water heater with a medium draw of a UEF of 0.58 and high draw of 0.63.	Hot Water	17	32	33
Gas	A02b Energy Star Heating System	WATER HEATER - INDIRECT	The baseline efficiency case is a standalone tank water heater with an energy factor of 0.61.	Hot Water	148	169	143
Gas	A02b Energy Star Heating System	COMBO Condensing 95	For heating, the end of life baseline efficiency case is a 86.5% rated with an actual efficiency of 83.7%. For the early retirement portion, t		953	1,225	1,099

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To: MPSMT

From: Nick Martin (Senior Consultant), Neeti Suhag (Consultant) - Dunsky Energy + Climate Advisors

Cc: RI Energy

Date: 2023-03-14

Re: MPS Refresh – Summary of Model Input and Assumption Updates

1 Context

The following memo documents the changes made to model inputs and assumptions for the Rhode Island MPS Refresh ("Study Refresh") relative to the original study conducted in 2019.[1]

2 Model Input and Assumption Updates

The Study Refresh focused on updating data sources and input data anticipated to have a significant impact (+/- 20% of a measure's savings) on study results. The following sections document these changes following a similar structure as Appendix F – Study Inputs and Assumptions in the original study report.

2.1 Measure Characterization

- Baselines for measures included in the original study were updated to reflect the appliance standards updates in Rhode Island's Appliance and Equipment Energy and Water Efficiency Standards Act of 2021[2] and Code of Federal Regulations. In most cases, the updated standards increased measure baselines to the previous measure upgrade efficiency levels. Where feasible, higher efficiency upgrades were characterized for these measures. In cases where higher efficiency upgrades are not feasible (e.g., limited to no higher efficiency models commercially available), the measures were eliminated. These changes are in Table 1.

[1] Rhode Island Market Potential Study 2021-2026
[2] Appliance and Equipment Energy and Water Efficiency Standards Act of 2021

Table 1. Measure Baseline Updates (New Standards)

Measure Name	Market	Fuel	Previous Baseline	Previous Upgrade	New Baseline (Standard)	New Upgrade
Dishwasher	Commercial	Electric	Non-Energy Star	Energy Star v.2.0	Energy Star v.2.0	Energy Star v.3.0
Dishwasher	Commercial	Gas				
Fryer	Commercial	Electric				
Hot Food Holding Cabinet	Commercial	Electric				20% better than Energy Star v.2.0
Oven Combination	Commercial	Electric		Energy Star v.2.2	Energy Star v.2.2	Energy Star v.3.0
Oven Combination	Commercial	Gas				
Oven Convection	Commercial	Electric				
Oven Convection	Commercial	Gas				
Steamer High Efficiency	Commercial	Electric		Energy Star v.1.2	Energy Star v.1.2	20% better than Energy Star v.1.2
Steamer High Efficiency	Commercial	Gas				
Low Flow Showerhead	Commercial	Electric	2.5 gpm	2 gpm	2 gpm	1.5 gpm
Low Flow Showerhead	Commercial	Gas				
HVAC Boiler < 300 kBtu/h Tier 1	Commercial	Gas	82% AFUE	90% AFUE	84% AFUE	90% AFUE
HVAC Boiler < 300 kBtu/h Tier 2	Commercial	Gas				
Steam Boiler	Commercial	Gas	80% AFUE	82 % AFUE	82% AFUE	85% AFUE
Fryer	Commercial	Gas	Non Energy Star	Energy Star v.2.0	Energy Star v.2.0	Measure eliminated
Faucet Aerator	Commercial	Electric	2.25 gpm	1.5 gpm	0.5 gpm	
Faucet Aerator	Commercial	Gas	2.25 gpm	1.5 gpm	0.5 gpm	
HVAC Boiler < 1000 kBtu/h[3]	Commercial	Oil	82% TE	86% TE	87% TE	
Boiler >= 1000 kBtu/h[3]	Commercial	Oil	82% TE	85% TE	87% TE	
ASHP (65,135) kBtu/h CEE Tier1[4]	Commercial	Electric	COP 3.3	COP 3.4	COP 3.4	

- New construction measures were updated to assume that the 2021 IECC will be adopted in 2023 without amendment and in place starting in 2024. However, the study assumes new construction projections passing through RI Energy programs adhering to this standard will not materialize until 2025, which aligns with the assumption employed in the original study. The savings improvement assumption for 2021 IECC relative to 2018 IECC was updated to 8.5% and 10% for residential and non-residential measures, respectively, based on assumptions provided by RI Energy.
- For measures not impacted by updated appliance standards, characterizations were updated to reflect the most recently available electronic version of the Rhode Island Technical Resource Manual (TRM).[5] Updates included revisions to measure savings, costs, effective

Commented [JN1]: Is Dunsky able to estimate the amount of programmatic savings potential "lost' due to new standards and 2021 IECC. This would be illuminating to parties to understand how effective codes and standards are in achieving savings.

[3] Code of Federal Regulations, effective Jan 10, 2023
[4] Code of Federal Regulations, effective Jan 1, 2023
[5] As provided by RI Energy ("TRM_DB_2023Plan_Final.xlsx")

useful life (EUL), impact factors (i.e., net-to-gross factors and realization rates), and load factors (i.e., summer peak coincidence factors and seasonal savings distributions). These updates focused on the measures contributing at least 80% of overall savings in the original study. A detailed table of the measure inputs used in the Study Refresh are provided in the detailed results workbook.

- For demand response measures, incremental costs were adjusted to reflect the assumption that advanced metering infrastructure will be rolled out to the entire RI Energy customer base during the study period in alignment with RI Energy's AMI business case plan. The adjustments assume AMI will allow communication capabilities with DR equipment, thereby reducing the initial costs associated with telemetry for applicable measures.

Commented [FE2]: did Dunsky adjust the C&I lighting measure lifetime downward by 1 year per year (~7 years in 2023, 6 in 2024, 5 in 2025, and 6 in 2026)

2.2 Market Characterization

- Residential customer population counts were updated based on U.S. Census estimates for Rhode Island, which suggest a slight decline in population over the last three years (~0.2% year-over-year decline).[6]
- Non-residential customer population counts were assumed to remain the same as the original study due to lack of data supporting revised population estimates.
- Market baseline data for non-residential lighting measures were updated to reflect the increasing saturation of LED lighting in the Rhode Island market based on the recent Rhode Island[7] and Massachusetts[8] studies on C&I lighting markets. Five key metrics were updated as described in Table 2.

Table 2. Market Characterization Updates for Lighting Measures

Metric	Update/ Change	Source
Percentage of linear lamps that are LED (Indoor)	Updated from 22% to 62%	Based on Rhode Island C&I lighting market characterization report
Percentage of Specialty bulbs that are LED (Outdoor)	Updated from 81% to 89%	Based on Massachusetts study on CI lighting market characterization
Percentage of Specialty bulbs that are LED (Indoor)	Updated from 36% to 60%	Based on the average change in the two metrices- percentage of linear lamps that are LED (Indoor) and percentage of Specialty bulbs that are LED (Outdoor).
Percentage of High Bay Lights that are Metal Halide (Indoor)	Updated from 64% to 40%	
Percentage of Exit signs which are LED	Updated from 59% to 83%	

[6] U.S. Census QuickFacts Rhode Island
[7] Rhode Island C&I lighting market report http://rieermc.ri.gov/wp-content/uploads/2022/11/rhode-island_ci-lighting-market-characterization-and-adjusted-measure-life-report_final.pdf
[8] Massachusetts C&I lighting market report https://ma-eeac.org/wp-content/uploads/MA19C14-E-LGHTMKT_2019-CI-Lighting-Inventory-and-Market-Model-Report_Final_2020.04.06.pdf

- For demand response, we reviewed data from current program results and recalibrated results for the base year (2023) to align with reported levels of enrolled market participation for the 2022 program year.

2.3 Program Characterization

- Program cost characterization inputs were inflated to 2024 real dollars.
- Program incentive levels for energy efficiency were updated in accordance with the single achievable scenario modeled in the study as shown in Table 3.

Commented [JN3]: I thought RIE provided updated cost assumptions beyond inflation. Was this not factored into the analysis?

Table 3. Program Characterization

Program	Mid Scenario (Original Study)	Ambitious Mid Scenario (Study Refresh)	Max Scenario (Original Study)
Residential Programs			
New Construction	75%	87.5%	100%
EnergyStar HVAC	75%	87.5%	100%
EnergyWise	84%	92.0%	100%
EnergyWise Multi Family	79%	89.5%	100%
Behavior Feedback	N/A	N/A	N/A
EnergyStar Lighting	75%	75%	100%
EnergyStar Appliances	75%	87.5%	100%
Low-Income SF	100%	100%	100%
Low-Income MF	100%	100%	100%
Heat Pump- Residential (Low income)	100%	100%	100%
Heat Pump- Residential	50%	75%	100%
Non-residential Programs			
New Construction	75%	87.5%	100%
Large Commercial Retrofit	75%	87.5%	100%
Small Business / Direct Install	85%	92.5%	100%
C&I Multifamily	90%	95.0%	100%
Heat Pump- Commercial	50%	75%	100%

2.4 Economic and Other Parameters

- Avoided costs were updated to the reflect the values in RI Energy's 2023 BCR Model, which reflect the Avoided Energy Supply Cost (AESC) in New England 2021 report. Avoided cost values were treated in the same way as described in the original study.
- The real discount factor was updated to 0.14% based on the real discount factor used in RI Energy's 2023 BCR Model.
- Marginal retail rates (electricity and natural gas) were updated to the latest rates as provided by RI Energy. Oil and propane marginal retail rates were updated to reflect the updated values in AESC 2021 in the same manner as the original study.
- Emission factors for electricity updated to reflect emission factor as documented in RI Energy's 2023 BCR Model.

Commented [JN4]: This assumption is unlikely to be used for 2024-26 by RIE. What if discount rate is higher? How much would that impact results?

- All monetary values throughout the study were inflated to 2024 real dollars based upon the inflation index in Table 4. The inflation index was derived from the CPI for All Urban Consumers (CPI-U) as reported by the Bureau of Labor Statistics through calendar year 2022. For 2023 and 2024, projections by Moody's Analytics are leveraged.[9]

Commented [JN5]: How does study address projected inflation in balance of study horizon: 2025 and 2026?

Table 4. Inflation Index

Year	Inflation Index
2013	233.0
2014	236.7
2015	237.0
2016	240.0
2017	245.1
2018	251.1
2019	255.7
2020	258.8
2021	271.0
2022	292.7
2023	304.1
2024	311.4

[9] Moody's Analytic. *Dissecting the Consumer Price Index*. (February 2023).

STATE OF RHODE ISLAND
ENERGY EFFICIENCY & RESOURCE MANAGEMENT COUNCIL

Rhode Island Energy Efficiency Market Potential Study Refresh

Draft Results

14th March, 2023

dunsky Energy + Climate

dunsky
Energy + Climate

ACCELERATING THE CLEAN ENERGY TRANSITION

ANALYSIS + STRATEGY

BUILDINGS **MOBILITY** **INDUSTRY** **ENERGY**

dunsky Energy + Climate

ACCELERATING THE CLEAN ENERGY TRANSITION

ANALYSIS + STRATEGY

BUILDINGS | **MOBILITY** | **INDUSTRY** | **ENERGY**

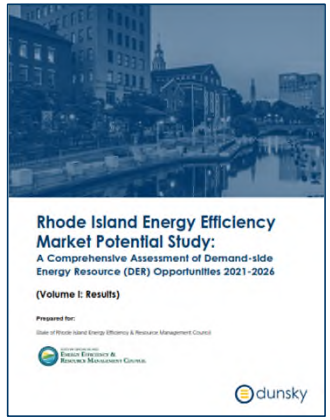
GOVERNMENTS | UTILITIES | CORPORATE + NON-PROFIT

Agenda

1. Overview
2. Energy Efficiency: Gas Programs
3. Energy Efficiency: Electric Programs
4. Active Demand Response
5. Key Takeaways & Next Steps

Study Refresh Overview

This study is an update to the Rhode Island Energy Efficiency Market Potential Study (MPS) conducted in 2019.



The objective of the analysis is to update key model inputs to reflect new information made available since the previous study including:

- Updated codes and standards
- Updated evaluated measure savings
- More recent avoided cost estimates

UN0

Overview

Study Parameters

Parameter	Study Refresh	Original Study
Study Period	2024 through 2026 (**three** years)	2021 through 2026 (six years)
Geography	Rhode Island	Rhode Island
Sectors	Residential, Low-Income Residential, Commercial, Industrial	Residential, Low-Income Residential, Commercial, Industrial
Fuels	Electricity (kWh, kW), natural gas, delivered fuels (oil and propane)	Electricity (kWh, kW), natural gas, delivered fuels (oil and propane)
Savings sources	EE and DR **only**	EE, DR, HE, CHP, PV
Potential Assessment	Technical, economic, and **single** achievable scenario.	Technical, economic, and three achievable scenarios.

Acronyms: Energy Efficiency (EE), Demand Response (DR), Heating Electrification (HE), Combined Heat and Power (CHP), Solar Photovoltaics (PV)
*Key differences from original study are **bolded**.*

Slide 6

JN0 For completeness, it would be best if results presented in PPT and workbook include HE and CHP results from prior study. (PV is not germane to targets)
Jeremy Newberger, 2023-03-24T18:28:08.142

Overview

Summary of Key Study Updates

- **The Study Refresh focused on updating data sources and input data anticipated to have a significant impact (+/- 20% of a measure's savings) on study results.**
- **A description of model input and assumption updates is provided in an accompanying memo.**

Key updates reflect:

- Updated measure baselines to reflect new standards (i.e., Appliance and Equipment Energy and Water Efficiency Standards Act of 2021)
- New measure evaluations since previous study
- Updated LED saturation assumptions
- AESC 2021 avoided costs

Overview

Potential Modeling & Achievable Scenario

The Study Refresh evaluates updated technical and economic potential assessments and evaluated a single achievable scenario.

The achievable scenario parameters were defined in collaboration with the MPS Management Team (MPSMT) and RI Energy.

For **energy efficiency**, the achievable scenario sets incentives at the midpoint between the Mid and Max scenarios of the original study for most modeled programs.

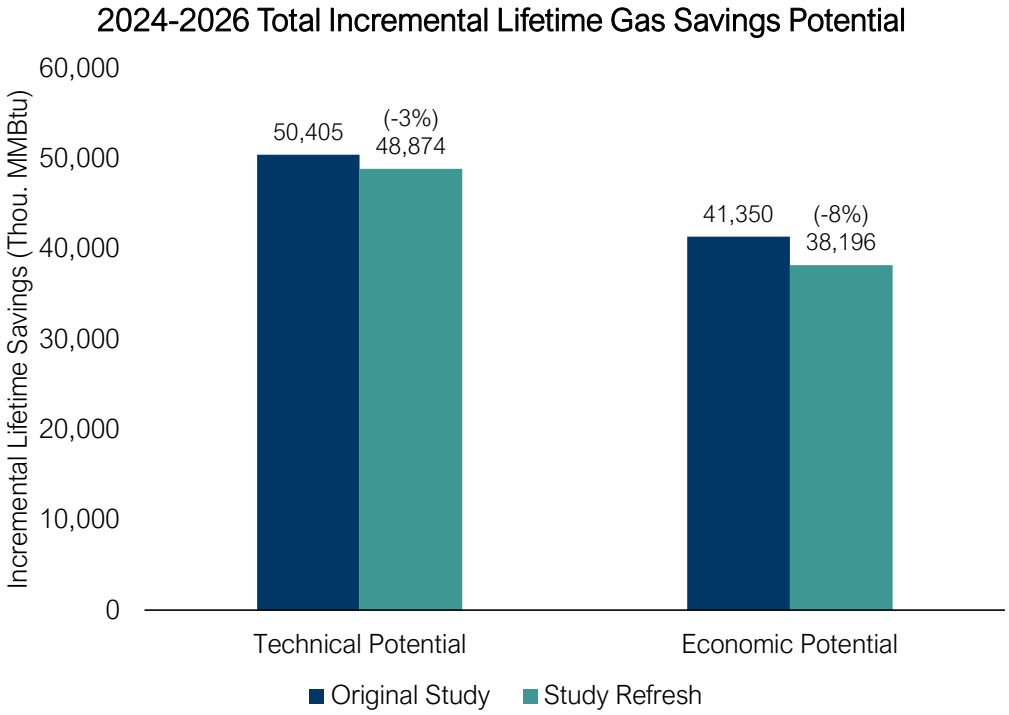
For **demand response,** the achievable scenario sets incentives at the same levels as the Mid Scenario in the original study.

02
Energy Efficiency: Gas Programs

Energy Efficiency | Gas Programs

Gas Potential: Technical and Economic Savings

- **Updates to state appliance standards reduce technical and economic potential**
  - Kitchen and low flow water fixture measures primarily affected
- **Greater proportional reduction in economic potential due to additional measures failed cost-effectiveness criteria**
  - Gas avoided costs slightly declined with 2021 AESC
  - Standards updates decreased benefits for some measures due to increased baseline

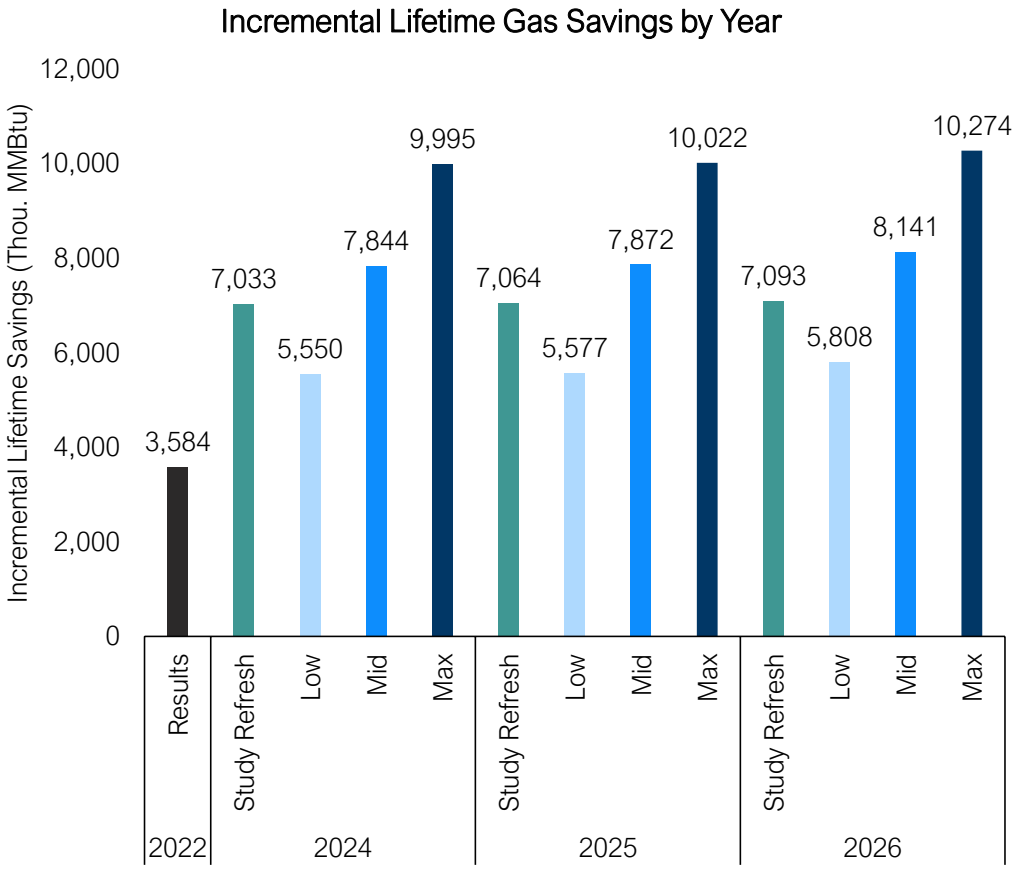


Note: Technical and economic potential expressed as gross savings.

Energy Efficiency | Gas Programs

Gas Potential: Achievable Energy Savings

- **Relative to the original study, the Study Refresh scenario savings fall below the Mid scenario despite higher incentive levels**
  - Similar to technical and economic potential, **updates to state appliance standards** reduce achievable potential
  - Additionally, **updated net-to-gross assumptions** generally reduced claimable gas savings
    - Original Study: 7% reduction in gross savings
    - Study Refresh: 19% reduction in gross savings



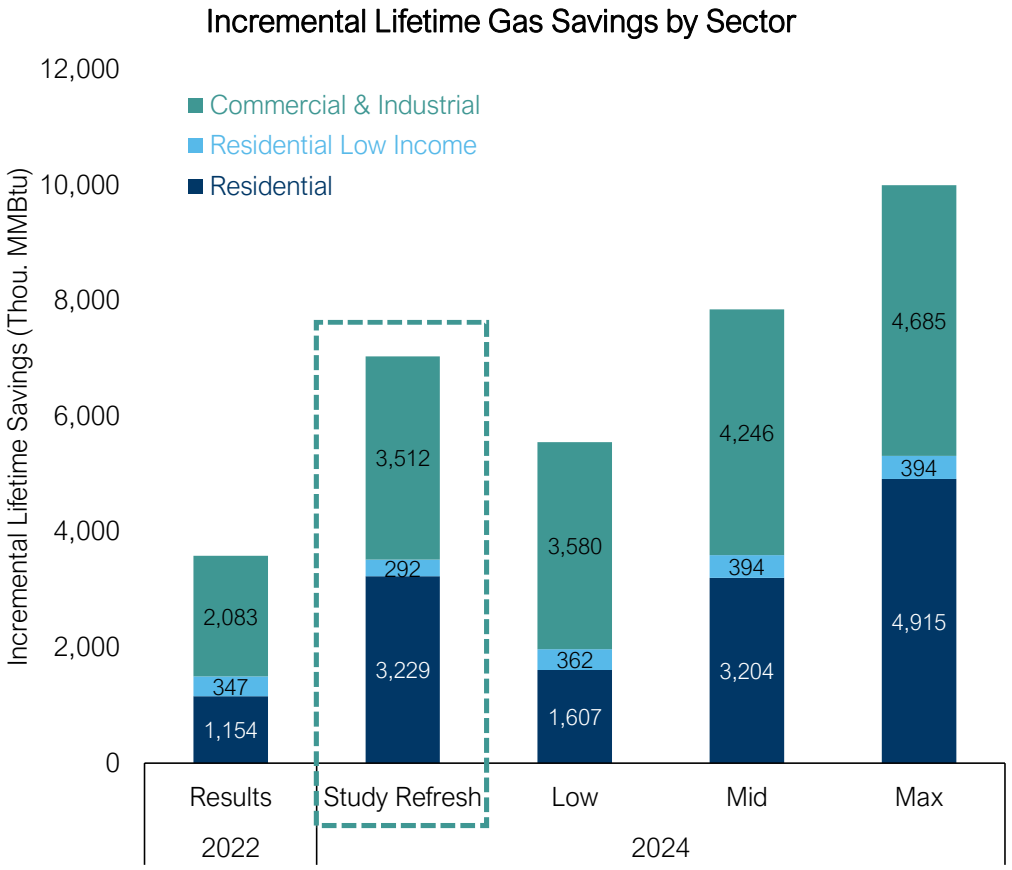
Note: Achievable potential expressed as net savings.

11

Energy Efficiency | Gas Programs

Gas Potential: Savings by Sector

- **Commercial & Industrial**
  - Savings fall below Low scenario primarily due to loss of kitchen-related savings opportunities
- **Residential Low Income**
  - Savings fall below Low scenario primarily due to loss of low flow fixture savings, which were substantial source of savings in original study
- **Residential**
  - Savings similar to Mid scenario as characterization updates for some measures offset loses due to standards updates

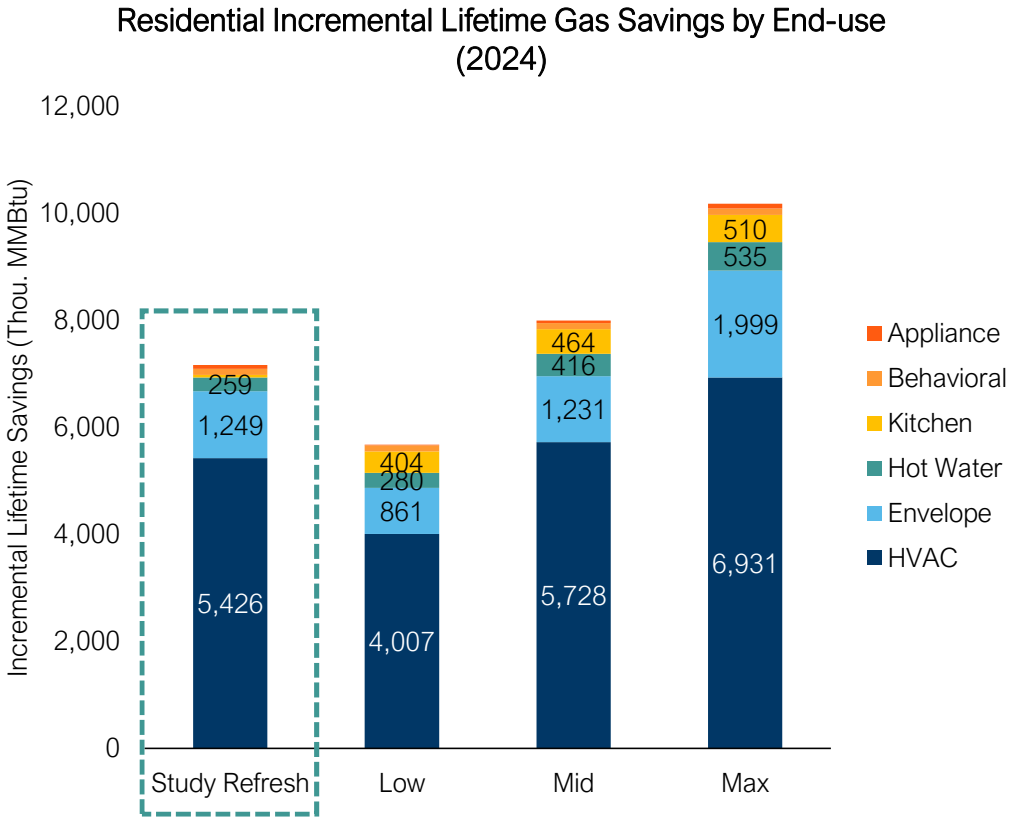


Note: Achievable potential expressed as net savings.

Energy Efficiency | Gas Programs

Residential Savings by End-use

- **HVAC** and **Envelope** savings remain primary source of residential gas savings
- **Hot water** savings decline due to reduction in low-flow fixture savings
- **Kitchen** savings almost entirely eliminated due to appliance standards updates



Note: Achievable potential expressed as net savings. Residential savings in figure include both market-rate and low income residential savings. Figure excludes indirect negative savings from lighting measures.

13

Slide 13

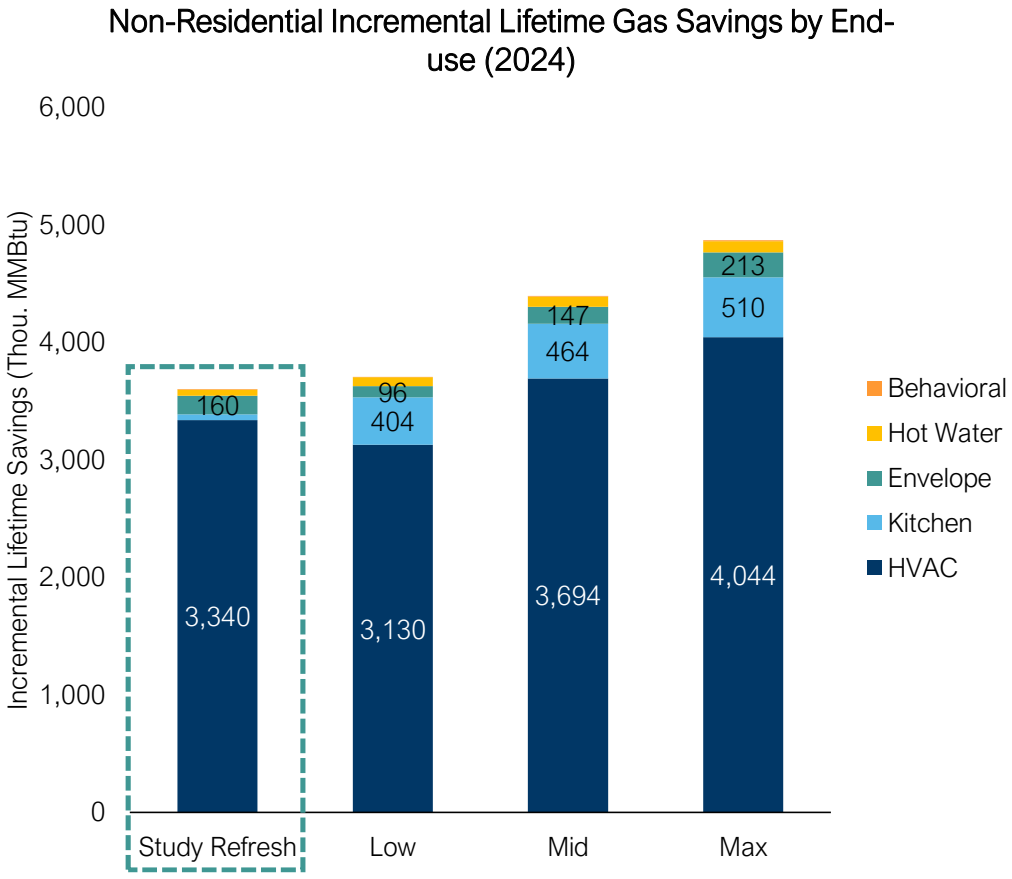
JN0 For program design purposes, can more details be provided here or in report about where that remaining potential can be found (more specifics on end uses and building types)? Same question for C&I and gas res and C&I potential. If these findings and recommendations are presented in 2020 report, reference that and indicate how, if at, they have changed

Jeremy Newberger, 2023-03-24T18:47:16.699

Energy Efficiency | Gas Programs

Non-Residential Savings by End-use

- **HVAC savings remain primary source of non-residential gas savings**
- **Kitchen savings almost entirely eliminated due to appliance standards updates**



Note: Achievable potential expressed as net savings.

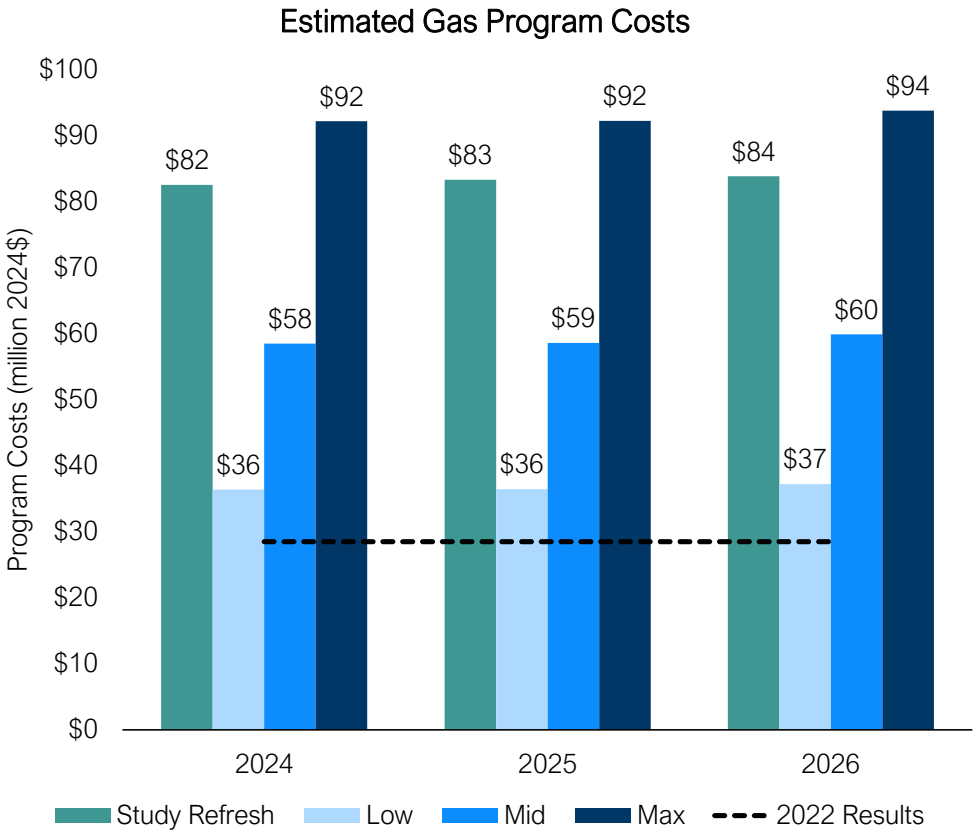
Energy Efficiency | Gas Programs

Gas Program Costs

- **Average acquisition costs increase due to lower NTG factors and higher incentives**
- **Estimated costs do not account for portfolio optimization and program design improvements**

Estimated Average Acquisition Costs

	$ per Incremental Annual MMBtu	$ per Incremental Lifetime MMBtu
Study Refresh	**$139.88**	**$11.78**
Low	$75.62	$6.95
Mid	$91.92	$7.65
Max	$120.09	$9.38
2022 Results	$75.17	$7.94



Note: Program costs include incentive and administrative costs for gas measures. 2022 Results exclude costs related to programs that do not claim savings.

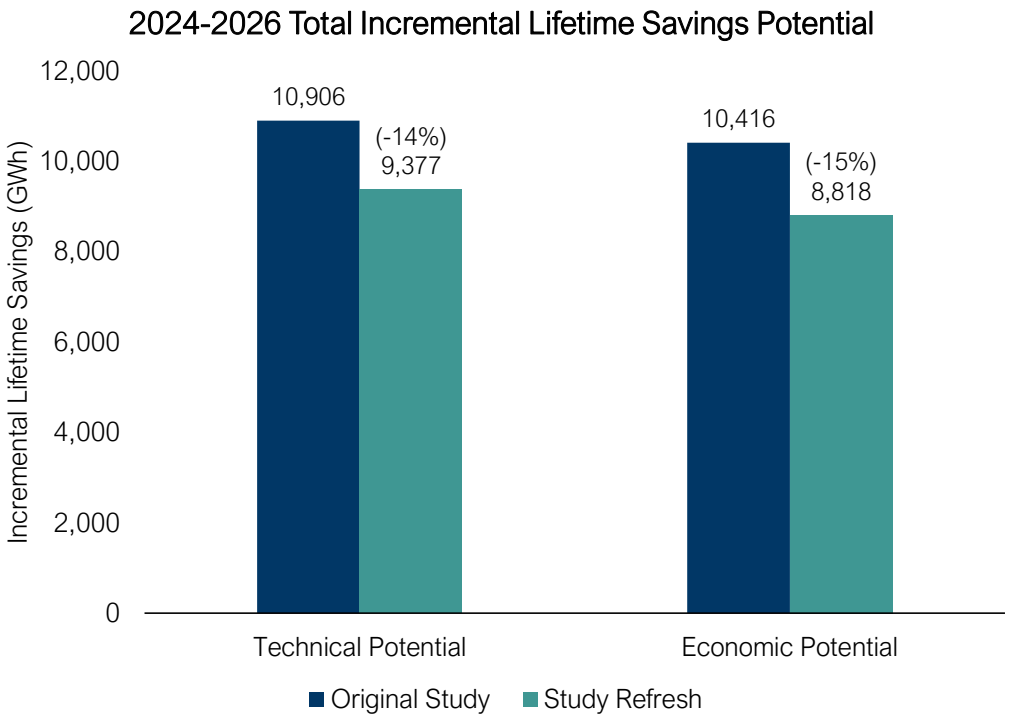
15

03
Energy Efficiency: Electric Programs

Energy Efficiency | Electric Programs

Technical and Economic Savings

- **Decline in lighting opportunities drives reduction in technical and economic potential**
  - Increasing saturation of LED lighting, particularly in the C&I sector where most lighting savings remained in original study
- **Updates to state appliance standards further reduce potential** JN0
- **Slightly less technical savings pass the TRC screening threshold with updated AESC values**



Note: Technical and economic potential expressed as gross savings.

17

Slide 17

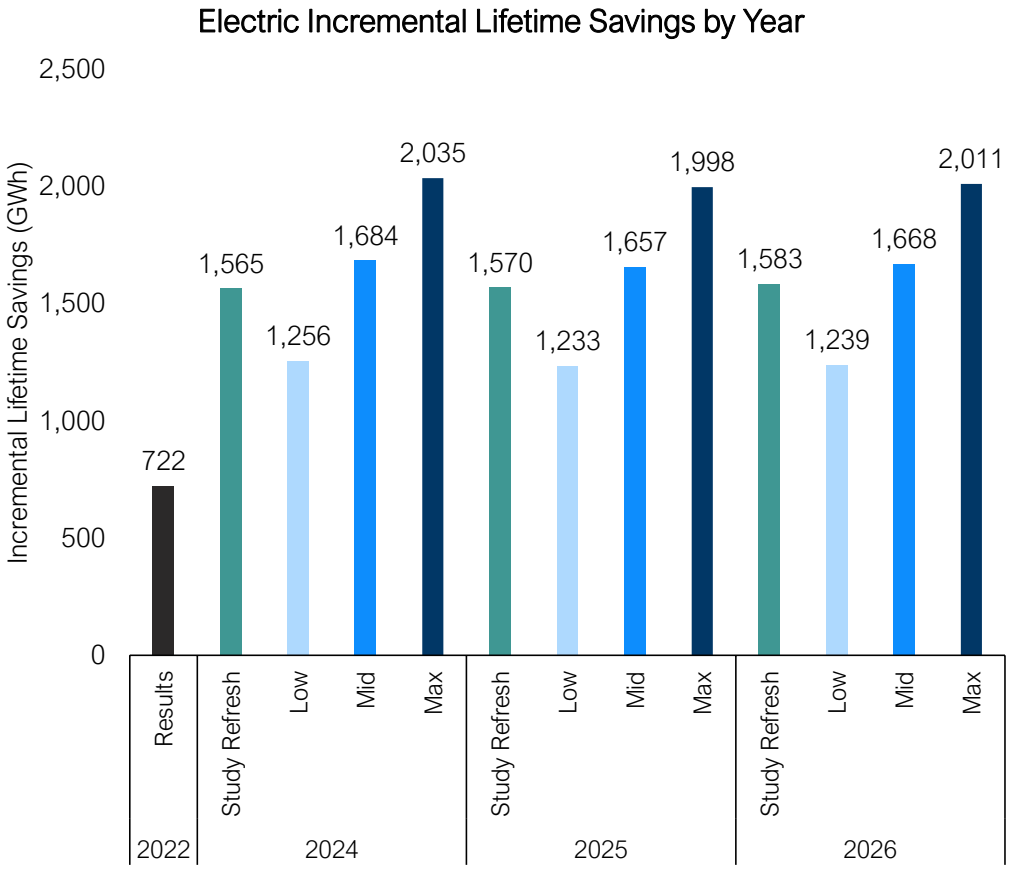
JN0 see comment in report
Jeremy Newberger, 2023-03-24T18:48:10.357

UN0

Energy Efficiency | Electric Programs

Achievable Energy Savings

- **Relative to the original study, the Study Refresh scenario savings fall below the Mid scenario despite higher incentive levels**
  - Similar to technical and economic potential, **updates to LED saturation assumptions** reduce achievable lighting savings
  - Updated net-to-gross assumptions slightly improve net savings relative to gross
    - Original Study: 21% reduction in gross savings
    - Study Refresh: 20% reduction in gross savings



Note: Achievable potential expressed as net savings.

18

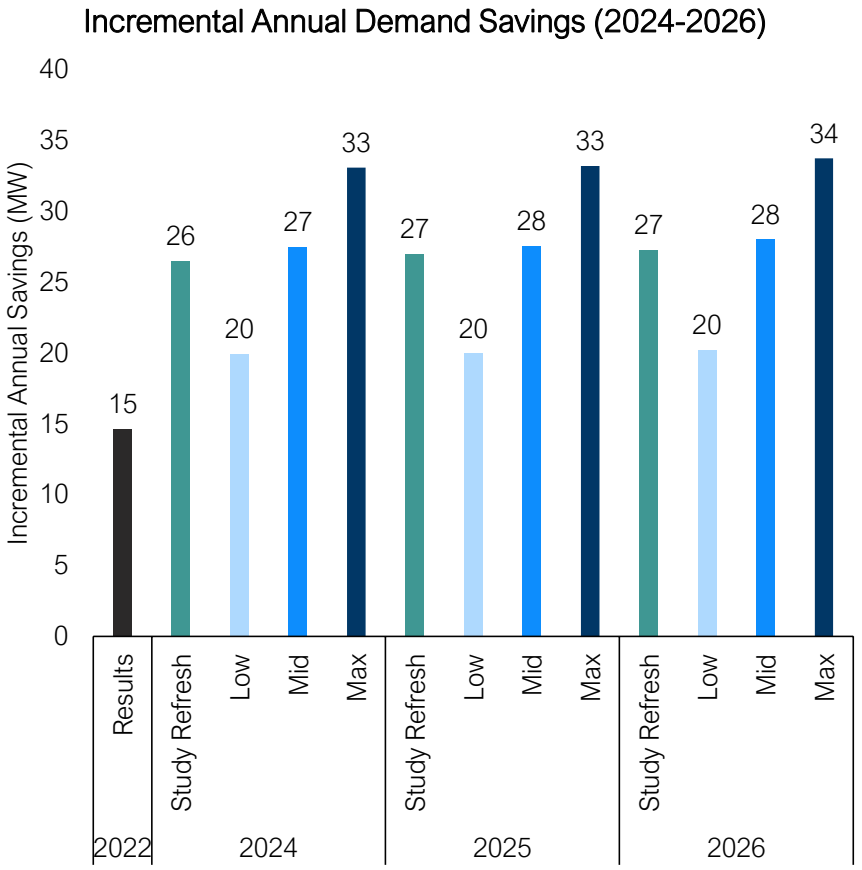
Slide 18

JN0 What assumptions are used for lighting measure lives? based on august 2022 study, they are supposed to decline by 1 year in each future year. relative flatness of these bars suggests that assumption was not modeled
Jeremy Newberger, 2023-03-24T18:50:21.768

Energy Efficiency | Electric Programs

Achievable Passive Demand Savings

- **For passive demand savings (kW), changes relative to the original study mirror changes to energy (kWh) savings**
  - Technical and economic potential experience similar proportional decreases (13% and 15%, respectively)
  - The Study Refresh scenario savings fall slightly below the Mid scenario

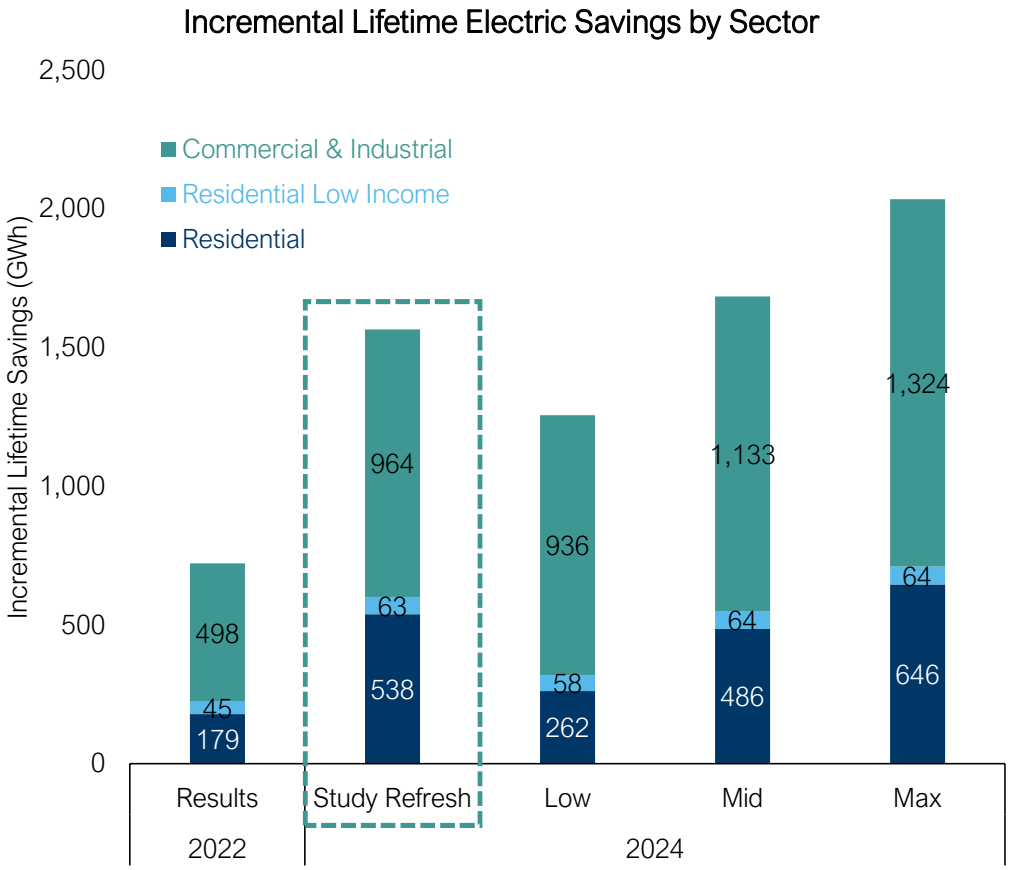


Note: Achievable potential expressed as net savings.

Energy Efficiency | Electric Programs

Savings by Sector

- **Commercial & Industrial**
  - Savings similar to Low scenario despite higher incentives primarily due to loss of lighting-related savings opportunities
- **Residential Low Income**
  - Savings largely unchanged from original study relative to Mid and Max scenario.
- **Residential**
  - Savings fall between original study's Mid and Max scenario

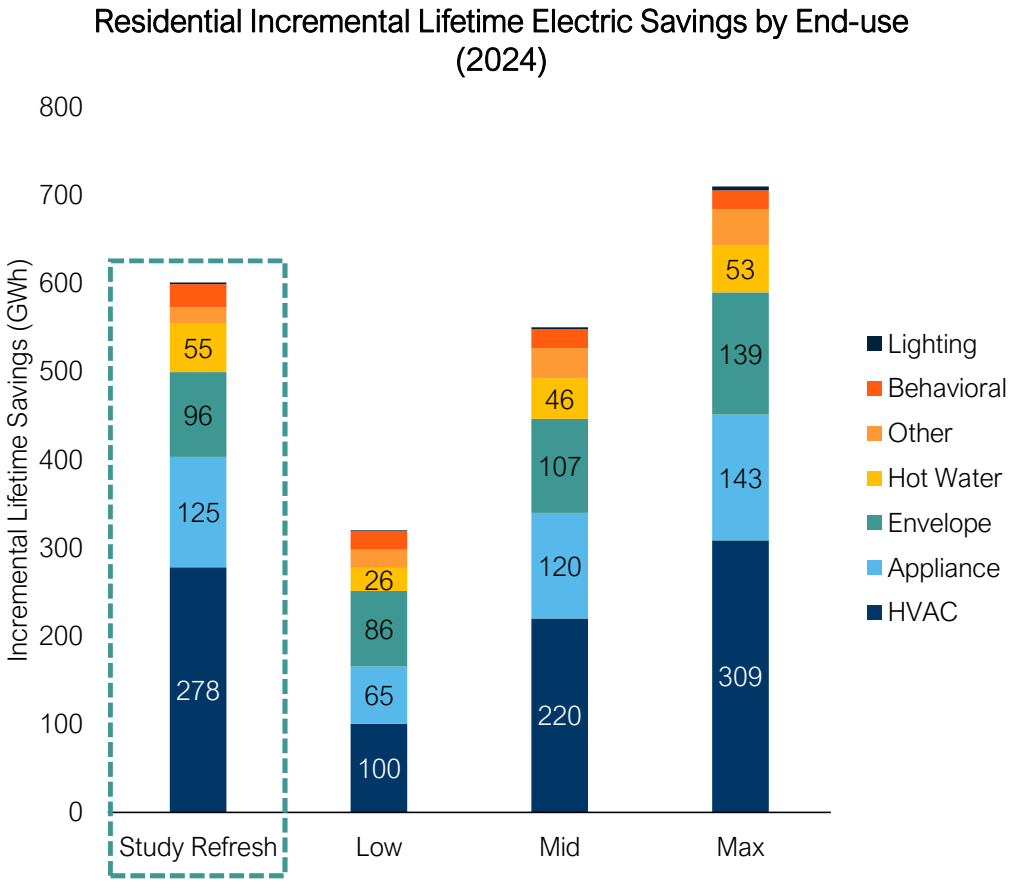


Note: Achievable potential expressed as net savings.

Energy Efficiency | Electric Programs

Residential Savings by End-use

- **HVAC savings remain the primary source of residential electric savings opportunities**
  - Nearly 50% of the HVAC opportunity is from displacing electric resistance heating with ductless heat pumps

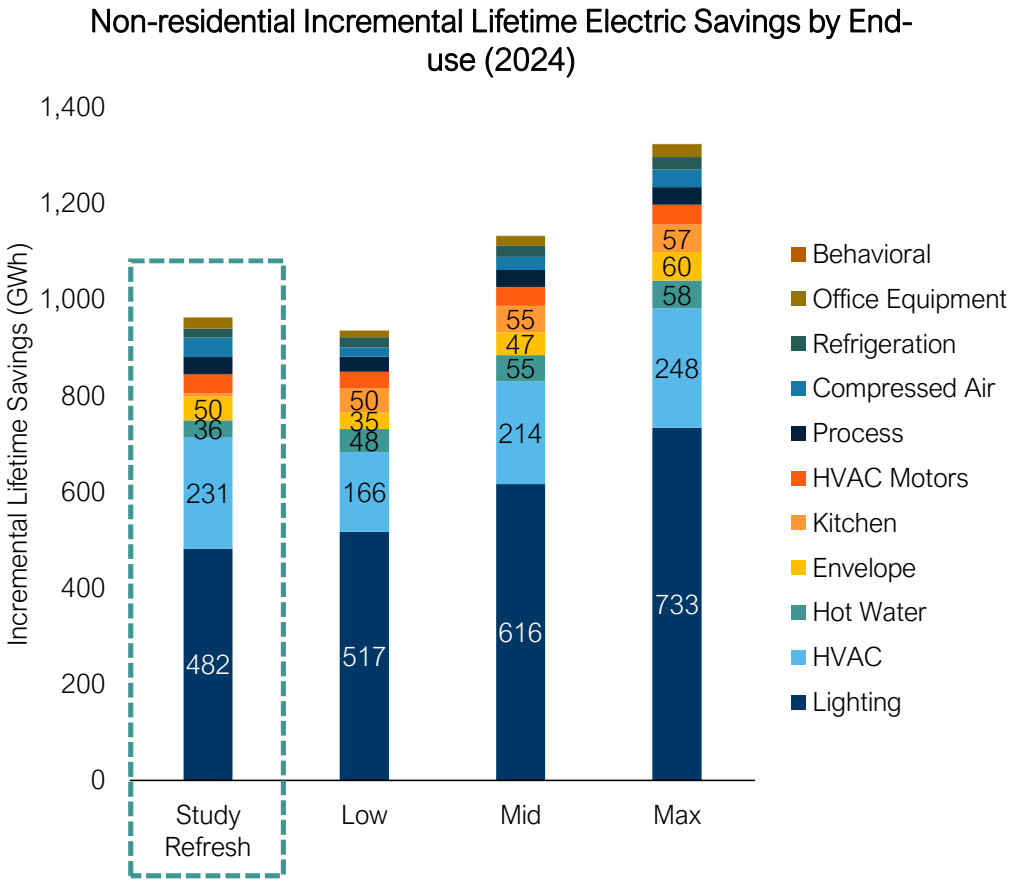


Note: Achievable potential expressed as net savings. Residential savings in figure include both market-rate and low income residential savings.

Energy Efficiency | Electric Programs

Non-Residential Savings by End-use

- **Lighting savings continue to be the primary source of savings in the non-residential sector, despite the transforming market**
- **HVAC opportunities – driven by heat pumps and controls – are the second largest opportunity**



Note: Achievable potential expressed as net savings.

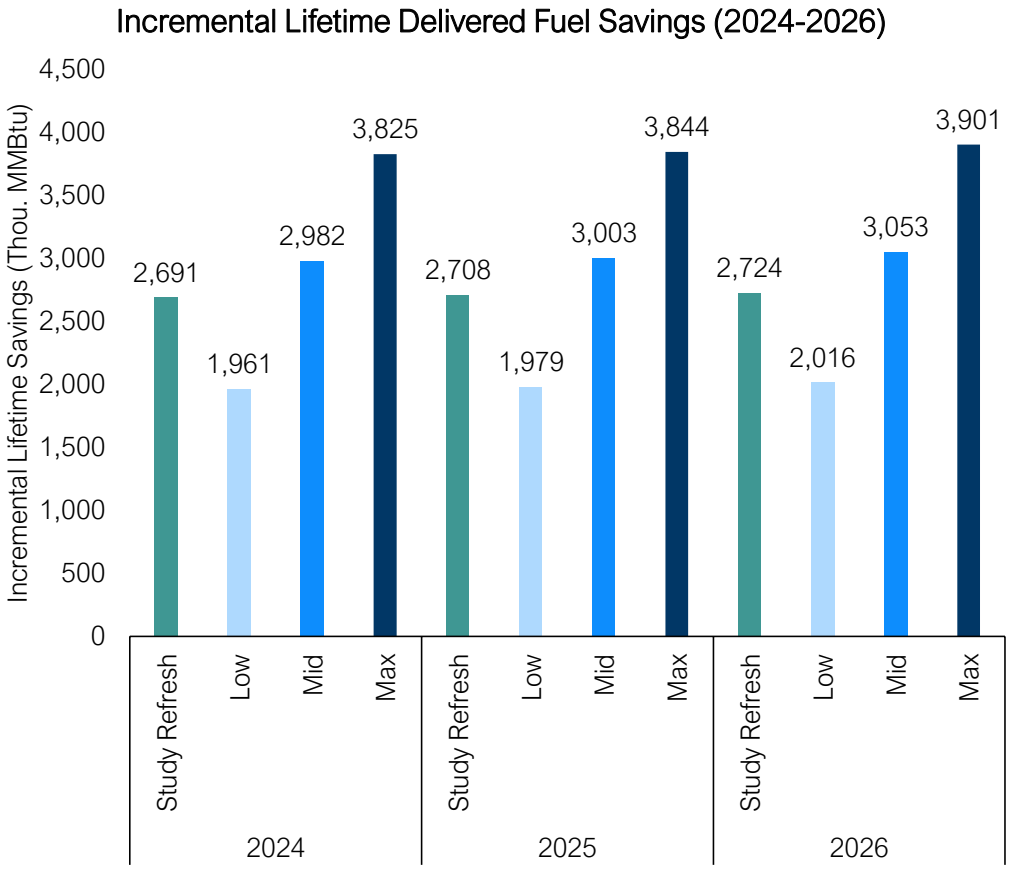
22

Energy Efficiency | Electric Programs

Achievable Delivered Fuel Savings

Relative to the original study, the Study Refresh scenario savings fall below the Mid scenario despite higher incentive levels

- Reduction almost entirely driven by **updated net-to-gross assumptions**
  - Original Study: 5% reduction in gross savings
  - Study Refresh: 22% reduction in gross savings
- Technical and economic potential largely unchanged



Note: Achievable potential expressed as net savings.

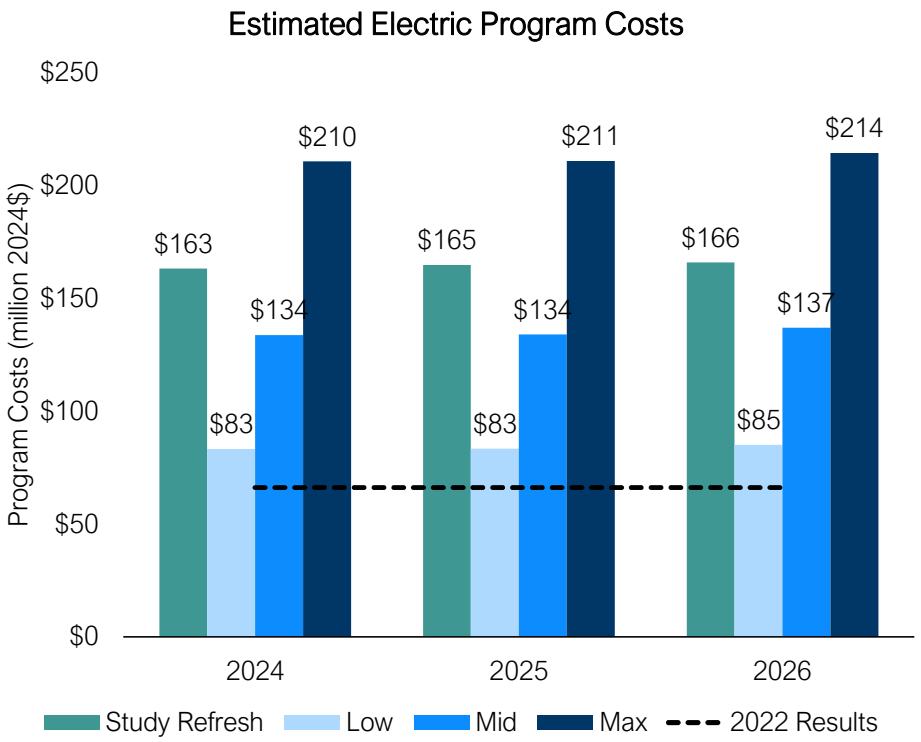
Energy Efficiency | Electric Programs

Electric Program Costs

- **Average acquisition costs increase due to higher incentives, lower NTGs for delivered fuel measures, and loss of (cheaper) lighting savings**
- **Estimated costs do not account for portfolio optimization and program design improvements**

Estimated Average Acquisition Costs

	$ per Incremental Annual kWh	$ per Incremental Lifetime kWh
Study Refresh	**$1.12**	**$0.10**
Low	$0.63	$0.07
Mid	$0.80	$0.08
Max	$1.09	$0.11
2022 Results	$0.64	$0.09



Note: Program costs include incentive and administrative costs for electric and delivered fuel measures. 2022 Results exclude costs related to programs that do not claim savings.

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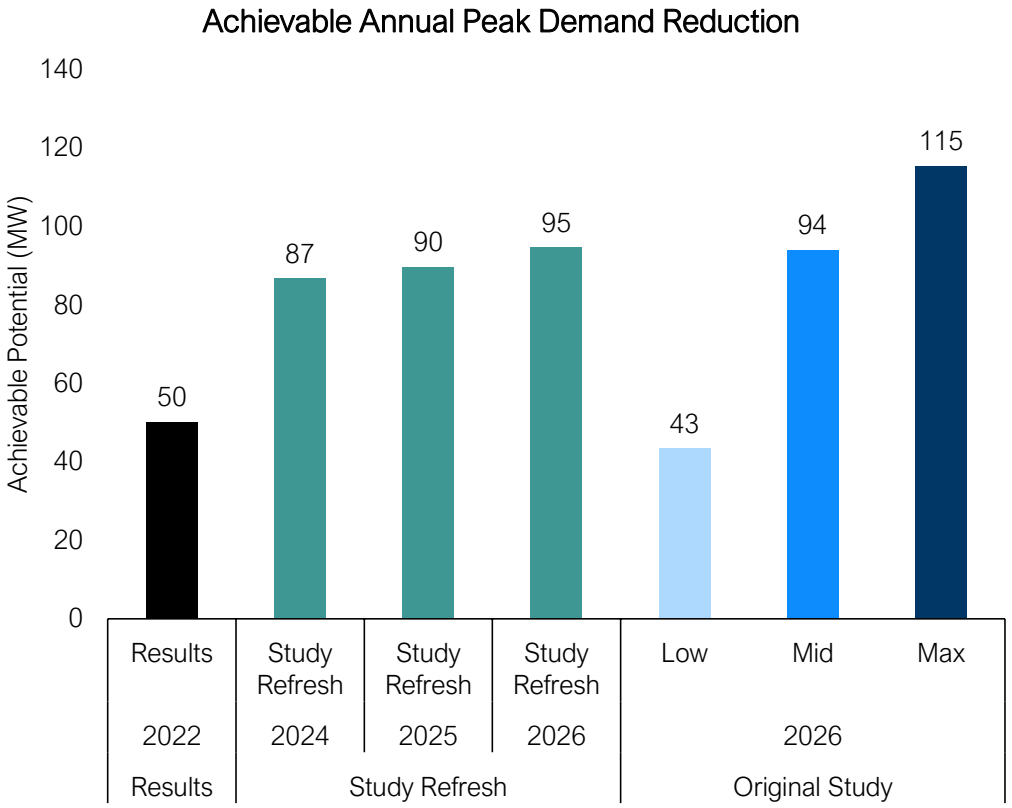
04
Active Demand Response

Active Demand Response

Achievable Annual Peak Demand Reduction

- **Relative to the original study, the Study Refresh scenario savings largely mirror the Mid scenario**
  - Limited changes made to model inputs and assumptions
  - Slight increase in 2026 achievable savings (relative to Mid scenario) driven by updated baseline program participation assumptions



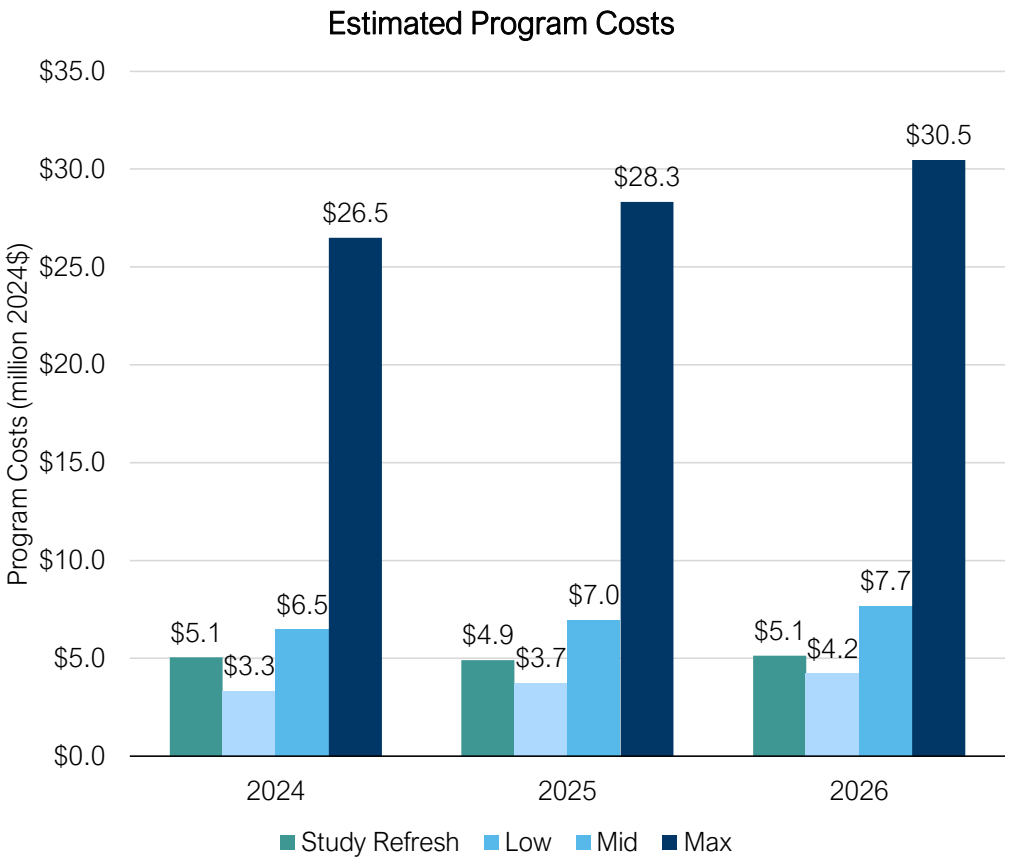
Note: Results are reported in terms of claimable reduction during the ISO New England peak period. The original study largely reported results in terms of net reductions to National Grid's peak load after accounting for snapback effects, which resulted in lower assessed achievable potential.

26

Active Demand Response

Estimated Budget

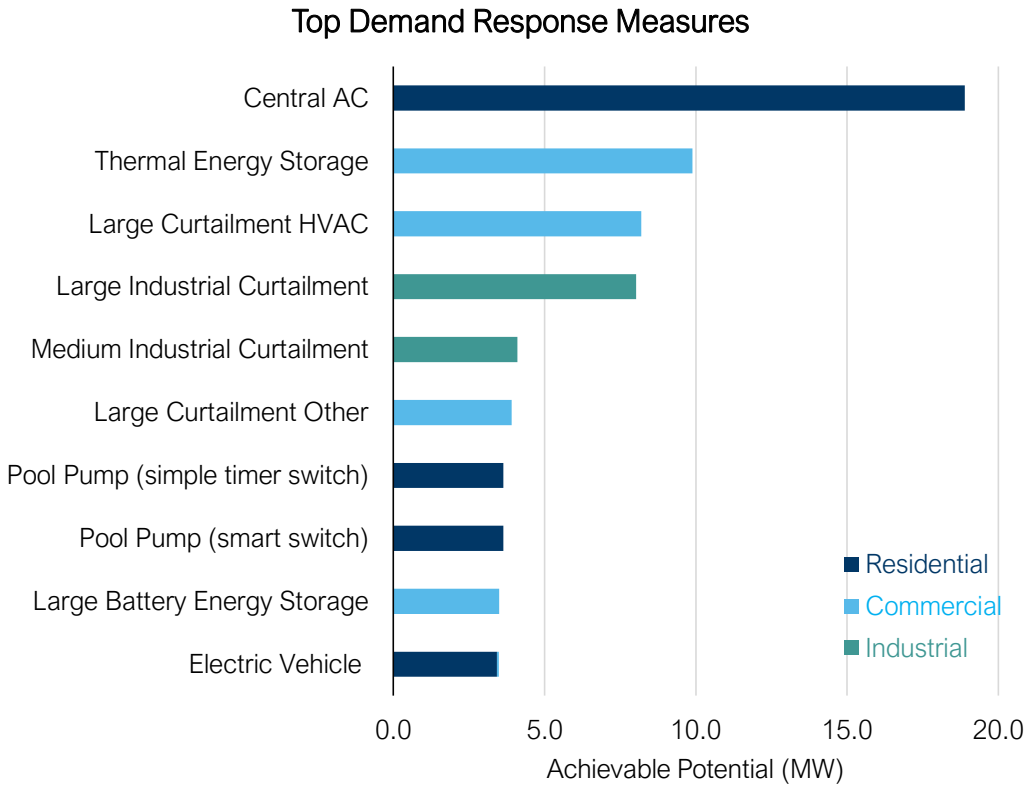
- **Relative to the original study, the Study Refresh scenario costs are slightly below the Mid scenario**
  - The Study Refresh assumes advanced metering infrastructure (AMI) is deployed during the study period – negating the initial costs associated with telemetry for applicable measures.



Active Demand Response

High Impact Measures

- **Central AC controls represent the biggest opportunity in the Residential sector**
- **For the Commercial and Industrial sectors, curtailment measures and thermal energy storage represent the bulk of the opportunity**
- **EV load management opportunities are growing with increased EV adoption**



Note: Results are reported in terms of claimable reduction during the ISO New England peak period. The original study largely reported results in terms of net reductions to National Grid's peak load after accounting for snapback effects, which resulted in lower assessed achievable potential.

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Active Demand Response

Cost-effectiveness

- **Modeled programs are highly cost-effective**
  - High avoided distribution costs ($/kW) and reduction in incremental telemetry costs with the rollout of AMI improve the cost-effectiveness
- **Incentives can be increased to drive additional participation while maintaining cost-effectiveness**

Program	RI Test Ratio	2026 Savings (MW)
Residential BYOD	1.7	8.8
Residential DLC	2.8	26.1
Small Commercial BYOD	1.4	0.8
Small Commercial DLC	5.1	12.7
Medium & Large Commercial Curtailment	4.7	30.5
Medium & Large Industrial Curtailment	4.7	12.7
Residential Behavioural DR	N/A	2.0

Note: Results are reported in terms of claimable reduction during the ISO New England peak period. The original study largely reported results in terms of net reductions to National Grid's peak load after accounting for snapback effects, which resulted in lower assessed achievable potential.

05
Key Takeaways and Next Steps

Key Takeaways and Next Steps

Key Takeaways

1. **Diminishing lighting opportunities.** As customers increasingly adopt LEDs, program opportunities for lighting savings are diminishing.

2. **State appliance standards reduce program opportunities.** While the improved efficiency of Rhode Island's appliance standards will decrease energy consumption in the state, it decreases claimable savings for voluntary incentive programs.

3. **Increasing free ridership.** Based on updated impact factors, free ridership is increasingly reducing net savings – particularly for natural gas and delivered fuel efficiency measures. This also increases acquisition costs as incentives go towards unclaimable savings.

4. **Demand response is cost-effective.** With the rollout of AMI and high avoided distribution capacity costs, demand response savings are becoming increasingly cost-effective in Rhode Island.

Key Takeaways and Next Steps

Next Steps

MARCH' 2023

Mon	Tue	Wed	Thurs	Fri	Sat	Sun
		1	2	3	4	5
6	7	8	9	10	11	12
13	***DRAFT RESULTS*** 14	15	16	17	18	19
20	21	22	23	24	25	26
27	***FEEDBACK*** 28	29	30	31		

APRIL' 2023

Mon	Tue	Wed	Thurs	Fri	Sat	Sun
					1	2
3	4	5	6	7	8	9
10	***FINAL RESULTS*** 11	12	13	14	15	16
17	18	19	***EERMC MEETING*** 20	21	22	23
24	25	26	27	28	29	30

Two weeks for review and feedback
(**Single set of consolidated feedback**)

- March 14th: Draft Results Presentation
- March 28th: Feedback Due
- April 11th: Final Results

Contact

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Consultant
Neeti.suhag@dunsky.com
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PUC 1-15
Program design and offerings

Request:

On page 16 of pre-filed testimony, the Company writes "the Company refined is gas efficiency portfolio to shift funds away from natural gas-consuming equipment and toward electric alternatives and measures that reduce all types of heating fuel use." To clarify the extent of these refinements, please file supplemental versions of Table 5 from Bates page 266 and Table 5 from Bates page 312-317 that provide the following new information for each measure in the proposed 2024 Annual Gas Efficiency Program. For formatting purposes, remove the three right-most columns from the existing tables and replace them with two new columns containing the following information for each measure:

a. Description of the specific refinement made by the Company for the 2024 Annual Plan. In your description, specify whether and how the Company changed the planned quantity relative to 2023 and/or the planned incentive level relative to 2023.

b. Explanation of why the Company made the specific refinement(s) described in part a. Provide the specific economic, technical, or policy rationale.

Response:

Attachment PUC 1-15 contains the measures included in Table 5 from Bates page 266 and Table 5 from Bates page 312-317 where funds were shifted away from natural gas-consuming equipment and toward electric alternatives and measures that reduce all types of heating fuel use. Only measures that were modified to shift funds away from natural gas-consuming equipment and toward electric alternatives were provided in the supplemental versions, and not measures where quantities or incentives were changed for other reasons (e.g. increasing measure penetration).

Each table in Attachment PUC 1-15 includes two new columns describing the specific refinement made by the Company and the explanation why the Company made the specific refinement. As requested, the Company deleted the three right-most columns from the existing tables.

Prepared by or under the supervision of: Brett Feldman, Spencer Lawrence,
Mark Siegal and Daniel Tukey

Table 5. Planned Measures for Gas Residential Programs

Program	Measure	Quantity	Incentive / Quantity	Total Incentives	Total Annual Gas Savings (MWh)	PUC 1-15 (a): Description of the specific refinement made by the Company for the 2024 Annual Plan. In your description, specify whether and how the Company changed the planned quantity relative to 2023 and/or the planned incentive level relative to 2023.	PUC 1-15 (b): Explanation of why the Company made the specific refinement(s) described in part a. Provide the specific economic, technical, or policy rationale.
Residential HVAC	Combo Condensing Boiler/Water Heater - 95% AFUE	600	$1,000.00	$600,000	5,356.3	Quantity decreased Incentive per measure decreased	Quantity and incentive per measure decreased due to policy- based on EERMC and OER priority to reduce gas incentives to contribute to Act on Climate
	Forced Hot Water Boiler - >=95% AFUE	240	$800.00	$192,000	1,959.4	Quantity decreased Incentive per measure decreased	Quantity and incentive per measure decreased due to policy- based on EERMC and OER priority to reduce gas incentives to contribute to Act on Climate
	Furnace w/ ECM - 97% AFUE	150	$550.00	$82,500	492.1	Quantity increased Incentive per measure decreased slightly	Quantity increased because "Furnace w/ ECM- 95% AFUE" is no longer offered. Incentive per measure decreased slightly due to policy- based on EERMC and OER priority to reduce gas incentives to contribute to Act on Climate
Residential New Construction	Renovation Rehab CP - DHW, Gas	2	$50.00	$100	1.0	Quantity decreased	Quantity decreased due to policy- based on EERMC and OER priority to reduce gas incentives to contribute to Act on Climate
Income Eligible Multifamily	HEATING _Custom_LI	11	$135,000.00	$1,485,000	5,956.5	Quantity decreased slightly	Quantity decreased due to policy- based on EERMC and OER priority to reduce gas incentives to contribute to Act on Climate

Table 7. Planned Measures for Gas Commercial and Industrial Programs

Program	Measure	Quantity (MMBtu)	Incentive / Quantity	Total Incentives	Total Annual Gas Savings (MWh)	PUC 1-15 (a): Description of the specific refinement made by the Company for the 2024 Annual Plan. In your description, specify whether and how the Company changed the planned quantity relative to 2023 and/or the planned incentive level relative to 2023.	PUC 1-15 (b): Explanation of why the Company made the specific refinement(s) described in part a. Provide the specific economic, technical, or policy rationale.
Large C&I Retrofit	Steam Trap HVAC - High Pressure	1320	$22.00	$29,040	1436.2	Quantity increased	Policy: steam trap surveys help reduce the amount of natural gas used by these facilities.
	Steam Trap HVAC - Low Pressure	1320	$22.00	$29,040	1436.2	Quantity increased	Policy: steam trap surveys help reduce the amount of natural gas used by these facilities.
	Steam Trap, Custom - Low Pressure	5405	$12.50	$67,563	5880.6	Quantity increased	Policy: steam trap surveys help reduce the amount of natural gas used by these facilities.
	Other Gas - All	5363	$34.00	$182,342	4924.7	Quantity and incentive increased	Policy: gas efficiency measures help reduce the amount of natural gas used by these facilities.

PUC 1-16
Program design and offerings

Request:

In the proposed 2024 Annual Gas Efficiency Plan, is the Company proposing to discontinue any gas efficiency measures that were offered through the 2023 Plan? If yes, please list the discontinued measures.

Response:

Yes, the Company is proposing to discontinue gas efficiency measures that were offered through the 2023 Plan. Please see the table below which contains measures discontinued due to BCRs below 1.0.

Program Name	2023 Measure Name
Residential New Construction	MFHR_HEATING
Residential New Construction	MFHR_WATER_HEATING
Residential New Construction	RR_DHWTIER1_GAS
Residential New Construction	RR_DHWTIER2_GAS
Residential New Construction	RR_DHWTIER3_GAS
Residential New Construction	Water Heating (CP)
Residential New Construction	Water Heating Tier 1
Residential New Construction	Water Heating Tier 2
Residential New Construction	Water Heating Tier 3
A02b Energy Star Heating System	WATER HEATER - INDIRECT

PUC 1-17
Program design and offerings

Request:

On Bates page 78, the Company writes "while cost effectiveness for the Plan is measured at the program level, measure-level benefit cost ratios are calculated as well. In this Plan, all programs are cost-effective; however, the Company looked at the measure-level to analyze which gas efficiency measures were not cost-effective. These gas efficiency measures, primarily in the residential sector, were reduced or removed entirely from the Plan where prudent. The funds from these gas efficiency measures were shifted to more cost-effective gas measures within the residential sector or to the C&I sector." Regarding this statement, please explain the following:

a. clarify whether the Company conducted measure-specific review of benefits cost ratios (BCR) for both the electric and gas portfolios or just the gas portfolio. If the later, please explain why the Company only reviewed gas measures.

b. provide a list of each measure that was identified as being not cost-effective. For each measure, provide the following information: the measure-specific BCR, the planned quantity of measures proposed for 2024, and the associated planned incentive budget.

Response:

a. The Company did conduct measure-specific review of benefit-cost ratios for both the electric and gas portfolios.

b. Please see Table 1 for electric measures and Table 2 for gas measures.

Table 1: 2024 Electric Non-Cost-Effective Measures

Program	Measure	Quantity	Incentive Budget	Benefit / Cost Ratio
Residential New Construction	Renovation Rehab - Heating Tier 3, Elec	3	$8,721	0.49
Large C&I Retrofit	Custom Other	1,917,608	$364,346	0.84
Large C&I Retrofit	O & M	1,375,464	$247,583	0.69
Income Eligible Multifamily	CUSTOM CHP	1	$540,000	-0.14
EnergyWise Multifamily	Heat Pumps	14	$273,000	0.68
Income Eligible Multifamily	Heat Pumps	5	$1,500,000	0.91

Prepared by or under the supervision of: Brett Feldman and Spencer Lawrence

PUC 1-17, Page 2
Program design and offerings

Large C&I New Construction	MFHR - Lighting	6,278	$2,449	0.00
Income Eligible Multifamily	Custom	1	$300,000	0.39
Income Eligible Multifamily	CUSTOM CIRCULATOR	2	$16,000	0.67
Income Eligible Multifamily	VFD	11	$308,000	0.87
EnergyWise Multifamily	CUSTOM CIRCULATOR	2	$9,600	0.45
EnergyWise Single Family	WiFi Thermostat - AC Only	10	$1,740	0.69
Large C&I New Construction	Vending Miser - Refridgerated Beverage Vending Machines UPSTR	1,200	$840	0.92
Large C&I New Construction	Vending Miser - Non-Refridgerated Snack Vending Machines UPSTR	1,200	$840	0.92
Large C&I New Construction	Vending Miser - Glass Front Refridgerated Coolers	1,200	$840	0.92
EnergyWise Single Family	Participant	12,750	$4,781,250	0.00
Small Business Direct Install	LED - Interior SI	3,616,954	$2,387,189	0.89
Income Eligible Single Family	Basic Educational Measures	2,000	$360,000	0.46
EnergyWise Single Family	Pre-weatherization	650	$147,875	0.00
Income Eligible Multifamily	LED Fixture - Common Ext	80	$26,400	0.49
Income Eligible Multifamily	LED Fixture - Common Int	370	$74,000	0.42
Income Eligible Multifamily	LED Fixture - Linear, Common Int	500	$100,000	0.23

PUC 1-17, Page 3
Program design and offerings

Table 2: 2024 Gas Non-Cost-Effective Measures

Program	Measure	Quantity	Incentive Budget	Benefit / Cost Ratio
C&I Multifamily	Heating, Custom	11	$528,000	0.88
Income Eligible Multifamily	HEATING _Custom_LI	11	$1,485,000	0.98
EnergyWise Multifamily	Duct Sealing	190	$10,853	0.06
Residential New Construction	Renovation Rehab CP - DHW, Gas	2	$100	0.26
Residential New Construction	Renovation Rehab - Heating Tier 3, Gas	2	$5,070	0.88

The list of measures presented in Table 2 differs from the list of measures presented in Tables 2 and 3 of the Company's response to Division 1-3. The difference is that Tables 2 and 3 from Division 1-3 only include non-cost-effective measures with reduced total incentive budgets between 2023 and 2024. Table 2 above includes all non-cost-effective measures regardless of changes in incentive budgets.

PUC 1-18
Program design and offerings

Request:

On page 39 of pre-filed testimony, the Company writes "the Annual Plan reduces budgets in areas that have created limited value including a reduction in the budget for Demonstrations, Pilots, and Assessments." Please provide the total proposed budgets for Demonstrations, Pilots, and Assessments included in the 2024 Annual Gas and Electric Plans broken down by individual demonstration, pilot, or assessment, and clarify the magnitude of the Demonstrations, Pilots, and Assessments budget reduction relative to 2023.

Response:

The total proposed budgets for Demonstrations, Pilots, and Assessments in the 2024 Annual Plan is as follows:

Demonstration/Pilot/Assessment Name	2024 Budget Amount		
	Electric	Gas	Total
Automated RTU Optimization	$1,863	$1,863	$3,726
Gas Leak Survey	$0	$14,000	$14,000
Commercial Weatherization	$35,228	$4,772	$40,000
Multifamily Financing	$15,448	$14,552	$30,000
Residential Equity Outreach	$35,881	$19,119	$55,000
Total	$88,420	$54,306	$142,726

The comparison between the 2023 and 2024 Demonstrations, Pilots, and Assessments budgets is as follows:

Plan Year	Budget Amount		
	Electric	Gas	Total
2023	$71,055	$572,847	$643,902
2024	$88,420	$54,306	$142,726
Difference	$17,365	-$518,541	-$501,176

Prepared by or under the supervision of: Michael O'Brien Crayne

PUC 1-19
Program design and offerings

Request:

For each of the pilots, demonstrations, and assessments included in the proposed 2024-2026 Three-Year Gas and Electric Efficiency Plans described on Bates pages 458 – 463, provide a timeline for the completion of the pilot, demonstration, or assessment.

Response:

The Company's timelines for the pilots, demonstrations, and assessments included on Bates pages 458 – 463 are provided below.

- 3.2.1 C&I Weatherization Demonstration (Bates 458): The Company has planned for this demonstration to be fully integrated into the programs offered to customers by the end of 2024.

- 3.3.1 Residential Equity Outreach Assessment (Bates 460): The Company plans for the Residential Equity Outreach Assessment to launch in Q1 2024, continue through the 2024 plan year, and end with an assessment in mid-2025.

- 3.3.2 Multifamily Financing Assessment (Bates 461): The Company plans for the Multifamily Financing Assessment to launch in Q1 2024, continue through the 2024 plan year, and end with an assessment in mid-2025.

Prepared by or under the supervision of: Spencer Lawrence,
Mark Siegal and Daniel Tukey

PUC 1-20
Program design and offerings

Request:

On Bates page 79, the Company writes "for multifamily gas furnaces specifically, the Company decided to keep the multifamily heating measures within the IES Multifamily and C&I Multifamily programs so there would be comprehensive offerings to building owners… Once in the door, the sales team can work on education which also includes electrification. There are also limited alternatives in the short term." What does the Company mean by "there are also limited alternatives in the short term" and once a customer is in the door, how does the Company work with the customer to assess those alternatives.

Response:

Multifamily property owners will engage with the Company when a building's heating system is near end-of-life. If the current equipment in the building is fueled by natural gas, the property owner may look for incentives to replace the existing equipment. The Company included gas incentives to ensure that comprehensive solutions were available for customers looking through the website at available incentives. Once a customer invites an energy auditor into the building, opportunities for gas and electric solutions can be investigated and determined if electric heating is feasible. If it is a good substitute, the customer would be directed to Clean Heat RI to see if incentives are available to convert from gas heating to electric heating. If there are no technical and cost-effective electric solutions, the customer could still put in a high efficiency gas heating system. The limited alternative in the short term refers to a lack of technical and cost-effective electric solutions.

Prepared by or under the supervision of: Spencer Lawrence

PUC 1-21
Program design and offerings

Request:

On Bates page 80, the Company writes "a recent evaluation indicates energy savings between recent new construction participants and non-participants has narrowed. This finding provides the Company with an opportunity to focus on higher savings building approaches. To do so, the Company plans to revisit which measures and/or market segments should be included in the Residential New Construction Program." Please explain how the Company adjusted the program size and budget for the Residential New Construction program in the proposed 2024 Annual Plan and 2024-2026 Three Year Plans relative to past years in light of the new evaluation results and the Company's assertion that "new residential construction has been very slow in Rhode Island compared to other states."

Response:

The Company did not make any significant adjustments to the size and budget of the Residential New Construction (RNC) Program because we are in the process of analyzing and adjusting the program in light of new evaluation results, as well as strong stakeholder interest in moving to a fully electric new construction program.

PUC 1-22
Program design and offerings

Request:

On Bates page 81, the Company proposes offering "enhanced incentives to [C&I] customers who commit to implementing comprehensive energy efficiency measures within a specified timeframe. To qualify for the enhanced incentives, the customer will need to commit to installing three or more energy efficiency measures with different end-uses within a program year." Regarding these "enhanced incentives," please explain the following:

a. Please clarify the specific objective that these enhanced incentives are proposed to achieve and explain how the enhanced incentive will achieve that objective in a way that standard incentives will not.

b. Is the Company proposing to offer these "enhanced incentives" in the 2024 program year? If yes, please provide a list of the specific measure offerings in the 2024 Plan that would qualify for the enhanced incentive and the dollar value of the enhanced incentive.

c. Has the Company offered this enhanced incentive to C&I customers in past program years? If yes, please describe the past offering(s) and whether they were successful at accelerating C&I customer adoption of comprehensive energy efficiency measures.

Response:

a. The specific objective in offering enhanced incentives is to stimulate demand and accelerate the adoption of multiple end-use efficiency measures that would otherwise not be considered. More specifically, the intent of the enhanced incentives is to increase customer contribution towards energy efficiency related capital and/or operational expenditures within a given capital cycle. By offering enhanced incentives, customers may look to adopt energy efficiency measures that would otherwise not be considered under standard incentive levels. And while the enhanced incentive and the standard incentive offerings share the same objective of accelerating energy efficiency adoption, the improved economics of the enhances incentive would theoretically increase the rate and pace of energy efficiency adoption.

b. No, the Company is not proposing tooffer these "enhanced incentives" in the 2024 program year.

Prepared by or under the supervision of: Mark Siegal and Daniel Tukey

PUC 1-22, Page 2
Program design and offerings

c. No, the Company has not offered enhanced incentives to customers that commit to installing three or more energy efficiency measures with different end-uses within a program year.

PUC 1-23
Program design and offerings

Request:

On Bates page 101, the Company writes "starting in 2024, the program will no longer offer LED lighting resulting in the decrease in MWh savings seen in 2024… the Company expects growth through emphasis on weatherization of electrically heated homes to help mitigate some of the losses associated with the sunsetting of the program's lighting offering." Referencing Bates page 263, it appears that the Company is proposing to perform a total of 2,319 weatherizations in 2024 through the electric EnergyWise Single Family program. Of those, only 263 appear to be weatherizing electrically-heated residences. Please explain how the proposed weatherization activity for 2024 represents a "mitigation" strategy for the loss of lighting-related electric energy savings when only 11% of the planned weatherizations are at electrically-heated residences.

Response:

The 263 electric heat weatherization (wx) projects planned for 2024 represent a 31.5% increase in the planned number of electric wx projects over 2023. The number of electric heat wx projects planned for 2024 takes into account the available population of electrically heated homes in the market; the number of electric wx projects historically completed by the program on an annual basis; and overall program budget considerations. The Company also expects that there will be additional opportunities to educate customers with electric heat who have sought weatherization services on the benefits of upgrading to heat pumps resulting in additional mWh savings for the program.

Prepared by or under the supervision of: Spencer Lawrence

PUC 1-24
Program design and offerings

Request:

Referencing Table 3 on Bates page 264, the Company is proposing an incentive budget of $360,000 for "basic educational measures" within the 2024 Income Eligible Single Family electric program. This appears to be a new offering relative to the 2023 program. Please explain what this offering is and how these "educational measures" yield electric energy savings.

Response:

The "basic educational measures" is not a new offering within the 2024 Income Eligible Single Family electric program. In prior years, this measure was called "TLC kits" or "EDUC - TLC" within the BCR models. The measure was renamed to "basic education measures" during the alignment of the TRM and BCR as that is the measure name used in the 2023 TRM. The measure yields electric energy savings as it includes the installation of basic measures (low-flow showerheads, lighting, etc.) during an audit to help customers become more aware of energy efficiency.

Prepared by or under the supervision of: Spencer Lawrence

PUC 1-25
Program design and offerings

Request:

On Bates page 102, the Company writes "the HER program has been offered in Rhode Island for 10 years. As the program continues, the degree of savings declines as customers move or opt out of the offering. There is a natural decline in year-over-year savings until enough new customers are available to create a new cohort of customers." Regarding HERs, please provide a table showing planned vs. actual HER budget and savings since the program was initiated 10 years ago, broken out by gas and electric.

Response:

Please see Tables 1 and 2 below for the Gas and Electric HER program planned vs actuals, as reported in the Year End Reports for the respective years. Please note 2023 Actuals are not available as they will be calculated after the year has been completed.

Table 1. Home Energy Reports Program, Gas - Planned vs Actual Budget and Annual Savings

Year	Budget		Annual Savings (MMBtu)	
	Plan	Actual	Plan	Actual
2023	$360,500	N/A	91,640	N/A
2022	$441,800	$379,415	93,548	115,975
2021	$450,900	$400,308	93,548	88,173
2020	$471,500	$366,484	115,426	103,159
2019	$447,900	$420,080	115,520	111,117
2018	$428,700	$417,100	77,220	132,562
2017	$497,000	$504,700	59,164	103,087
2016	$436,600	$453,600	53,989	75,543
2015	$470,500	$455,500	50,806	66,882
2014	$286,000	$252,300	73,877	56,694
2013	$298,100	$312,800	35,781	15,248

PUC 1-25, Page 2
Program design and offerings

Table 2. Home Energy Reports, Electric - Planned vs Actual Budget and Annual Savings

Year	Budget		Annual Savings (MWh)	
	Plan	Actual	Plan	Actual
2023	$2,147,200	N/A	24,350	N/A
2022	$2,641,300	$2,389,672	26,852	30,814
2021	$2,641,700	$2,374,944	26,852	31,512
2020	$2,728,100	$2,196,123	23,239	26,345
2019	$2,641,200	$2,562,476	24,130	24,938
2018	$2,629,300	$2,568,600	25,054	23,527
2017	$2,447,000	$2,389,800	26,184	30,451
2016	$2,796,700	$2,722,400	32,186	28,792
2015	$2,594,200	$2,464,200	25,634	31,177
2014	$2,445,200	$2,417,000	25,028	36,307
2013	$1,419,800	$1,410,900	15,325	10,002

PUC 1-26
Program design and offerings

Request:

On Bates page 237, the Company writes "the Company plans to allocate program budgets to increase marketing to underserved populations [through the 2024 Annual Plan]." Please describe this "budget allocation" in greater detail and demonstrate where in the proposed 2024 Annual Plan budget schedules this "budget allocation" is evidenced.

Response:

The Company's indication of "[allocating] program budgets to increase marketing to underserved populations" in the 2024 Annual Energy Efficiency Plan refers to the general energy efficiency program budgets and the comprehensive marketing budget. The proposed sector and program budgets are provided in Attachment 5: Electric EE Program Tables, Table E-2, and Attachment 6: Gas EE Program Tables, Table G-2.

There is no specific budget detailed for the underserved populations because energy efficiency marketing is used to increase outreach, awareness, and drive activity to specific programs. The underserved populations can participate in any of the residential or income eligible (provided they are on the discount electric or gas rate) programs. An example of a marketing effort that targeted underserved populations in 2023 was an email and mailing campaign to five target communities: Central Falls, East Providence, Pawtucket, Providence, and Woonsocket. The campaigns focused on a no-cost, moderate-income weatherization offering and landlord offerings. 2024 will have similar marketing strategies, a Spanish radio campaign on the Latino radio stations, and the education of local nonprofits.

Prepared by or under the supervision of: Brendan Dagher

PUC 1-27
Program design and offerings

Request:

On Bates page 238, the Company explains that "the Rhode Island Strategic Electrification Study cites the main barriers preventing customers from moving to air source heat pumps as being: 1) a lack of awareness and 2) the high initial cost of system installations. The Company believes … the high initial cost is being addressed through RIE incentives, OER's heat pump program, and through federal funding." For all of the heat pumps proposed to be installed through the 2024 Annual Electric Efficiency Plan, what is the percentage of installations the Company expects will receive a federal or state incentive?

Response:

Heat pumps installations for market rate customers funded by the Clean Heat RI (CHRI) program are eligible for a Company incentive for the cooling efficiency associated with the heat pump. The Company expects that the CHRI installations, which receive a state incentive, will account for approximately 60% of the installations proposed in the 2024 Annual Efficiency Plan HVAC program. CHRI incentives for low-income residents are limited to deliverable fuel customers and for these installations there will be no mixing of CHRI and Company funding. The Company will fund heat pump installations for low-income electric resistance customers, who are not eligible for CHRI funding.

The Company has estimated that no heat pump installations will receive a federal incentive in 2024.

Prepared by or under the supervision of: Toby Ast

PUC 1-28
Program design and offerings

Request:

Table 3 on Bates page 264 indicates the Company is planning to deliver 1,500 "wifi programmable thermostat with cooling (oil)" through the 2024 Residential HVAC (electric) program. In the 2023 Plan, the Company planned to deliver 4,200 of what appears to be the same measure (Bates page 143 of the 2023 Annual Plan filing in Docket No. 22-33-EE). In prior data requests, the Company has indicated that over the course of a program year, actual installations of this measure have increased significantly relative to planned levels. For example, the Company's response to PUC Post-Decision 3-3 in Docket No. 5189 states "the measure 'WiFi Tstat-cool only, Elec' had a planned quantity of 1,700 units … whereas the actuals for this measure was 8,299 units." Given this, please explain why the Company is planning to deliver far fewer "wifi programmable thermostat with cooling (oil)" through the 2024 Residential HVAC (electric) program than in prior years.

Response:

The Company believes that its 2024 planned quantities are in line with 2023 YTD actuals and projections. 2022 actuals were historically high but have decreased since then due to year-to-year variations in performance, as well as the increased adoption of heat pumps in the marketplace.

Prepared by or under the supervision of: Spencer Lawrence

PUC 1-29
Program design and offerings

Request:

Table 5 on Bates page 266 indicates the Company is planning to deliver 125 "wifi thermostat, gas - cooling and heating" through the 2024 Residential HVAC (gas) program. In the 2023 Plan, the Company planned to deliver 3,200 of the same measure (Bates page 148 of the 2023 Annual Plan filing in Docket No. 22-33-EE). Please explain why the Company is planning to deliver far fewer "wifi thermostat, gas - cooling and heating" through the 2024 Residential HVAC (gas) program than in prior years.

Response:

2023 planned values were based on historically high actuals achieved in 2022. However, due to a variety of factors including year to year variation in performance, as well as the continued growth of new heat pump installations in the residential market, the quantities achieved have dropped significantly in 2023. Therefore our 2024 values are based on 2023 actuals and projections. The following table shows 2024 planned values and 2023 YTD values.

2024 Measure Name	2023 Measure Name	2024 Planned Quantity	2023 YTD as of 10/31
WiFi Thermostat, Gas - Cooling and Heating	Wi-Fi Thermostat - Gas Cooling and Htg	125	153
WiFi Thermostat, Gas - Heat Only	WI-FI THERMOSTAT, GAS	425	422

Prepared by or under the supervision of: Spencer Lawrence

PUC 1-30
Program design and offerings

Request:

On Bates page 302, the Company writes that it will "launch a Heat Pump Hot Water Heater calculator, an Energy Management System prescriptive calculator, a C&I weatherization tool and other customer express tools. These efforts are likely to yield savings in 2024." Regarding these new calculator tools, please explain the following:

a. Please explain how, specifically, launching these tools will yield savings in 2024.

b. Who is the intended user of these tools? (e.g. the customer, a vendor, the Company, etc.)

c. What cost associated with these calculator tools has been included in the proposed 2024 Annual Plan budget, and where in the 2024 Annual budget is that cost embedded (e.g. in what program)?

Response:

a. The Heat Pump Hot Water Heater calculator, the Energy Management System prescriptive calculator, the C&I Weatherization Tool, and other customer express tools streamline the data collection and review process when compared to the custom process. More specifically, the customer express tools allow vendors to expedite the energy assessment process by inputting building attributes and conditions to arrive at a calculated energy savings value, thereby reducing or eliminating the time-consuming and sometimes burdensome practice of collecting site-specific data. This streamlined approach should enable vendors to access additional facilities to perform more energy assessments within a given program-year. Additionally, the customer express tools should enable customers to make informed energy efficiency decisions in a timelier manner when compared to the longer custom process. Given these factors, the Company expects the tools will yield savings in 2024.

b. The intended user of these tools are vendors who then work with customers to collect data needed to complete an energy assessment and submit an application.

c. Development costs for the Heat Pump Hot Water Heater calculator, the Energy Management System prescriptive calculator, and the C&I Weatherization Tool were funded under the Commercial and Industrial Retrofit Program during the 2022 and

PUC 1-30, Page 2
Program design and offerings

2023 program years. In 2024, the Company is estimating ongoing maintenance costs of approximately $8,000 which will be funded under the Commercial and Industrial Retrofit Program.

PUC 1-31
Program design and offerings

Request:

Comparing Table E-2 from the Updated Compliance Filing in Docket No. 22-33-EE to Table E-2 in this filing, please explain what factors contribute to the proposed budgets for Program Planning & Administration and Sales, Technical Assistance & Training decreasing from 2023 to 2024, while the proposed budgets for Marketing and EMV increase from 2023 to 2024.

Response:

The decrease in the electric Program Planning & Administration budget is mainly driven by the removal of the roughly $1.7 million in the 2023 Plan that was allocated to the Electric Resistance to Heat Pump Conversions plan. This was a special budget item for the 2023 Annual Plan, and in the 2024 Plan funds to support the conversion of customers from electric resistance heating to heat pump heating are distributed among relevant programs in the appropriate budget categories. As another point of comparison, if the following items are removed from the 2023 Plan electric budget and the 2024 Plan electric budget where applicable, the 2024 Plan electric budget shows a 1.3% increase in Program Planning & Administration:

- Electric Resistance to Heat Pump Conversions (discussed above)
- Residential ConnectedSolutions (moved to System Reliability Procurement (SRP))
- Commercial ConnectedSolutions (moved to System Reliability Procurement (SRP))
- OER (dependent on overall budget levels)
- EERMC (not determined by the Company)

The decrease in the electric Sales, Technical Assistance & Training budget is mainly driven by the fact that the 2023 Plan included expenses for the Residential and Commercial ConnectedSolutions programs, while in 2024 these programs have been moved to SRP. If these programs are removed from the 2023 Plan electric budget, the 2024 Plan electric budget shows a 0.6% increase in Sales, Technical Assistance & Training.

The most significant factors contributing to the increase in the electric Marketing budget are an increase in budget for residential community-based initiatives marketing, and an increase in budget for small business direct install marketing. This increased budget is in support of the

PUC 1-31, Page 2
Program design and offerings

Company's efforts to expand outreach to diverse communities. Other programs have more modest budget increases, as the Company plans to maintain current levels of marketing activities with very slight budget growth to continue driving awareness and participation.

Please see the Company's response to PUC 1-32 for a discussion of the increase in the electric EM&V budget.

PUC 1-32
Program design and offerings

Request:

Regarding the proposed 2024 EMV budget (electric), please explain the specific factors driving the $0.5 million increase from 2023 to 2024. In your response, address whether the Company is proposing to increase the volume of EMV work in 2024 relative to 2023, whether the EMV studies proposed for 2024 are more expensive than the studies in 2023, or both.

Response:

The Company is planning to conduct 13 evaluation studies in 2024 that will be charged fully or partially against the electric portfolio evaluation budget. This compares to 12 studies being conducted in 2023 that are being charged fully or partially against the electric portfolio evaluation budget.

In addition to an increase in the number of studies, more of the overall evaluation budget – approximately 80% - is being allocated to the electric portfolio budget in 2024, compared to 68% in the 2023 Compliance filing. Allocations are made using overall actual spending by program for 2022, the most recently completed program year.

Because the nature of the proposed studies differs from year to year, it is not possible to say whether the 2024 studies are more expensive than the studies budgeted for in 2023.

Prepared by or under the supervision of: Ann Clarke

PUC 1-33
Program design and offerings

Request:

Regarding the Company's proposed 2024 gas and electric EM&V budgets, please explain the following:

a. Will any of the work included proposed EM&V budgets be performed directly by the Company or will they be performed by third-party EM&V vendors?

b. Will any of the work included proposed EM&V budgets be performed through a multi-state, multi-utility or multi-vendor collaborative in such a manner that will result in Rhode Island Energy bearing only a portion of the total study cost?

Response:

a. Yes, some of the work included in the proposed EM&V budgets will be performed directly by the Company. All studies included in the EM&V budgets will be performed by third-party EM&V vendors. The work included in the EM&V budget that is performed by the Company includes labor for project management of the studies: reviewing workplans, survey instruments, and draft reports; providing requested data to the vendor from the Company's EE rebate tracking database and customer billing systems; processing of vendor invoices; and ensuring the study budget and deliverables are met.

b. Yes, some of the work included in the proposed EM&V budgets will be performed through a multi-state collaborative. The Company is participating in the multi-state avoided energy supply cost (AESC) study that began in 2023, will continue into 2024, and is only paying for the Rhode Island proportion of the study. While additional multi-state studies are not planned at this time, the Company maintains regular communication with Massachusetts Program Administrators to assess such opportunities as they arise.

Prepared by or under the supervision of: Ann Clarke

PUC 1-34
Program design and offerings

Request:

Please provide an update on the status of the Company's implementation of its Plan to Convert Electric Resistance Heat to Heat Pumps (filed in Docket No. 22-33-EE).

Response:

The Company has eight projects that have been completed and billed through its Plan to Convert Electric Resistance Heat to Heat Pumps. Seven units are in the post inspection phase and will be billed before the end of year. 25 projects are in process, but it is unknown how many will be completed before year-end. Additional marketing went out in September and brought in 31 additional leads. It is unclear yet if those additional leads will be completed by year-end.

Please see the Company's response to PUC 1-35 for more details on units and budget related to the plan.

PUC 1-35
Program design and offerings

Request:

Please update the response to PUC 1-30 in Docket No. 22-33-EE with actual information from 2023.

Response:

Please refer to Table 1 and Table 2 below. In Tables 1 and 2, 2023 planned values are from the Company's "Electric Resistance Heating to Air Source Heat Pumps: Implementation Plan for the Income Eligible Sector" submitted February 24, 2023 and actual values are year-to-date as of 10/30/2023.

There were no planned or actual heat pump replacements for existing electric resistance heating systems in the Commercial & Industrial sector for 2019 through year-to-date as of 10/30/2023.

Table 1. Planned vs Actual Electric Resistance Heat Pump Installations 2019 to 2023

Planned vs. Actual Electric Resistance-to-Heat Pump Installations			
Year	**Sector**	**Units**	
		Planned	**Actual**
2019	Non-Income Eligible	0	65
	Income Eligible	15	12
2020	Non-Income Eligible	38	347
	Income Eligible	20	9
2021	Non-Income Eligible	186	615
	Income Eligible	46	15
2022	Non-Income Eligible	430	780
	Income Eligible	48	27
2023	Non-Income Eligible	355	464
	Income Eligible	60	6

Prepared by or under the supervision of: Spencer Lawrence,
Mark Siegal and Daniel Tukey

PUC 1-35, Page 2
Program design and offerings

Table 2. Planned vs Actual Electric Resistance Heat Pump Spending 2019 to 2023

Planned vs. Actual Electric Resistance-to-Heat Pump Spending			
Year	**Sector**	**Incentives**	
		Planned	**Actual**
2019	Non-Income Eligible	$0	$136,066
	Income Eligible	$60,000	$158,884
2020	Non-Income Eligible	$114,000	$661,283
	Income Eligible	$300,000	$106,329
2021	Non-Income Eligible	$600,780	$1,123,213
	Income Eligible	$690,000	$252,098
2022	Non-Income Eligible	$1,720,000	$1,268,137
	Income Eligible	$720,000	$394,829
2023	Non-Income Eligible	$1,423,600	$785,494
	Income Eligible	$1,588,300	$120,095

PUC 1-36
Program design and offerings

Request:

Please update the response to PUC 1-31 in Docket No. 22-33-EE for the proposed 2024 program year.

Response:

Please refer to the table below. There are no planned heat pump replacements for existing electric resistance heating systems in the Commercial & Industrial sector for 2024.

Planned Installations and Incentive Spend for Heat Pump Replacements for Existing Electric Resistance in 2024

Sector	**Planned Units**	**Planned Incentives**
Non-Income Eligible	868	$3,474,000
Income Eligible	120	$2,100,000
Commercial & Industrial	N/A	N/A
Total	*988*	*$5,574,000*

Prepared by or under the supervision of: Spencer Lawrence,
Mark Siegal and Daniel Tukey

PUC 1-37
Program design and offerings

Request:

Please update the response to PUC 1-27 in Docket No. 22-33-EE with actual information on the 100% weatherization incentive offerings for moderate income customers in 2023.

Response:

Please see Attachment PUC 1-27 which shows the updated Q2, 2022 through Q2, 2023 moderate income participation numbers and costs reported for RGGI. 354 moderate income customers have been served during this period with 174 moderate income customers participating in 2022 and 180 moderate income customers participating in 2023. As of Q3 2023, the RGGI funding for moderate income customers have been depleted and the moderate income offering has transitioned to an income verification model with energy efficiency funding covering the moderate income customer weatherization copayment. The Company has not yet been invoiced for these income qualification services in 2023, so the specific costs are not available at this time.

Prepared by or under the supervision of: Spencer Lawrence

Year	2022 Quarter 2	2022 Quarter 3	2022 Quarter 4	2023 Quarter 1	2023 Quarter 2	Total
# Projects by fuel						
Electric	0	3	6	1	5	15
Natural Gas	12	20	50	29	64	175
Delivered	4	26	53	26	55	164
Total costs	$ 79,147.57	$ 286,286.23	$ 649,847.80	$ 337,087.08	$ 744,737.29	$ 2,097,105.97
SBC funds	$ 46,443.60	$ 178,789.29	$ 375,294.54	$ 189,140.68	$ 421,908.04	$ 1,211,576.15
RGGI funds	$ 32,703.97	$ 107,496.94	$ 274,553.26	$ 147,946.40	$ 322,829.25	$ 885,529.82
Customer Copay	$ -					
Interest accrued						
Estimated time to depletion						
Average lifetime						

*Savings shown below are Net savings.

CO2 (electricity)	CO2/MWh	0.3820	AESC 2021, Appendix G Table 159, average of winter peak/off-peak summer peak/off-peak for all years 2021-2035
CO2 (natural gas)	CO2/MMBTU	0.0585	AESC 2021, Appendix G Table 159
CO2 (oil)	CO2/MMBTU	0.0805	AESC 2021, Appendix G Table 159
CO2 (propane)	CO2/MMBTU	0.0695	AESC 2021, Appendix G Table 159

Quarter	Application #	Annual kWh*	Lifetime kWh*	Annual MMBtu*	Lifetime MMBtu*	Projected lifetime	Annual Savings (native units)	Lifetime savings (native units)	CO2 avoided (tons-annual)	CO2 avoided (tons-lifetime)	Building type	Building type details	Total Project cost	RGGI cost	Leveraged funding amount	Building Type	Heating Fuel
Q2 2022	13625174	41.76	1044	8.352	208.8	25					Single family	RAN	3243.59	1377.63	1865.96		Energy Wise - Gas
Q2 2022	13625180	41.76	1044	8.352	208.8	25					Single family	RAN	5311.54	2284.61	3026.93		Energy Wise - Gas
Q2 2022	13625228	41.76	1044	8.352	208.8	25					Single family	CAP	5032.64	1903.72	3128.92		Energy Wise - Gas
Q2 2022	13625253	41.76	1044	8.352	208.8	25					Single family	COL	3870.44	1620.06	2250.38		Energy Wise - Gas
Q2 2022	13625377	41.76	1044	8.352	208.8	25					Single family	RAN	626.32	208.7	417.62		Energy Wise - Gas
Q2 2022	13625202	41.76	1044	8.352	208.8	25					Single family	VIC	4286.39	1834.61	2451.78		Energy Wise - Gas
Q2 2022	13625207	41.76	1044	8.352	208.8	25					Single family	RAN	4764.6	2030.48	2734.12		Energy Wise - Gas
Q2 2022	13625362	41.76	1044	8.352	208.8	25					Single family	CAP	5514.02	2127.92	3386.1		Energy Wise - Gas
Q2 2022	13593237	41.76	1044	8.352	208.8	25					Single family	RAN	4173.85	1785.64	2388.21		Energy Wise - Gas
Q2 2022	13593238	41.76	1044	8.352	208.8	25					Single family	CAP	3807.67	1520.91	2286.76		Energy Wise - Gas
Q2 2022	13625790	41.76	835.2	8.526	170.52	20					Single family	CAP	10118.97	4034.68	6084.29		Energy Wise - Oil
Q2 2022	13625665	41.76	835.2	8.526	170.52	20					Single family	RAN	4029.54	1564.82	2464.72		Energy Wise - Oil
Q2 2022	13625724	41.76	835.2	8.526	170.52	20					Single family	CAP	9204.71	3959.65	5245.06		Energy Wise - Oil
Q2 2022	13608084	41.76	835.2	8.526	170.52	20					Single family	CAP	9182.02	3949.69	5232.33		Energy Wise - Oil
Q2 2022	13607176	41.76	1044	8.352	208.8	25					Single family	RAN	3529.42	1502.98	2026.44		Energy Wise - Gas
Q2 2022	13607213	41.76	1044	8.352	208.8	25					Single family	CAP	2451.85	997.87	1453.98		Energy Wise - Gas
Q3 2022	13651902	41.76	1044	8.352	208.8	25					Single family	COL	4717.28	1851.48	2865.8		Energy Wise - Gas
Q3 2022	13651971	41.76	1044	8.352	208.8	25					Single family	CAP	9897.51	3875.92	6021.59		Energy Wise - Gas
Q3 2022	13651998	41.76	1044	8.352	208.8	25					Single family	RAI	10439.53	4092.03	6347.5		Energy Wise - Gas
Q3 2022	13652061	41.76	1044	8.352	208.8	25					Single family	CAP	10315.78	4001.78	6314		Energy Wise - Gas
Q3 2022	13652072	41.76	1044	8.352	208.8	25					Single family	RAN	4779.56	1835.27	2944.29		Energy Wise - Gas
Q3 2022	13652099	41.76	1044	8.352	208.8	25					Single family	RAN	6320	2449.48	3870.52		Energy Wise - Gas
Q3 2022	13652467	41.76	835.2	8.526	170.52	20					Single family	COL	3227.47	1224.77	2002.7		Energy Wise - Oil
Q3 2022	13652503	41.76	835.2	8.526	170.52	20					Single family	COL	16373.49	4638.1	11735.39		Energy Wise - Oil
Q3 2022	13652537	41.76	835.2	8.526	170.52	20					Single family	RAN	6008.38	2343.75	3664.63		Energy Wise - Oil
Q3 2022	13652586	41.76	835.2	8.526	170.52	20					Single family	CAP	10053.49	3979.01	6074.48		Energy Wise - Oil
Q3 2022	13652608	41.76	835.2	8.526	170.52	20					Single family	RAN	6191.31	2433.73	3757.58		Energy Wise - Oil
Q3 2022	13671604	41.76	1044	8.352	208.8	25					Single family	RAN	3999.4	1553.74	2445.66		Energy Wise - Gas
Q3 2022	13671765	41.76	1044	8.352	208.8	25					Single family	RAI	6328.9	2453.03	3875.87		Energy Wise - Gas
Q3 2022	13672295	41.76	835.2	8.526	170.52	20					Single family	RAN	4924.4	1958.5	2965.9		Energy Wise - Oil
Q3 2022	13672393	41.76	835.2	8.526	170.52	20					Single family	RAN	976.47	359.8	616.67		Energy Wise - Oil
Q3 2022	13672449	41.76	835.2	8.526	170.52	20					Single family	CAP	7028.91	2732.14	4296.77		Energy Wise - Oil
Q3 2022	13695226	41.76	1044	8.352	208.8	25					Single family	RAN	6540.37	2567.08	3973.29		Energy Wise - Gas
Q3 2022	13695073	41.76	1044	8.352	208.8	25					Single family	CAP	9531.15	3700.61	5830.54		Energy Wise - Gas
Q3 2022	13695094	41.76	1044	8.352	208.8	25					Single family	RAN	6426.87	2521.64	3905.23		Energy Wise - Gas
Q3 2022	13695266	41.76	835.2	8.526	170.52	20					Single family	COL	2907.68	1118.45	1789.23		Energy Wise - Oil
Q3 2022	13695343	41.76	835.2	8.526	170.52	20					Single family	RAN	10220.14	2854.88	7365.26		Energy Wise - Oil
Q3 2022	13695354	41.76	835.2	8.526	170.52	20					Single family	RAN	6845.58	2647.68	4197.9		Energy Wise - Oil
Q3 2022	13695391	41.76	835.2	8.526	170.52	20					Single family	COL	3104.8	1167.5	1937.3		Energy Wise - Oil
Q3 2022	13721938	730.8	14616			20					Single family	RAI	3104.55	1178.77	1925.78		Energy Wise - Elec
Q3 2022	13721988	41.76	835.2	8.526	170.52	20					Single family	SPL	3994.95	1551.97	2442.98		Energy Wise - Oil
Q3 2022	13722032	41.76	835.2	8.526	170.52	20					Single family	RAN	5549.53	2172	3377.53		Energy Wise - Oil
Q3 2022	13721824	41.76	1044	8.352	208.8	25					Single family	RAN	7427.23	2875.11	4552.12		Energy Wise - Gas
Q3 2022	13742296	41.76	1044	8.352	208.8	25					Single family	RAI	4070	1577.81	2492.19		Energy Wise - Gas
Q3 2022	13744055	41.76	835.2	8.526	170.52	20					Single family	RAN	5549.53	2172	3377.53		Energy Wise - Oil
Q3 2022	13744157	41.76	835.2	8.526	170.52	20					Single family	RAN	4731.96	1857.2	2874.76		Energy Wise - Oil
Q3 2022	13744150	41.76	835.2	8.526	170.52	20					Single family	CAP	3259.33	1280.67	1978.66		Energy Wise - Oil
Q3 2022	13671775	41.76	1044	8.352	208.8	25					Single family	CAP	10315.78	4001.78	6314		Energy Wise - Gas
Q3 2022	13768227	41.76	1044	8.352	208.8	25					Single family	RAI	5528.4	2060.09	3468.31		Energy Wise - Gas
Q3 2022	13768243	41.76	1044	8.352	208.8	25					Single family	RAN	6282.83	2505.12	3777.71		Energy Wise - Gas
Q3 2022	13768305	41.76	1044	8.352	208.8	25					Single family	COL	2796.22	1044.47	1751.75		Energy Wise - Gas
Q3 2022	13768326	41.76	1044	8.352	208.8	25					Single family	GAM	3471.93	1313.88	2158.05		Energy Wise - Gas
Q3 2022	13768496	41.76	835.2	8.526	170.52	20					Single family	GAM	3568.02	1280.71	2287.31		Energy Wise - Oil
Q3 2022	13768548	41.76	835.2	8.526	170.52	20					Single family	RAN	5475.35	1277.45	4197.9		Energy Wise - Oil
Q3 2022	13768614	41.76	835.2	8.526	170.52	20					Single family	CAP	5159.43	2016.28	3143.15		Energy Wise - Oil
Q3 2022	13768653	730.8	14616			20					Single family	RAN	8704.23	3411.64	5292.59		Energy Wise - Elec
Q3 2022	13791316	41.76	835.2	8.526	170.52	20					Single family	CAP	1057.3	339.75	717.55		Energy Wise - Oil
Q3 2022	13791358	41.76	835.2	8.526	170.52	20					Single family	RAN	4271.23	1662.35	2608.88		Energy Wise - Oil
Q3 2022	13791380	41.76	835.2	8.526	170.52	20					Single family	RAN	10072.85	4196.91	5875.94		Energy Wise - Oil
Q3 2022	13807470	41.76	1044	8.352	208.8	25					Single family	RAN	5554.22	2176.91	3377.31		Energy Wise - Gas
Q3 2022	13807737	41.76	1044	8.352	208.8	25					Single family	RAI	826.85	69	757.85		Energy Wise - Gas
Q3 2022	13808642	41.76	835.2	8.526	170.52	20					Single family	SPL	3829.26	1485.91	2343.35		Energy Wise - Oil
Q3 2022	13808683	41.76	835.2	8.526	170.52	20					Single family	RAN	7516.86	2956.24	4560.62		Energy Wise - Oil
Q3 2022	13808816	41.76	835.2	8.526	170.52	20					Single family	CAP	2071.8	744.21	1327.59		Energy Wise - Oil
Q3 2022	13813311	730.8	14616			20					Single family	RAI	4938.12	1928.34	3009.78		Energy Wise - Elec
Q4 2022	13836916	41.76	1044	8.352	208.8	25					Single family	SPL	11736.96	4158.39	7578.57		Energy Wise - Gas
Q4 2022	13836943	41.76	1044	8.352	208.8	25					Single family	CAP	6569.06	2687.54	3881.52		Energy Wise - Gas
Q4 2022	13837091	41.76	835.2	8.526	170.52	20					Single family	RAN	11904.26	4494.34	7409.92		Energy Wise - Oil
Q4 2022	13837109	41.76	835.2	8.526	170.52	20					Single family	RAN	4398.72	438	3960.72		Energy Wise - Oil
Q4 2022	13837114	41.76	835.2	8.526	170.52	20					Single family	RAI	6086.24	2074.6	4011.64		Energy Wise - Oil
Q4 2022	13837158	41.76	835.2	8.526	170.52	20					Single family	RAN	3598.98	1435	2163.98		Energy Wise - Oil
Q4 2022	13837165	41.76	835.2	8.526	170.52	20					Single family	CAP	7636.5	2911.8	4724.7		Energy Wise - Oil

Q4 2022	13837187	41.76	835.2	8.526	170.52	20	Single family	RAN	3363.85	1316.87	2046.98	Energy Wise - Oil
Q4 2022	13909597	41.76	1044	8.352	208.8	25	Single family	RAN	6149.94	2697.33	3452.61	Energy Wise - Gas
Q4 2022	13909603	41.76	1044	8.352	208.8	25	Single family	SPL	5614.6	2209.04	3405.56	Energy Wise - Gas
Q4 2022	13909605	41.76	1044	8.352	208.8	25	Single family	RAI	6410.65	2360.5	4050.15	Energy Wise - Gas
Q4 2022	13909608	41.76	1044	8.352	208.8	25	Single family	RAN	6308.77	2606.92	3701.85	Energy Wise - Gas
Q4 2022	13909629	41.76	1044	8.352	208.8	25	Single family	RAI	3345.96	1459.3	1886.66	Energy Wise - Gas
Q4 2022	13909642	41.76	1044	8.352	208.8	25	Single family	CAP	8606.84	3390.92	5215.92	Energy Wise - Gas
Q4 2022	13909685	41.76	1044	8.352	208.8	25	Single family	CAP	7803.39	3395.77	4407.62	Energy Wise - Gas
Q4 2022	13909846	41.76	1044	8.352	208.8	25	Single family	RAN	2774.55	1065.41	1709.14	Energy Wise - Gas
Q4 2022	13909863	41.76	1044	8.352	208.8	25	Single family	RAN	5863.81	2571.84	3291.97	Energy Wise - Gas
Q4 2022	13909876	41.76	1044	8.352	208.8	25	Single family	RAN	5338.38	2341.38	2997	Energy Wise - Gas
Q4 2022	13910668	41.76	835.2	8.526	170.52	20	Single family	RAN	4704.68	1834.95	2869.73	Energy Wise - Oil
Q4 2022	13910674	41.76	835.2	8.526	170.52	20	Single family	CAP	7755.11	3523.58	4231.53	Energy Wise - Oil
Q4 2022	13910685	41.76	835.2	8.526	170.52	20	Single family	RAN	7761.42	2690.1	5071.32	Energy Wise - Oil
Q4 2022	13910708	41.76	835.2	8.526	170.52	20	Single family	RAN	5452.5	2020.38	3432.12	Energy Wise - Oil
Q4 2022	13910761	41.76	835.2	8.526	170.52	20	Single family	RAI	5111.88	2242.05	2869.83	Energy Wise - Oil
Q4 2022	13910830	41.76	835.2	8.526	170.52	20	Single family	RAN	3147.26	1300.52	1846.74	Energy Wise - Oil
Q4 2022	13910869	41.76	835.2	8.526	170.52	20	Single family	RAN	8856.05	3492.23	5363.82	Energy Wise - Oil
Q4 2022	13910870	41.76	835.2	8.526	170.52	20	Single family	RAN	6784.39	2975.61	3808.78	Energy Wise - Oil
Q4 2022	13910874	41.76	835.2	8.526	170.52	20	Single family	CAP	6449.6	2828.76	3620.84	Energy Wise - Oil
Q4 2022	13910885	41.76	835.2	8.526	170.52	20	Single family	RAN	10072.85	4196.91	5875.94	Energy Wise - Oil
Q4 2022	13910923	41.76	835.2	8.526	170.52	20	Single family	RAN	7335.87	3217.48	4118.39	Energy Wise - Oil
Q4 2022	13910955	41.76	835.2	8.526	170.52	20	Single family	RAI	7277.59	3191.92	4085.67	Energy Wise - Oil
Q4 2022	13910958	41.76	835.2	8.526	170.52	20	Single family	CAP	11818.75	5122.59	6696.16	Energy Wise - Oil
Q4 2022	13910988	730.8	14616			20	Single family	GAM	2988.08	1042.27	1945.81	Energy Wise - Elec
Q4 2022	13911001	730.8	14616			20	Single family	RAN	4678.39	1783.57	2894.82	Energy Wise - Elec
Q4 2022	13914490	41.76	1044	8.352	208.8	25	Single family	CAP	1511.23	662.82	848.41	Energy Wise - Gas
Q4 2022	13914497	41.76	1044	8.352	208.8	25	Single family	BUN	9656.04	4110.1	5545.94	Energy Wise - Gas
Q4 2022	13914510	41.76	1044	8.352	208.8	25	Single family	CAP	6215.71	2726.18	3489.53	Energy Wise - Gas
Q4 2022	13914553	41.76	1044	8.352	208.8	25	Single family	BUN	8509.56	3280.32	5229.24	Energy Wise - Gas
Q4 2022	13914557	41.76	1044	8.352	208.8	25	Single family	RAN	5578.68	2446.78	3131.9	Energy Wise - Gas
Q4 2022	13914824	41.76	835.2	8.526	170.52	20	Single family	RAN	5804.77	2273.59	3531.18	Energy Wise - Oil
Q4 2022	13914831	41.76	835.2	8.526	170.52	20	Single family	RAN	4856.45	2428.22	2428.23	Energy Wise - Oil
Q4 2022	13914883	41.76	835.2	8.526	170.52	20	Single family	COL	6748.32	2959.79	3788.53	Energy Wise - Oil
Q4 2022	13976227	41.76	1044	8.352	208.8	25	Single family	CAP	5846.21	2564.12	3282.09	Energy Wise - Gas
Q4 2022	13976236	41.76	1044	8.352	208.8	25	Single family	RAN	2935.22	1287.36	1647.86	Energy Wise - Gas
Q4 2022	13976241	41.76	1044	8.352	208.8	25	Single family	RAN	7351.31	3224.25	4127.06	Energy Wise - Gas
Q4 2022	13976258	41.76	1044	8.352	208.8	25	Single family	CAP	10260.24	4465.69	5794.55	Energy Wise - Gas
Q4 2022	13976270	41.76	1044	8.352	208.8	25	Single family	CAP	6116.76	2682.79	3433.97	Energy Wise - Gas
Q4 2022	13976306	41.76	1044	8.352	208.8	25	Single family	RAN	5626.24	2538.5	3087.74	Energy Wise - Gas
Q4 2022	13976324	41.76	1044	8.352	208.8	25	Single family	RAI	4543.65	1911.25	2632.4	Energy Wise - Gas
Q4 2022	13976353	41.76	1044	8.352	208.8	25	Single family	SPL	2581.8	975	1606.8	Energy Wise - Gas
Q4 2022	13976381	41.76	1044	8.352	208.8	25	Single family	RAN	3951.3	1733.02	2218.28	Energy Wise - Gas
Q4 2022	13976564	41.76	835.2	8.526	170.52	20	Single family	BUN	5111.84	2398.99	2712.85	Energy Wise - Oil
Q4 2022	13976570	41.76	835.2	8.526	170.52	20	Single family	RAN	4565.14	2002.24	2562.9	Energy Wise - Oil
Q4 2022	13976587	41.76	835.2	8.526	170.52	20	Single family	RAN	8641.46	3790.1	4851.36	Energy Wise - Oil
Q4 2022	13976648	41.76	835.2	8.526	170.52	20	Single family	RAN	6426.23	1347.21	5079.02	Energy Wise - Oil
Q4 2022	13976662	41.76	835.2	8.526	170.52	20	Single family	RAN	9012.18	4116.49	4895.69	Energy Wise - Oil
Q4 2022	13976693	41.76	835.2	8.526	170.52	20	Single family	RAN	3560.61	1561.66	1998.95	Energy Wise - Oil
Q4 2022	13978045	41.76	1044	8.352	208.8	25	Single family	CAP	4802.52	2106.36	2696.16	Energy Wise - Gas
Q4 2022	13978057	41.76	1044	8.352	208.8	25	Single family	CAP	8018.42	3516.84	4501.58	Energy Wise - Gas
Q4 2022	13978065	41.76	1044	8.352	208.8	25	Single family	RAN	7074.74	2946.15	4128.59	Energy Wise - Gas
Q4 2022	13978086	41.76	1044	8.352	208.8	25	Single family	RAN	7051.33	2983.03	4068.3	Energy Wise - Gas
Q4 2022	13978113	41.76	1044	8.352	208.8	25	Single family	RAI	5595.01	2453.95	3141.06	Energy Wise - Gas
Q4 2022	13978148	41.76	1044	8.352	208.8	25	Single family	RAN	3778.74	1407.19	2371.55	Energy Wise - Gas
Q4 2022	13978154	41.76	1044	8.352	208.8	25	Single family	COL	2606.08	1014.14	1591.94	Energy Wise - Gas
Q4 2022	13978195	730.8	14616			20	Single family	RAN	4714.68	2067.83	2646.85	Energy Wise - Elec
Q4 2022	13978197	730.8	14616			20	Single family	CTM	9065.79	3976.22	5089.57	Energy Wise - Elec
Q4 2022	13978209	730.8	14616			20	Single family	RAI	6922.01	3035.97	3886.04	Energy Wise - Elec
Q4 2022	13978576	41.76	835.2	8.526	170.52	20	Single family	RAN	7842.02	4043.71	3798.31	Energy Wise - Oil
Q4 2022	13978584	41.76	835.2	8.526	170.52	20	Single family	RAI	9845.12	4440.09	5405.03	Energy Wise - Oil
Q4 2022	13978598	41.76	835.2	8.526	170.52	20	Single family	RAN	8471.15	4089.56	4381.59	Energy Wise - Oil
Q4 2022	13978625	41.76	835.2	8.526	170.52	20	Single family	RAI	6933.33	3040.93	3892.4	Energy Wise - Oil
Q4 2022	13978626	41.76	835.2	8.526	170.52	20	Single family	COL	6036.98	2547.8	3489.18	Energy Wise - Oil
Q4 2022	13978633	41.76	835.2	8.526	170.52	20	Single family	RAN	3923.85	1720.98	2202.87	Energy Wise - Oil
Q4 2022	13978634	41.76	835.2	8.526	170.52	20	Single family	CAP	2610.65	1145.02	1465.63	Energy Wise - Oil
Q4 2022	13978637	41.76	835.2	8.526	170.52	20	Single family	CAP	1534.93	673.21	861.72	Energy Wise - Oil
Q4 2022	13978643	41.76	835.2	8.526	170.52	20	Single family	RAN	3741.93	1327.36	2414.57	Energy Wise - Oil
Q4 2022	13978663	41.76	835.2	8.526	170.52	20	Single family	COL	5667.42	2485.71	3181.71	Energy Wise - Oil
Q4 2022	13978668	41.76	835.2	8.526	170.52	20	Single family	RAN	6699.8	3349.89	3349.91	Energy Wise - Oil
Q4 2022	14020922	41.76	1044	8.352	208.8	25	Single family	CAP	8469.31	4142.32	4326.99	Energy Wise - Gas
Q4 2022	14020957	41.76	1044	8.352	208.8	25	Single family	COL	2683.41	1051.93	1631.48	Energy Wise - Gas
Q4 2022	14020995	41.76	1044	8.352	208.8	25	Single family	CAP	6689.33	2933.9	3755.43	Energy Wise - Gas
Q4 2022	14021002	41.76	1044	8.352	208.8	25	Single family	COL	6519.95	2859.62	3660.33	Energy Wise - Gas
Q4 2022	14021010	41.76	1044	8.352	208.8	25	Single family	COL	1351.8	467.89	883.91	Energy Wise - Gas
Q4 2022	14021020	41.76	1044	8.352	208.8	25	Single family	BUN	9955.16	4241.29	5713.87	Energy Wise - Gas
Q4 2022	14021401	41.76	835.2	8.526	170.52	20	Single family	RAN	3590.2	1574.64	2015.56	Energy Wise - Oil
Q4 2022	14021402	41.76	835.2	8.526	170.52	20	Single family	CAP	2508.17	1100.07	1408.1	Energy Wise - Oil
Q4 2022	14021414	41.76	835.2	8.526	170.52	20	Single family	CAP	3271.54	1434.88	1836.66	Energy Wise - Oil
Q4 2022	14021444	41.76	835.2	8.526	170.52	20	Single family	CAP	7835.62	3309.64	4525.98	Energy Wise - Oil
Q4 2022	14021454	41.76	835.2	8.526	170.52	20	Single family	CAP	886.54	263.83	622.71	Energy Wise - Oil
Q4 2022	14021461	41.76	835.2	8.526	170.52	20	Single family	RAN	8023.04	3518.87	4504.17	Energy Wise - Oil
Q4 2022	14021499	41.76	835.2	8.526	170.52	20	Single family	RAN	10131.4	4443.59	5687.81	Energy Wise - Oil
Q4 2022	14021503	41.76	835.2	8.526	170.52	20	Single family	RAN	8658.04	3722.38	4935.66	Energy Wise - Oil
Q4 2022	14053609	41.76	1044	8.352	208.8	25	Single family	CAP	4749.88	2083.27	2666.61	Energy Wise - Gas
Q4 2022	14053624	41.76	1044	8.352	208.8	25	Single family	RAN	7689.98	3339.11	4350.87	Energy Wise - Gas
Q4 2022	14053633	41.76	1044	8.352	208.8	25	Single family	RAI	5126.07	2173.26	2952.81	Energy Wise - Gas
Q4 2022	14053638	41.76	1044	8.352	208.8	25	Single family	RAN	3219.52	1412.07	1807.45	Energy Wise - Gas
Q4 2022	14053654	41.76	1044	8.352	208.8	25	Single family	COL	9273.06	4104.15	5168.91	Energy Wise - Gas
Q4 2022	14053666	41.76	1044	8.352	208.8	25	Single family	RAN	3851.26	1591.43	2259.83	Energy Wise - Gas
Q4 2022	14053668	730.8	14616			20	Single family	COL	2159.39	947.1	1212.29	Energy Wise - Elec
Q4 2022	14053703	41.76	1044	8.352	208.8	25	Single family	RAN	4509.63	1977.91	2531.72	Energy Wise - Gas
Q4 2022	14053712	41.76	1044	8.352	208.8	25	Single family	RAI	4976.86	2182.83	2794.03	Energy Wise - Gas
Q4 2022	14053724	41.76	1044	8.352	208.8	25	Single family	RAN	7200.71	3158.2	4042.51	Energy Wise - Gas
Q4 2022	14053725	41.76	1044	8.352	208.8	25	Single family	COL	2547.48	992.31	1555.17	Energy Wise - Gas
Q4 2022	14053738	41.76	1044	8.352	208.8	25	Single family	BUN	9134.79	3897.26	5237.53	Energy Wise - Gas
Q4 2022	14053787	41.76	835.2	8.526	170.52	20	Single family	CAP	10593.44	4558.52	6034.92	Energy Wise - Oil

Q4 2022	14053800	41.76	835.2	8.526	170.52	20	Single family	CAP	8533.73	4069.86	4463.87	Energy Wise - Oil
Q4 2022	14053838	41.76	835.2	8.526	170.52	20	Single family	RAI	3155.59	1577.79	1577.8	Energy Wise - Oil
Q4 2022	14053849	41.76	835.2	8.526	170.52	20	Single family	COL	3970.67	1616.52	2354.15	Energy Wise - Oil
Q4 2022	14053858	41.76	835.2	8.526	170.52	20	Single family	RAN	2912.91	1284.59	1628.32	Energy Wise - Oil
Q4 2022	14053867	41.76	835.2	8.526	170.52	20	Single family	RAN	3615.99	1585.95	2030.04	Energy Wise - Oil
Q1 2023	14073020	41.76	1044	8.352	208.8	25	Single family	BUN	5046.23	2088.26	2957.97	Energy Wise - Gas
Q1 2023	14073034	41.76	1044	8.352	208.8	25	Single family	SPL	1967.91	863.12	1104.79	Energy Wise - Gas
Q1 2023	14073067	41.76	835.2	8.526	170.52	20	Single family	RAN	7949.41	3486.57	4462.84	Energy Wise - Oil
Q1 2023	14073082	41.76	835.2	8.526	170.52	20	Single family	RAN	3839.46	1683.97	2155.49	Energy Wise - Oil
Q1 2023	14073093	41.76	835.2	8.526	170.52	20	Single family	RAN	3711.62	1707.98	2003.64	Energy Wise - Oil
Q1 2023	14168375	41.76	1044	8.352	208.8	25	Single family	RAN	4684	2054.36	2629.64	Energy Wise - Gas
Q1 2023	14168408	41.76	1044	8.352	208.8	25	Single family	BUN	7792.4	3292.72	4499.68	Energy Wise - Gas
Q1 2023	14168438	41.76	1044	8.352	208.8	25	Single family	RAI	4832.21	2119.38	2712.83	Energy Wise - Gas
Q1 2023	14168454	41.76	1044	8.352	208.8	25	Single family	COT	9778.42	4163.78	5614.64	Energy Wise - Gas
Q1 2023	14168456	41.76	1044	8.352	208.8	25	Single family	COT	3487.82	1404.74	2083.08	Energy Wise - Gas
Q1 2023	14168482	41.76	1044	8.352	208.8	25	Single family	RAN	12106.69	5679.16	6427.53	Energy Wise - Gas
Q1 2023	14168483	41.76	1044	8.352	208.8	25	Single family	COL	3836.01	1682.46	2153.55	Energy Wise - Gas
Q1 2023	14168499	41.76	1044	8.352	208.8	25	Single family	BUN	2578.16	1005.77	1572.39	Energy Wise - Gas
Q1 2023	14168510	41.76	1044	8.352	208.8	25	Single family	RAN	5300.49	2324.77	2975.72	Energy Wise - Gas
Q1 2023	14168550	41.76	1044	8.352	208.8	25	Single family	RAN	4249.59	1863.85	2385.74	Energy Wise - Gas
Q1 2023	14168571	41.76	1044	8.352	208.8	25	Single family	CAP	7583.98	3326.3	4257.68	Energy Wise - Gas
Q1 2023	14168572	41.76	1044	8.352	208.8	25	Single family	COL	12502.22	5108.42	7393.8	Energy Wise - Gas
Q1 2023	14168586	41.76	1044	8.352	208.8	25	Single family	COL	3975.22	1987.6	1987.62	Energy Wise - Gas
Q1 2023	14168636	41.76	1044	8.352	208.8	25	Single family	COL	9273.06	4104.15	5168.91	Energy Wise - Gas
Q1 2023	14168646	41.76	1044	8.352	208.8	25	Single family	CAP	7747.22	3433.58	4313.64	Energy Wise - Gas
Q1 2023	14168713	730.8	14616			20	Single family	COL	3918.5	1718.64	2199.86	Energy Wise - Elec
Q1 2023	14169016	41.76	835.2	8.526	170.52	20	Single family	RAN	6944.85	3045.99	3898.86	Energy Wise - Oil
Q1 2023	14169055	41.76	835.2	8.526	170.52	20	Single family	RAN	14629.16	6416.29	8212.87	Energy Wise - Oil
Q1 2023	14169058	41.76	835.2	8.526	170.52	20	Single family	COL	7922.38	3365.07	4557.31	Energy Wise - Oil
Q1 2023	14169133	41.76	835.2	8.526	170.52	20	Single family	CAP	9466.73	4042.86	5423.87	Energy Wise - Oil
Q1 2023	14169138	41.76	835.2	8.526	170.52	20	Single family	COL	10481.41	4795.47	5685.94	Energy Wise - Oil
Q1 2023	14169196	41.76	835.2	8.526	170.52	20	Single family	CAP	1774.95	733.44	1041.51	Energy Wise - Oil
Q1 2023	14169200	41.76	835.2	8.526	170.52	20	Single family	RAN	9855.66	4322.65	5533.01	Energy Wise - Oil
Q1 2023	14169216	41.76	835.2	8.526	170.52	20	Single family	RAN	1683.57	738.41	945.16	Energy Wise - Oil
Q1 2023	14169259	41.76	835.2	8.526	170.52	20	Single family	RAN	8124.21	3563.25	4560.96	Energy Wise - Oil
Q1 2023	14169277	41.76	835.2	8.526	170.52	20	Single family	RAN	4499.1	1973.29	2525.81	Energy Wise - Oil
Q1 2023	14169287	41.76	835.2	8.526	170.52	20	Single family	CAP	10797.44	4735.72	6061.72	Energy Wise - Oil
Q1 2023	14169296	41.76	835.2	8.526	170.52	20	Single family	RAN	12948.46	5679.13	7269.33	Energy Wise - Oil
Q1 2023	14169310	41.76	835.2	8.526	170.52	20	Single family	CAP	2604.15	1142.16	1461.99	Energy Wise - Oil
Q1 2023	14219012	41.76	1044	8.352	208.8	25	Single family	COL	3487.84	1454.74	2033.1	Energy Wise - Gas
Q1 2023	14219030	41.76	1044	8.352	208.8	25	Single family	RAN	7209.03	3036.84	4172.19	Energy Wise - Gas
Q1 2023	14219045	41.76	1044	8.352	208.8	25	Single family	SPL	4495.56	1971.72	2523.84	Energy Wise - Gas
Q1 2023	14219046	41.76	1044	8.352	208.8	25	Single family	RAN	2871.97	1259.63	1612.34	Energy Wise - Gas
Q1 2023	14219058	41.76	1044	8.352	208.8	25	Single family	RAN	7484.95	3195.14	4289.81	Energy Wise - Gas
Q1 2023	14219062	41.76	1044	8.352	208.8	25	Single family	CAP	2836.07	1243.89	1592.18	Energy Wise - Gas
Q1 2023	14219066	41.76	1044	8.352	208.8	25	Single family	RAN	7189.77	3153.41	4036.36	Energy Wise - Gas
Q1 2023	14219097	41.76	1044	8.352	208.8	25	Single family	VIC	5574.42	2335.25	3239.17	Energy Wise - Gas
Q1 2023	14219110	41.76	1044	8.352	208.8	25	Single family	RAN	3728.45	1635.28	2093.17	Energy Wise - Gas
Q1 2023	14219111	41.76	1044	8.352	208.8	25	Single family	CAP	1746.94	766.2	980.74	Energy Wise - Gas
Q1 2023	14219119	41.76	1044	8.352	208.8	25	Single family	COL	3341.72	1340.66	2001.06	Energy Wise - Gas
Q1 2023	14219136	41.76	1044	8.352	208.8	25	Single family	RAN	3963.37	1738.31	2225.06	Energy Wise - Gas
Q1 2023	14219229	41.76	835.2	8.526	170.52	20	Single family	RAN	7360.38	3228.23	4132.15	Energy Wise - Oil
Q1 2023	14219252	41.76	835.2	8.526	170.52	20	Single family	RAN	3347.86	1542.26	1805.6	Energy Wise - Oil
Q1 2023	14219257	41.76	835.2	8.526	170.52	20	Single family	RAN	1250.34	1250.34	0	Energy Wise - Oil
Q1 2023	14219262	41.76	835.2	8.526	170.52	20	Single family	CAP	10762.77	4595.5	6167.27	Energy Wise - Oil
Q1 2023	14219272	41.76	835.2	8.526	170.52	20	Single family	RAN	5934.1	2602.67	3331.43	Energy Wise - Oil
Q1 2023	14247589	41.76	835.2	8.526	170.52	20	Single family	RAN	5487.64	2406.85	3080.79	Energy Wise - Oil
Q1 2023	14247598	41.76	835.2	8.526	170.52	20	Single family	RAI	5530.43	2425.62	3104.81	Energy Wise - Oil
Q1 2023	14247648	41.76	835.2	8.526	170.52	20	Single family	COL	3068.31	1345.75	1722.56	Energy Wise - Oil
Q1 2023	14247654	41.76	835.2	8.526	170.52	20	Single family	COT	5084.63	2502.59	2582.04	Energy Wise - Oil
Q1 2023	14247657	41.76	835.2	8.526	170.52	20	Single family	RAN	7437.84	3262.21	4175.63	Energy Wise - Oil
Q2 2023	14247476	41.76	1044	8.352	208.8	25	Single family	RAN	10227.62	4485.79	5741.83	Energy Wise - Gas
Q2 2023	14247509	41.76	1044	8.352	208.8	25	Single family	COL	2679.51	1175.22	1504.29	Energy Wise - Gas
Q2 2023	14247538	41.76	1044	8.352	208.8	25	Single family	RAN	5004.73	2351.85	2652.88	Energy Wise - Gas
Q2 2023	14247541	41.76	1044	8.352	208.8	25	Single family	COL	8007.26	3402.3	4604.96	Energy Wise - Gas
Q2 2023	14247543	41.76	1044	8.352	208.8	25	Single family	CAP	8767.72	4011.71	4756.01	Energy Wise - Gas
Q2 2023	14247545	41.76	1044	8.352	208.8	25	Single family	RAN	7419.33	3254.08	4165.25	Energy Wise - Gas
Q2 2023	14247546	41.76	1044	8.352	208.8	25	Single family	RAN	5844.92	2563.55	3281.37	Energy Wise - Gas
Q2 2023	14247554	41.76	1044	8.352	208.8	25	Single family	COL	7818.46	3326.08	4492.38	Energy Wise - Gas
Q2 2023	14247562	41.76	1044	8.352	208.8	25	Single family	RAN	5755.14	2687.25	3067.89	Energy Wise - Gas
Q2 2023	14284508	41.76	1044	8.352	208.8	25	Single family	RAN	9030.02	3960.53	5069.49	Energy Wise - Gas
Q2 2023	14284520	41.76	1044	8.352	208.8	25	Single family	RAI	4317.67	1893.71	2423.96	Energy Wise - Gas
Q2 2023	14284530	41.76	1044	8.352	208.8	25	Single family	RAN	8210.28	3600.99	4609.29	Energy Wise - Gas
Q2 2023	14284538	41.76	1044	8.352	208.8	25	Single family	RAN	3799.46	1666.43	2133.03	Energy Wise - Gas
Q2 2023	14284544	41.76	1044	8.352	208.8	25	Single family	CAP	5746.35	2375.02	3371.33	Energy Wise - Gas
Q2 2023	14284562	41.76	1044	8.352	208.8	25	Single family	DUP	3203.49	1405.04	1798.45	Energy Wise - Gas
Q2 2023	14284579	41.76	1044	8.352	208.8	25	Single family	CAP	7595.98	3331.57	4264.41	Energy Wise - Gas
Q2 2023	14284583	41.76	1044	8.352	208.8	25	Single family	COL	5425.4	2254.56	3170.84	Energy Wise - Gas
Q2 2023	14284624	41.76	1044	8.352	208.8	25	Single family	CAP	3852.06	1564.5	2287.56	Energy Wise - Gas
Q2 2023	14284632	41.76	835.2	8.526	170.52	20	Single family	CAP	5055.45	2527.72	2527.73	Energy Wise - Oil
Q2 2023	14284644	41.76	1044	8.352	208.8	25	Single family	RAN	6171.74	2706.89	3464.85	Energy Wise - Gas
Q2 2023	14284653	41.76	1044	8.352	208.8	25	Single family	RAN	3232.58	1417.8	1814.78	Energy Wise - Gas
Q2 2023	14284660	41.76	1044	8.352	208.8	25	Single family	RAN	7461.21	3272.43	4188.78	Energy Wise - Gas
Q2 2023	14285046	41.76	835.2	8.526	170.52	20	Single family	RAN	5860.09	2570.21	3289.88	Energy Wise - Oil
Q2 2023	14285061	41.76	835.2	8.526	170.52	20	Single family	CAP	8082.98	3420.16	4662.82	Energy Wise - Oil
Q2 2023	14285077	41.76	835.2	8.526	170.52	20	Single family	DUP	10345.65	4412.56	5933.09	Energy Wise - Oil
Q2 2023	14285142	41.76	835.2	8.526	170.52	20	Single family	RAN	3351.44	1530.97	1820.47	Energy Wise - Oil
Q2 2023	14285151	41.76	835.2	8.526	170.52	20	Single family	RAN	6666.45	2923.88	3742.57	Energy Wise - Oil
Q2 2023	14285157	41.76	835.2	8.526	170.52	20	Single family	COL	6505.82	2853.43	3652.39	Energy Wise - Oil
Q2 2023	14285162	41.76	835.2	8.526	170.52	20	Single family	RAN	6534.2	2865.87	3668.33	Energy Wise - Oil
Q2 2023	14285169	41.76	835.2	8.526	170.52	20	Single family	CAP	16031.54	7114.53	8917.01	Energy Wise - Oil
Q2 2023	14285191	41.76	835.2	8.526	170.52	20	Single family	RAN	7910.9	3469.69	4441.21	Energy Wise - Oil
Q2 2023	14285205	41.76	835.2	8.526	170.52	20	Single family	SPL	8804.39	3861.56	4942.83	Energy Wise - Oil
Q2 2023	14285212	41.76	835.2	8.526	170.52	20	Single family	RAN	6043.08	2650.47	3392.61	Energy Wise - Oil
Q2 2023	14285216	41.76	835.2	8.526	170.52	20	Single family	RAN	3916.12	1717.58	2198.54	Energy Wise - Oil
Q2 2023	14285219	41.76	835.2	8.526	170.52	20	Single family	RAN	8633.82	3981.63	4652.19	Energy Wise - Oil
Q2 2023	14285240	730.8	14616			20	Single family	RAN	5342.92	2343.38	2999.54	Energy Wise - Elec

Q2 2023	14285249	730.8	14616			20	Single family	COL	8581.33	3763.74	4817.59	Energy Wise - Elec
Q2 2023	14322246	41.76	1044	8.352	208.8	25	Single family	COL	5594.96	2097.21	3497.75	Energy Wise - Gas
Q2 2023	14322247	41.76	1044	8.352	208.8	25	Single family	RAN	3694.48	1620.37	2074.11	Energy Wise - Gas
Q2 2023	14322249	41.76	1044	8.352	208.8	25	Single family	BUN	3452.02	1389.04	2062.98	Energy Wise - Gas
Q2 2023	14322260	41.76	1044	8.352	208.8	25	Single family	COL	5449.27	2390.03	3059.24	Energy Wise - Gas
Q2 2023	14322271	41.76	1044	8.352	208.8	25	Single family	RAI	1568.72	648.23	920.49	Energy Wise - Gas
Q2 2023	14322283	41.76	1044	8.352	208.8	25	Single family	RAI	6407.16	2810.15	3597.01	Energy Wise - Gas
Q2 2023	14322296	41.76	1044	8.352	208.8	25	Single family	RAN	8484.28	3646.17	4838.11	Energy Wise - Gas
Q2 2023	14322297	41.76	1044	8.352	208.8	25	Single family	RAN	5232.77	2295.07	2937.7	Energy Wise - Gas
Q2 2023	14322308	41.76	1044	8.352	208.8	25	Single family	RAN	5525.1	2323.28	3201.82	Energy Wise - Gas
Q2 2023	14322320	730.8	14616			20	Single family	TDH	4090.43	1669.04	2421.39	Energy Wise - Elec
Q2 2023	14322329	41.76	1044	8.352	208.8	25	Single family	RAN	3871.63	1698.08	2173.55	Energy Wise - Gas
Q2 2023	14322334	41.76	1044	8.352	208.8	25	Single family	RAN	7251.7	3055.56	4196.14	Energy Wise - Gas
Q2 2023	14322363	41.76	1044	8.352	208.8	25	Single family	SPL	6082.29	2667.65	3414.64	Energy Wise - Gas
Q2 2023	14322364	41.76	1044	8.352	208.8	25	Single family	COL	3218.36	1286.55	1931.81	Energy Wise - Gas
Q2 2023	14322370	41.76	1044	8.352	208.8	25	Single family	RAN	7840	3438.58	4401.42	Energy Wise - Gas
Q2 2023	14322379	41.76	1044	8.352	208.8	25	Single family	RAN	7532.04	3303.51	4228.53	Energy Wise - Gas
Q2 2023	14322404	41.76	1044	8.352	208.8	25	Single family	COL	9061.21	3849.21	5212	Energy Wise - Gas
Q2 2023	14322410	41.76	1044	8.352	208.8	25	Single family	RAI	3731.64	1636.68	2094.96	Energy Wise - Gas
Q2 2023	14322441	41.76	835.2	8.526	170.52	20	Single family	RAN	5054.19	2216.75	2837.44	Energy Wise - Oil
Q2 2023	14322442	41.76	835.2	8.526	170.52	20	Single family	RAN	5592.93	2453.04	3139.89	Energy Wise - Oil
Q2 2023	14322448	41.76	835.2	8.526	170.52	20	Single family	RAN	5754.61	2523.94	3230.67	Energy Wise - Oil
Q2 2023	14322454	41.76	835.2	8.526	170.52	20	Single family	RAN	5073.89	2225.38	2848.51	Energy Wise - Oil
Q2 2023	14322504	41.76	835.2	8.526	170.52	20	Single family	CTM	5848.95	2565.33	3283.62	Energy Wise - Oil
Q2 2023	14322507	41.76	835.2	8.526	170.52	20	Single family	CAP	8902.47	4176.58	4725.89	Energy Wise - Oil
Q2 2023	14322511	41.76	835.2	8.526	170.52	20	Single family	RAI	3528.07	1547.39	1980.68	Energy Wise - Oil
Q2 2023	14322517	41.76	835.2	8.526	170.52	20	Single family	CAP	3961.8	1612.63	2349.17	Energy Wise - Oil
Q2 2023	14322524	41.76	835.2	8.526	170.52	20	Single family	RAI	3620.15	1587.78	2032.37	Energy Wise - Oil
Q2 2023	14322528	41.76	835.2	8.526	170.52	20	Single family	RAN	4583.59	2010.34	2573.25	Energy Wise - Oil
Q2 2023	14322530	41.76	835.2	8.526	170.52	20	Single family	RAN	4342.42	1969.37	2373.05	Energy Wise - Oil
Q2 2023	14322545	41.76	835.2	8.526	170.52	20	Single family	COL	12265.78	5254.72	7011.06	Energy Wise - Oil
Q2 2023	14350177	41.76	1044	8.352	208.8	25	Single family	CAP	7076.44	3103.7	3972.74	Energy Wise - Gas
Q2 2023	14350194	41.76	1044	8.352	208.8	25	Single family	COL	13030.39	5605.43	7424.96	Energy Wise - Gas
Q2 2023	14350218	41.76	1044	8.352	208.8	25	Single family	RAN	5119.93	2245.58	2874.35	Energy Wise - Gas
Q2 2023	14350222	41.76	1044	8.352	208.8	25	Single family	RAI	3455.48	1515.56	1939.92	Energy Wise - Gas
Q2 2023	14350223	41.76	1044	8.352	208.8	25	Single family	RAN	5416.11	2375.48	3040.63	Energy Wise - Gas
Q2 2023	14350231	41.76	1044	8.352	208.8	25	Single family	COT	4668.51	2036.68	2631.83	Energy Wise - Gas
Q2 2023	14350240	41.76	1044	8.352	208.8	25	Single family	COL	3350.7	1469.6	1881.1	Energy Wise - Gas
Q2 2023	14350248	41.76	1044	8.352	208.8	25	Single family	SPL	3134.98	1374.99	1759.99	Energy Wise - Gas
Q2 2023	14350260	41.76	1044	8.352	208.8	25	Single family	RAN	4459.07	1951.43	2507.64	Energy Wise - Gas
Q2 2023	14350273	41.76	1044	8.352	208.8	25	Single family	BUN	4207.09	1803.01	2404.08	Energy Wise - Gas
Q2 2023	14350282	41.76	1044	8.352	208.8	25	Single family	RAN	6800.04	2982.47	3817.57	Energy Wise - Gas
Q2 2023	14350303	41.76	1044	8.352	208.8	25	Single family	CAP	8342.13	3658.82	4683.31	Energy Wise - Gas
Q2 2023	14350308	41.76	1044	8.352	208.8	25	Single family	RAN	3643.5	1598.02	2045.48	Energy Wise - Gas
Q2 2023	14350328	730.8	14616			20	Single family	RAN	3630.5	1592.32	2038.18	Energy Wise - Elec
Q2 2023	14350488	41.76	835.2	8.526	170.52	20	Single family	CAP	6326.99	2774.98	3552.01	Energy Wise - Oil
Q2 2023	14350499	41.76	835.2	8.526	170.52	20	Single family	RAN	7855.44	3356.71	4498.73	Energy Wise - Oil
Q2 2023	14350501	41.76	835.2	8.526	170.52	20	Single family	RAN	13006.67	5704.67	7302	Energy Wise - Oil
Q2 2023	14350510	41.76	835.2	8.526	170.52	20	Single family	COL	3390.02	1486.84	1903.18	Energy Wise - Oil
Q2 2023	14350520	41.76	835.2	8.526	170.52	20	Single family	CAP	3410.04	1495.65	1914.39	Energy Wise - Oil
Q2 2023	14350526	41.76	835.2	8.526	170.52	20	Single family	RAN	9209.02	4039.03	5169.99	Energy Wise - Oil
Q2 2023	14350527	41.76	835.2	8.526	170.52	20	Single family	SPL	6534.09	2790.82	3743.27	Energy Wise - Oil
Q2 2023	14350543	41.76	835.2	8.526	170.52	20	Single family	CAP	3391.18	1487.35	1903.83	Energy Wise - Oil
Q2 2023	14350549	41.76	835.2	8.526	170.52	20	Single family	COL	7857.87	3321.43	4536.44	Energy Wise - Oil
Q2 2023	14350552	41.76	835.2	8.526	170.52	20	Single family	RAI	3250.08	1425.47	1824.61	Energy Wise - Oil
Q2 2023	14350585	41.76	835.2	8.526	170.52	20	Single family	RAN	6455.58	2831.38	3624.2	Energy Wise - Oil
Q2 2023	14350597	41.76	835.2	8.526	170.52	20	Single family	RAN	7540.11	3307.06	4233.05	Energy Wise - Oil
Q2 2023	14350600	41.76	835.2	8.526	170.52	20	Single family	RAN	3636.84	1595.1	2041.74	Energy Wise - Oil
Q2 2023	14382332	41.76	1044	8.352	208.8	25	Single family	RAN	6126.27	2577.3	3548.97	Energy Wise - Gas
Q2 2023	14382366	41.76	1044	8.352	208.8	25	Single family	RAI	3699.93	1622.77	2077.16	Energy Wise - Gas
Q2 2023	14382389	41.76	1044	8.352	208.8	25	Single family	RAI	3825.21	1677.72	2147.49	Energy Wise - Gas
Q2 2023	14382404	41.76	1044	8.352	208.8	25	Single family	CAP	11073.25	4753.62	6319.63	Energy Wise - Gas
Q2 2023	14382450	41.76	1044	8.352	208.8	25	Single family	RAN	6800.04	2982.47	3817.57	Energy Wise - Gas
Q2 2023	14382462	41.76	1044	8.352	208.8	25	Single family	DDH	7067.76	2974.89	4092.87	Energy Wise - Gas
Q2 2023	14382511	41.76	1044	8.352	208.8	25	Single family	RAN	6886.46	3020.37	3866.09	Energy Wise - Gas
Q2 2023	14385530	730.8	14616			20	Single family	RAI	4535.73	1914.35	2621.38	Energy Wise - Elec
Q2 2023	14386089	41.76	835.2	8.526	170.52	20	Single family	MOD	6303.74	2764.8	3538.94	Energy Wise - Oil
Q2 2023	14386112	41.76	835.2	8.526	170.52	20	Single family	COL	3948	1606.58	2341.42	Energy Wise - Oil
Q2 2023	14386114	41.76	835.2	8.526	170.52	20	Single family	RAN	8466.83	3713.51	4753.32	Energy Wise - Oil
Q2 2023	14386139	41.76	835.2	8.526	170.52	20	Single family	CAP	9313.12	3959.69	5353.43	Energy Wise - Oil
Q2 2023	14386141	41.76	835.2	8.526	170.52	20	Single family	COL	7284.03	3069.75	4214.28	Energy Wise - Oil
Q2 2023	14386154	41.76	835.2	8.526	170.52	20	Single family	COL	5995.24	2504.49	3490.75	Energy Wise - Oil
Q2 2023	14386159	41.76	835.2	8.526	170.52	20	Single family	RAN	5708.11	2503.55	3204.56	Energy Wise - Oil
Q2 2023	14386164	41.76	835.2	8.526	170.52	20	Single family	COL	9915.54	4261.2	5654.34	Energy Wise - Oil
Q2 2023	14386179	41.76	835.2	8.526	170.52	20	Single family	RAN	5970.61	2618.69	3351.92	Energy Wise - Oil
Q2 2023	14386181	41.76	835.2	8.526	170.52	20	Single family	CAP	2148.91	942.5	1206.41	Energy Wise - Oil
Q2 2023	14428265	41.76	1044	8.352	208.8	25	Single family	RAN	4602.52	1820.77	2781.75	Energy Wise - Gas
Q2 2023	14428274	41.76	1044	8.352	208.8	25	Single family	RAN	3764.5	1651.09	2113.41	Energy Wise - Gas
Q2 2023	14428284	41.76	1044	8.352	208.8	25	Single family	RAN	4234.86	1782.39	2452.47	Energy Wise - Gas
Q2 2023	14428311	41.76	1044	8.352	208.8	25	Single family	CAP	3227.17	1481.21	1745.96	Energy Wise - Gas
Q2 2023	14428358	41.76	1044	8.352	208.8	25	Single family	RAI	4994.06	2190.37	2803.69	Energy Wise - Gas
Q2 2023	14428366	41.76	1044	8.352	208.8	25	Single family	RAN	6499.22	2850.53	3648.69	Energy Wise - Gas
Q2 2023	14429393	41.76	835.2	8.526	170.52	20	Single family	COL	1759.1	771.52	987.58	Energy Wise - Oil
Q2 2023	14429405	41.76	835.2	8.526	170.52	20	Single family	RAN	10987.87	3426.17	7561.7	Energy Wise - Oil
Q2 2023	14429414	41.76	835.2	8.526	170.52	20	Single family	GAM	1823.11	799.61	1023.5	Energy Wise - Oil
Q2 2023	14429427	41.76	835.2	8.526	170.52	20	Single family	RAN	7382.08	3237.75	4144.33	Energy Wise - Oil
Q2 2023	14429457	41.76	835.2	8.526	170.52	20	Single family	CAP	6021.63	2770.76	3250.87	Energy Wise - Oil
Q2 2023	14429478	41.76	835.2	8.526	170.52	20	Single family	VIC	2319.57	966.91	1352.66	Energy Wise - Oil

CO2 (electricity)	CO2/MWh	0.3820	AESC 2021, Appendix G Table 159, average of winter peak/off-peak summer peak/off-peak for all years 2021-2035
CO2 (natural gas)	CO2/MMBTU	0.0585	AESC 2021, Appendix G Table 159
CO2 (oil)	CO2/MMBTU	0.0805	AESC 2021, Appendix G Table 159
CO2 (propane)	CO2/MMBTU	0.0695	AESC 2021, Appendix G Table 159

BUILIDING CODE	DEFINITION
RAN	RANCH
CAP	CAPE
COL	COLONIAL
RAI	RAISED RANCH
VIC	VICTORIAN

PUC 1-38
Program design and offerings

Request:

Please confirm whether the Company is proposing to continue offering the 100% weatherization incentive offering for moderate income customers in the 2024 program. If yes, please clarify whether it will continue to be funded with RGGI proceeds, as in prior program years, or whether it is included in the 2024 Annual Plan budget to be funded by ratepayers.

Response:

The Company is proposing to continue offering the 100% weatherization incentive for moderate-income customers. The funding for this is included in the 2024 Annual Plan budget, to be funded by ratepayers. RGGI proceeds for moderate income weatherization were fully subscribed in 2023.

Prepared by or under the supervision of: Spencer Lawrence

PUC 1-39
Program design and offerings

Request:

Referencing the budget categories contained in Tables E-2 and G-2 of the proposed 2024 Annual Electric and Gas Efficiency Plans, in what budget category is the cost of home energy assessments included? If the budget categorization differs across sectors or programs, please explain.

Response:

In both the Gas and Electric 2024 Annual Efficiency Plans, the cost of home energy assessments is included in the "Sales, Technical Assistance & Training" budget category.

Prepared by or under the supervision of: Spencer Lawrence

PUC 1-40
Carbon accounting

Request:

Please explain in greater detail the methodology being proposed by the Company to value carbon emissions reductions from avoided electricity consumption. Specifically explain how the Company incorporated the 100% Renewable Energy Standard into the baseline for electric sector carbon emissions against which the value of avoided emissions will be calculated. Please provide supporting equations and/or illustrative calculations.

Response:

For the 2024 Plan, the Company monetized electricity-associated carbon emission reductions for the summer peak, summer off-peak, winter peak, and winter off-peak energy costing periods separately.

For each costing period, the Company calculated the carbon emissions reduction benefit as indicated in the equations in Attachment 4, Bates page 369. Below is a simplified illustration of the calculation of GHG Benefits:

$$GHGBenefits = EnergySaved * EnergyPercent * CarbonValue * (1 + LossPercent),$$

- $GHGBenefits$ is the costing period non-embedded benefit associated with reduced greenhouse gas emissions measured in dollars;
- $EnergySaved$ is the annual energy saved by the measure measured in kilowatt hours;
- $EnergyPercent$ is the percent of annual energy savings that occur during the costing period;
- $CarbonValue$ is the cumulative net present value over the lifetime of the measure (in 2023 dollars) of the avoided non-embedded monetary value of a reduction in energy consumption in the costing period measured in dollars per kilowatt hour (the value used is based on the Marginal Abatement Cost (MAC) from the 2021 Avoided Energy Supply Component (AESC) Study); and
- $LossPercent$ is the percent of delivered energy lost during the costing period.

Prepared by or under the supervision of: Brett Feldman

PUC 1-40, Page 2

Carbon accounting

Regarding the 100% Renewable Energy Standard (RES), the Company confirmed with Synapse Energy Economics, the author of the 2021 AESC, that the 2021 AESC's calculated avoided cost of carbon values already considers increases in renewable energy sources over time consistent with the RES. Therefore, before 2033, the Company did not make any adjustments to carbon values published in the 2021 AESC and used in the calculation described above. The Company zeroed-out all carbon benefits accruing in 2033 and beyond.

Prepared by or under the supervision of: Brett Feldman

PUC 1-41
Carbon accounting

Request:

Regarding the avoided carbon benefits from the electric savings to be delivered by the proposed 2024 Annual Gas and Electric Efficiency Plans, please provide an estimate of the avoided carbon benefits (in dollars) to be delivered before 2033 vs. after 2033.

Response:

As detailed in the Company's response to data request PUC 1-40, the Company zeroed out all carbon benefits accruing in 2033 and beyond. Therefore, all reported carbon benefits from electric savings in the 2024 Annual Plan are to be delivered before 2033. Please see the table below for specific details.

Portfolio	**Carbon Benefits from Electric Savings 2024-2032**	**Carbon Benefits from Electric Savings 2033-**
Electric	$26,782,452	$0
Gas	$98,763	$0
Total	$26,881,215	$0

Prepared by or under the supervision of: Brett Feldman

PUC 1-42
Carbon accounting

Request:

Regarding the avoided carbon benefits from the electric savings to be delivered by the proposed 2024-2026 Three-Year Gas and Electric Efficiency Plans, please provide an estimate of the avoided carbon benefits (in dollars) to be delivered before 2033 vs. after 2033.

Response:

As detailed in the Company's response to data request PUC 1-40, the Company zeroed out all carbon benefits accruing in 2033 and beyond. Therefore, all reported carbon benefits from electric savings in the 2024-26 Three-Year Plan are to be delivered before 2033. Please see the table below for specific details on the cumulative avoided carbon benefits from all three years of the 2024-26 Plan.

Portfolio	**Carbon Benefits from Electric Savings 2024-2032**	**Carbon Benefits from Electric Savings 2033-**
Electric	$82,163,531	$0
Gas	$304,279	$0
Total	$82,467,810	$0

Prepared by or under the supervision of: Brett Feldman

PUC 1-43
Carbon accounting

Request:

On Bates page 368, the Company explains that it "obtained the non-embedded cost of carbon values from… User Interface file Appendix G for gas, oil, and propane savings." Regarding the cost of carbon values for oil savings, were those values calculated using an emissions baseline that captures the biodiesel blending requirements set forth in Senate Bill No. 357 enacted in 2021?

Response:

The cost of carbon values for oil savings were not calculated using an emissions baseline that captures the biodiesel blending requirements set forth in Senate Bill No. 357. The AESC 2021 study was published in March 2021 (with a May 2021 update), which is before Senate Bill No. 357 was signed into law in August 2021.

If the carbon values for oil savings were calculated using an emission baseline that captures the biodiesel blending requirements set forth in Senate Bill No. 357, since biodiesel has lower emissions than fuel oil, the impact of a blend requirement would likely be a decrease in claimed carbon benefits associated with oil savings. The magnitude of the decrease on total benefits would be small: 2024 oil-associated carbon benefits account for 10.4% of 2024 electric portfolio carbon benefits and 1.6% of 2024 electric portfolio total benefits.

Prepared by or under the supervision of: Brett Feldman

PUC 1-44
Carbon accounting

Request:

Please update the response to PUC 1-52 in Docket No. 22-33-EE for the proposed 2024 Electric Efficiency Plan. Please also perform the requested analysis for the proposed 2024-2026 Three-Year Electric Plan. The original data request requested the Company "further break down the avoided carbon value from electric savings by cost methodology (i.e. the value associated with savings from fossil fuel replacement measures vs. the value associated with all other measures)." Given that the Company is not proposing different carbon accounting methodologies for savings from fossil fuel replacement measures vs. non-fossil replacement measures in this docket, disregard the associated request from PUC 1-52 .

Response:

The Company has provided Table 1 below as a response to the Commission.

Table 1. Breakdown of Non-Embedded Carbon Benefits by Fuel Type from the 2024-2026 Electric Plan

Non-Embedded Carbon Benefits from the 2024-2026 Electric Plan					
Year	**Electric**	**Gas**	**Oil**	**Propane**	**All**
2023*	$110,280,188	($1,879,356)	$28,654,854	$2,260,133	$139,315,819
2024	$26,782,452	($470,155)	$3,122,167	$601,226	$30,035,690
2025	$27,419,300	($187,523)	$3,506,587	$640,774	$31,379,139
2026	$27,961,779	$83,861	$3,637,837	$734,212	$32,417,689

*Please note the 2023 values present the sum of the Social Cost of Carbon (SCC) and the Marginal Cost of Carbon (MAC) from the 2023 Electric Plan. The differences in 2023 values compared to the 2024 to 2026 values are due to the different carbon accounting methodologies. In the 2023 Electric Plan, a hybrid approach was proposed where the SCC was applied to some measures and the MAC was applied to other measures. However, in the 2024 to 2026 Plan, only the MAC was used resulting in lower non-embedded carbon benefits due to the differences in MAC and SCC.

Prepared by or under the supervision of: Brett Feldman

PUC 1-45
Carbon accounting

Request:

Please update the response to PUC 1-53 in Docket No. 22-33-EE for the proposed 2024 Gas Efficiency Plan. Please also perform the requested analysis for the proposed 2024-2026 Three-Year Gas Plan. The original data request requested the Company "further break down the avoided carbon value from electric savings by cost methodology (i.e. the value associated with savings from fossil fuel replacement measures vs. the value associated with all other measures)." Given that the Company is not proposing different carbon accounting methodologies for savings from fossil fuel replacement measures vs. non-fossil replacement measures in this docket, please disregard the associated request from PUC 1-53.

Response:

The Company has provided Table 1 below as a response to the Commission.

Table 1. Breakdown of Non-Embedded Carbon Benefits by Fuel Type from the 2024-2026 Gas Plan

Non-Embedded Carbon Benefits from the 2024-2026 Gas Plan			
Year	**Electric**	**Gas**	**All**
2023*	$2,143,736	$59,302,330	$61,446,066
2024	$98,763	$19,721,489	$19,820,251
2025	$100,858	$20,670,863	$20,771,722
2026	$104,658	$21,582,046	$21,686,704

* Please note the 2023 values present the sum of the Social Cost of Carbon (SCC) and the Marginal Cost of Carbon (MAC) from the 2023 Electric Plan. The differences in 2023 values compared to the 2024 to 2026 values are due to the different carbon accounting methodologies. In the 2023 Electric Plan, a hybrid approach was proposed where the SCC was applied to some measures and the MAC was applied to other measures. However, in the 2024 to 2026 Plan, only the MAC was used resulting in lower non-embedded carbon benefits due to the differences in MAC and SCC.

Prepared by or under the supervision of: Brett Feldman

PUC 1-46
Financing

Request:

Provide a table showing the HEAT Loan budget for each program year of the proposed Three-Year Gas and Electric Efficiency Plans.

Response:

The Company has provided the below tables to show the HEAT Loan budget for each program year of the proposed Three-Year Gas and Electric Efficiency Plans.

2024-2026 Electric Programs HEAT Loan Budget

Sector	Program Name	2024 Budget ($)	2025 Budget ($)	2026 Budget ($)
Residential	Residential HVAC	189,000.00	200,000.00	206,000.00
Residential	EnergyWise Single Family	634,000.00	667,000.00	701,000.00
Residential	EnergyWise Multifamily	84,000.00	75,000.00	66,000.00
	Total	**907,000.00**	**942,000.00**	**973,000.00**

2024-2026 Gas Programs HEAT Loan Budget

Sector	Program Name	2024 Budget ($)	2025 Budget ($)	2026 Budget ($)
Residential	Residential HVAC	60,000.00	54,000.00	48,000.00
Residential	EnergyWise Single Family	209,000.00	221,000.00	233,000.00
	Total	**269,000.00**	**275,000.00**	**281,000.00**

Prepared by or under the supervision of: Brendan Dagher

PUC 1-47
Financing

Request:

On Bates page 82, the Company writes "one concern with the current HEAT Loan model is that the zero percent interest buy down may restrict the overall number of customers that the loan can reach, given its limited funds combined with the recent increase in interest rates. The company is working to restructure the HEAT Loan to a flat 5% interest rate buy down." Regarding this proposal, please explain the following:

a. When is the Company planning on instituting this change to the HEAT Loan?

b. How did the Company pick a 5% interest rate?

c. Explain what the Company means by "limited funds." In your response, address whether the Company believes there to be a firm "limit" or cap on the HEAT Loan budget.

d. How many more customers will the Company be able to serve with the 5% interest HEAT Loan than the 0% interest HEAT Loan?

e. Why does the Company propose to offer a uniform HEAT Loan interest rate to all customers regardless of their financial position?

Response:

a. The Company is planning on instituting this change to the HEAT Loan in Q1 2024.

b. The Company picked a 5% interest rate due to the rapid rise in the federal funds rate, and consequently the prime rate, over the past year-and-a-half. As of November 1st, 2023, the prime rate is set at 8.5% for most major financial institutions. The Company has historically offered a 5% interest rate buydown or Prime + 1% for its HEAT Loan, whichever is higher. The Company knows that lenders are receptive to financing projects with the 5% buydown.

c. When referring to "limited funds", the Company is broadly referring to balancing cost-effectiveness and benefits across its full portfolio of programs. While the Company does not believe there to be a specific "limit" or cap on the HEAT Loan budget, it must consider how much to allocate to the HEAT Loan versus other activities, programs, and measures that benefit customers.

Prepared by or under the supervision of: Brendan Dagher

PUC 1-47, Page 2
Financing

d. The Company estimates it will be able to serve approximately 80%-100% more customers with the shift to the 5% interest HEAT Loan.

e. The Company does not currently have a process in place to tier HEAT Loan interest rates for customers based on their financial position. This would require additional conversation and coordination with the Company's lending institutions.

PUC 1-48
Financing

Request:

Please list the measures that a customer is eligible to pay for through the Company's HEAT Loan.

Response:

A customer is eligible to pay for several measures through the Company's HEAT Loan program provided that those measures meet certain energy efficiency standards, installation requirements, and system-switching parameters. The measures are listed below.

- Furnace with Electronic Commutated Motor
- Hot Water Boiler
- Combined condensing boiler and on-demand water heating unit
- Combined Natural Gas Furnace and on-demand water heating unit
- Air Source Heat Pump (for electric resistance heating customers upgrading to ASHP)
- Heat Recovery Ventilator
- Weather Responsive Outdoor Boiler Reset Control (After Market)
- Knob and tube wiring
- Vermiculite
- Asbestos (to enable heating equipment improvements)
- Indirect Water Heater
- ENERGY STAR® On-demand Tankless Water Heater
- Heat Pump Water Heater
- Solar Water Heater
- ENERGY STAR® Storage Water Heater
- ENERGY STAR® Condensing Gas Water Heater

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PUC 1-48, Page 2
Financing

- Low-E Storm Windows
- Insulation, air sealing, and duct system improvements (must be recommended at the time of the home energy assessment and included in a customer's Action Plan)

PUC 1-49
Financing

Request:

Can a customer receive a HEAT Loan from the Company to cover the cost of a measure for which they are also receiving funding from a non-utility program (e.g. the Clean Heat RI program)?

Response:

A customer must be participating in the Company's energy efficiency programs to receive a HEAT Loan. HEAT Loans may not be used to cover measures offered through the Clean Heat Rhode Island program. However, there may be instances where a customer receives a HEAT Loan from the Company to help cover the cost of a measure for which they are also receiving funding from a non-utility program.

Prepared by or under the supervision of: Brendan Dagher

PUC 1-50
Financing

Request:

On Bates page 82, the Company describes its on-bill repayment offering for C&I gas and electric customers. Please provide the number of C&I customers that have participated in on-bill payments over the past three program years and the size of the loans being repaid through the bills.

Response:

Please see the tables below for the total for the C&I sector, C&I Electric measures, and C&I Gas measures.

C&I TOTAL	2020	2021	2022	2023	Grand Total
# Accounts	106	106	108	68	330
# Loans	151	138	135	82	506
Total Loan $	$9,481,740	$9,906,264	$6,612,116	$4,261,455	$30,261,575
Average	$62,793	$71,785	$48,979	$51,969	$59,805

C&I ELECTRIC	2020	2021	2022	2023	Grand Total
# Accounts	86	101	82	59	277
# Loans	124	128	95	72	419
Total Loan $	$9,014,999	$9,824,425	$5,339,914	$4,052,938	$28,232,276
Average	$72,702	$76,753	$56,210	$56,291	$67,380

C&I GAS	2020	2021	2022	2023	Grand Total
# Accounts	20	5	26	9	53
# Loans	27	10	40	10	87
Total Loan $	$466,741	$81,839	$1,272,202	$208,517	$2,029,299
Average	$17,287	$8,184	$31,805	$20,852	$23,325

Prepared by or under the supervision of: Spencer Lawrence

PUC 1-51
Financing

Request:

Referencing Table E-2 of the Updated Compliance Filing in Docket No. 22-33-EE, the Company included an incremental $2 million in "finance costs" in the 2023 C&I electric sector budget. No such funding appears to be included in the 2024 C&I electric sector budget. Separately, Table E-9 on Bates page 414 appears to indicate the Company projects the electric Revolving Loan Fund balance to be $8.7 at the beginning of the 2024 program year. Table E-9 also appears to indicate that the Company estimates there will be $7.9 million in loans made in 2024; because the loan repayments in 2024 are projected to be $8.4 million, the it appears that the Company expects the projected 2024 year-end loan fund balance to be $9.3 million. Regarding the proposed 2024 C&I electric sector financing budget, please explain the following:

a. Verify the following: the Company expects to have $8.7 million available for loans at the beginning of 2024 and expects $7.9 million in loans over the course of 2024, thus leaving a projected 2024 year-end fund balance of $9.3 million.

b. Clarify whether the Company is proposing to zero out the 2024 C&I electric sector financing budget because of the projected 2024 year-end fund balance of $9.3 million.

c. How did the Company develop its estimate of $7.9 million in "estimated loans" for 2024?

d. Please provide a table showing estimated vs. actual loans from the past 5 program years.

e. Is this the first year that the Company is not proposing an incremental budget for C&I financing in the Annual Electric Efficiency Plan? If not, please list the prior program years in which the proposed budget was zero and explain why the budget proposal in that year(s) was zero.

Response:

a. This is correct. The Company expects to have $8.7 million available for loans at the beginning of 2024. Over the course of 2024, the company expects to receive $8.5 million in loan repayments, and to issue $7.9 million in loans, for a net increase of funds of $8.5 million - $7.9 million = $0.6 million. Thus, the projected 2024 year-end fund balance is $8.7 million + $0.6 million = $9.3 million.

Prepared by or under the supervision of: Michael O'Brien Crayne

PUC 1-51, Page 2
Financing

b. Yes, the Company is proposing to zero out the 2024 C&I electric sector financing budget because of the projected 2024 year-end fund balance of $9.3 million. This budget line item represents the Company's request for funds to be injected into the large C&I revolving loan fund in order to maintain adequate levels of available funds for financing. Given the projected 2024 year-end fund balance of $9.3 million, the Company does not believe that an injection of funds will be needed to maintain adequate levels of funding available for C&I financing in 2024.

c. The estimated $7.9 million for 2024 loans was derived based on the current projection of 2023 loans (Loans Paid Year-To-Date, plus Projected Additional Loans from Previous Year).

d. Please see the table below:

Year	Estimated Loans	Actual Loans
2023	$9,100,000	$7,870,922*
2022	$8,928,261	$5,968,107
2021	$9,563,358	$9,476,199
2020	$8,000,000	$7,893,453
2019	$7,400,000	$3,276,586
2018	$11,000,000	$7,189,918

*The "Actual Loans" value for 2023 is the projected 2023 loans from the 2024 Annual Plan, which includes actual YTD loans and projected loans for the remainder of the year.

e. This is not the first year that the Company is not proposing a fund injection for C&I financing in the Annual Electric Efficiency Plan. The Company did not propose injections in 2018, 2019, or 2020. When preparing the annual plan each year, the Company reviews the projected year end loan fund balance and determines if it appears that an injection should be requested to help ensure adequate financing funds are maintained. In 2018, 2019 and 2020, a determination was made that adequate financing funds were available.

Prepared by or under the supervision of: Michael O'Brien Crayne

PUC 1-52
Financing

Request:

Referencing the proposed 2024-2026 Three-Year Plan budgets included in Schedule A, Attachment 2, it appears that the Company is proposing to maintain the C&I financing budgets for both gas and electric at zero for each of the three program years. Please explain why.

Response:

This budget line item represents the Company's request for funds to be injected into the large C&I revolving loan fund in order to maintain adequate levels of available funds for financing. Based on current forecasts, the Company estimates that the large C&I revolving loan fund will have a fund balance of $9.3 million for electric and $3.8 million for gas at the end of 2024. Given this amount, the Company does not believe that an injection of funds will be needed to maintain adequate levels of funding available for C&I financing in 2024.

At this time, the Company cannot forecast whether or not an injection of funds will be needed to maintain adequate levels of funding available for C&I financing in 2025 and 2026, and so no such injections were included in the budget. When the 2025 and 2026 Annual Plans are prepared, we will review the forecasted loan fund balances to determine if any such injections will be needed and we will request them at that time.

Prepared by or under the supervision of: Michael O'Brien Crayne

PUC 1-53
Pre-weatherization barriers

Request:

In the 2024 Annual Electric Efficiency Plan, how much funding is the Company proposing for the remediation of pre-weatherization barriers? In your response, clarify the specific sectors in which the Company is proposing a budget for pre-weatherization.

Response:

In the 2024 Annual Electric Efficiency Plan, the Company is proposing for $162,500 to fund the remediation of pre-weatherization barriers for the market rate EnergyWise Single Family program.

The Income Eligible program maintains a contingency budget of ~ 3% of the total incentive budget to accommodate program deferrals. For 2024 electric, this comes out to $290,809 for the Income Eligible Single Family program. This funding is used when a project is not able to leverage LIHEAP or WAP funding to overcome pre-weatherization barriers.

Prepared by or under the supervision of: Spencer Lawrence

PUC 1-54
Pre-weatherization barriers

Request:

In the 2024 Annual Gas Efficiency Plan, how much funding is the Company proposing for the remediation of pre-weatherization barriers? In your response, clarify the specific sectors in which the Company is proposing a budget for pre-weatherization.

Response:

The Company is not proposing funding for the remediation of pre-weatherization barriers in the 2024 Annual Gas Efficiency Plan for the market rate EnergyWise Single Family program. The costs occur in the electric plan for this program (please reference the Company's response to PUC 1-53).

The Income Eligible program maintains a contingency budget of ~ 3% of the total incentive budget to accommodate program deferrals. For 2024 gas, this comes out to $102,504 for the Income Eligible Single Family program. This funding is used when a project is not able to leverage LIHEAP or WAP funding to overcome pre-weatherization barriers.

Prepared by or under the supervision of: Spencer Lawrence

PUC 1-55
Pre-weatherization barriers

Request:

On Bates page 84, the Company writes "the Company intends to identify and compile resources for leveraging funding to address pre-weatherization barriers. While RI Energy cannot guarantee that additional outside resources for pre-weatherization barriers will be secured, the Company will continue to engage with potential funders in pursuit of these resources, including engaging with OER to understand if any IRA funds might be eligible for this kind of remediation." What is the status of the Company's engagement with OER to-date on developing an understanding of whether IRA funds are eligible for remediating pre-weatherization barriers?

Response:

The Company has inquired of OER about the potential to use IRA funds to remediate pre-weatherization barriers. Electric panel upgrades are an eligible measure under the IRA and some barrier remediation entails upgrades to the existing electric system. OER is investigating this application of IRA funds but as of the date of this response it remains unclear if IRA funding may be used in this way.

Prepared by or under the supervision of: Toby Ast

PUC 1-56
Pre-weatherization barriers

Request:

Do any of the LIHEAP, WAP, or other funds administered by the Department of Human Services (DHS) cover the cost of remediating pre-weatherization barriers?

Response:

Yes, LIHEAP and WAP funds regularly cover the cost of remediating pre-weatherization barriers. In addition, The Department of Energy (DOE) has provided Weatherization Readiness Funds (WRF) expressly to cover costs to resolve pre-weatherization barriers (PWB). However, these funds are unique; they can only be used to resolve a deferral, and do not impact the savings to investment ratio.

PUC 1-57
Pre-weatherization barriers

Request:

For program years 2025 and 2026, what level of pre-weatherization funding does the Company plan on including in the budget? If the Company plans on changing the level of pre-weatherization funding relative to its 2024 proposal, please explain why.

Response:

For the EnergyWise Single Family program:

- In program year 2025, the Company plans to include $178,750 in pre-weatherization funding in the electric portfolio. This is an increase of $16,250 relative to the 2024 proposal. The increase in funding is a result of an increase in planned quantities.
- In program year 2026, the Company plans to include $187,000 in pre-weatherization funding in the electric portfolio. This is an increase of $8,250 relative to the 2025 proposal, and an increase of $24,500 relative to the 2024 proposal. The increase in funding is a result of an increase in planned quantities.

For the Income Eligible Single Family program:

- In program year 2025, the Company plans to include $416,303 in pre-weatherization funding combined between the electric and gas portfolios. This is an increase of $22,989 relative to the 2024 proposal. The increase in funding is a result of an increase in planned quantities.
- In program year 2026, the Company plans to include $429,742 in pre-weatherization funding combined between the electric and gas portfolios. This is an increase of $13,439 relative to the 2025 proposal, and an increase of $36,428 relative to the 2024 proposal. The increase in funding is a result of an increase in planned quantities.

Prepared by or under the supervision of: Spencer Lawrence

PUC 1-58
Pre-weatherization barriers

Request:

Please provide a table showing planned vs. actual pre-weatherization budgets for the past 5 program years.

Response:

EnergyWise Single Family

Please see the data below for EnergyWise Single Family pre-weatherization incentives.

Year	Planned	Actual
2022	$188,700	$261,500
2021	$177,300	$283,350
2020	$161,100	$129,80
2019	$153,900	$194,20
2018	$30,000	$141,00

The HEAT Loan can also be used to finance pre-weatherization barrier remediation. Ratepayer funds only go towards the interest rate buy down of the financed amount.

Income Eligible Single Family

For Income Eligible Single Family (IE SF), Low Income Home Energy Assistance Program (LIHEAP) and Weatherization Assistance Program (WAP) funds are generally used to remediate pre-weatherization barriers (PWBs). The Company does not have a clear line of sight into what is spent through LIHEAP and WAP funds, because these funds are administered through the Rhode Island Department of Human Services (DHS)

The IE SF program typically allocates 3% of the program budget to be used as a contingency; this 3% is used on occasion to push forward a project where LIHEAP and/or WAP funds cannot fully remediate or solve the relevant barriers. One example of this would be for electrical repairs due to knob and tube wiring in the attic, which must be remediated before insulation can be installed in the attic. However, these costs typically show up as "General Labor" or "General Repair" in our records, because the Company's data systems are set up to track traditional energy efficiency measures that have direct energy benefits, as opposed to pre-weatherization barriers.

PUC 1-59
Pre-weatherization barriers

Request:

On Bates page 242, the Company writes "in 2022, the Lead Vendor began including more information on addressing pre-weatherization barriers for customers who face these constraints. This includes information on types of contractors to call… and information on available grants and loans." Please provide a copy of those informational materials that describe the grants and loans available for remediating pre-weatherization barriers.

Response:

Please see Attachment PUC-1-59-1. This table lists available pre-weatherization grants and was distributed to the Energy Specialists in the EnergyWise Single Family program to serve as a resource at the time of their assessment.

Please reference Attachment PUC 1-59-2 (Home Energy Action Report) and Attachment PUC 1-59-3 (Weatherization Barrier Incentive), which are provided to customers in the EnergyWise Single Family program and are relevant to pre-weatherization barriers.

Prepared by or under the supervision of: Spencer Lawrence

Sources of Remediation Grants

Useful links available at: https://www.hud.gov/states/rhode_island/homeownership/homerepairs

Grant Available	Program Administrator	Details	Eligibility	Grant/Loan Amounts	Loan Terms	Website
Single Family Housing Repair Loans & Grants in Rhode Island (Section 504 Home Repair program)	U.S. Department of Agriculture	Provides home repair loans to low income homeowners. Measures taken to improve health and safety outcomes of the homes are included.	Low income homeowners	Maximum loan is $40,000, maximum grant is $10,000. They can be used together.	1% interest for 20 years	https://www.rd.usda.gov/programs-services/single-family-housing-programs/single-family-housing-repair-loans-grants/ri
203(K) Rehab Mortgage Insurance	U.S. Department of Housing and Urban Development	This assistance provides insurance for mortages that cover both the home and the cost of rehabilitation.	Not specified	Must be greater than $5,000		https://www.hud.gov/program_offices/housing/sfh/203k/203k--df
Homeowner Renovation Loans/203(k)	RI Housing Department	Available for health and safety standards. List of vendors available here https://www.rihousing.com/buyers/participating-lenders/	Not specified	Loan amount must be under FHA maximum loan amounts (mortgage total limit for 2022 is $647,200)		https://www.rihousing.com/first-time-homebuyer-renovation-mortgage-203k/
Residential Rehabilitation Program	Cranston Department of Community Development	Partial grant loan program provides up to 50% of the rehabilitation work up to $7,500. The rest is provided by a loan.		Grant up to $7,500	Loan amount is either 2% for families with a median income not above 80% or 0% for families below 50% median income. Loan term is 15 years.	https://www.cranstonri.gov/departments/community-development/default.aspx
Home Improvement Packet	City of East Providence	Provides assistance for single or multifamily homeowners if household income is below 80% of the area's median income adjusted for household size. The grant is available for multifamily homes, but only if at least 50% of the units are income eligible.	Single family homes and multifamily homes if at least half the units are income eligible	Funding caps: Single family: $35,000 2-family: $40,000 3-4 family: $50,000	Two options for homeowners: 1. 0% interest nonrecourse deferred payment loan 2. 60/40 Loan, where 60% of the loan amount has a 3% interest rate over 10 years, and the remaining 40% has a 0% interest deferred payment loan and becomes a grant after 10 years if the 3% loan is paid in full For rental property owners, they quality for a 3% interest rate loan for 10 years	https://eastprovidenceri.gov/departments/community-development/home-improvement-program
Housing Rehabilitation Program	Town of Lincoln Housing Department	Two grants available for rehabilitation on a first come first serve basis (preference given to low-income/elderly but not limited to them)	All, preference given to low-income and elderly	1. 100% grants for low-income home owners. Maximum amount is $10,000 per year and applicants are limited to grants once every five years. 2. 50% grants for home owners. Maximum grant amount is $10,000 once every five years		https://www.lincolnri.org/departments/list/housing.php
Home Investment Partnership Program	City of Providence Division of Housing and Community Development	Funds can be used for site improvements	1-4 single family homes Condos Group homes Rental unit housing Transitional housing Permanent supportive housing	Minimum assistance is $1,000 per assisted unit. Maximum amount varies by number of bedrooms. Max for 4+ bedrooms is about $300,000. 0% interest loans. For low income housing, funds may be provided as amortized debt	0% interest loans. For low income housing, funds may be provided as amortized debt.	https://www.providenceri.gov/planning/community-development/
Home Repair Program	City of Providence Division of Housing and Community Development	Funds can be used for "serious deficiencies" that threaten the health or safety of the home	Available for income eligible owner-occupied single family or multifamily residential homes	Up to $25,000 loan	0% interest, deferred payment loan. Loan is payable and due upon sale of the residence.	https://www.providenceri.gov/planning/community-development/
Woonsocket Safe at HOME Rehab Program Single Family	Woonsocket Housing and Community Development	Loans to fund upgrades for complying with the RI State Property Mainentance Code	For income-eligible, owner-occupied single family homes	Up to $30,000 for single family	For single family, 0% interest loan that will be 50% forgiven and 50% deferred. It is forgiven after a period of affordability, and the owner must pay back the other half when the property is sold.	https://www.woonsocketri.org/housing-and-community-development/pages/woonsocket-housing-assistance-programs https://www.woonsocketri.org/sites/g/files/vyhlif5231/f/uploads/_safeathome_rehab_oosf_app_1-6-22_003.pdf
Woonsocket Safe at HOME Rehab Program Multi Family	Woonsocket Housing and Community Development	Loans to fund upgrades for complying with the RI State Property Mainentance Code	Owner-occupied multi-family properties. Households must qualify as low-income.	Up to $20,000 per unit for a max of $80,000	0% loan, half of which is forgiven and the other half is deferred. Loans are forgiven after an affordability period based on how long the owner agrees to maintain affordable housing units	https://www.woonsocketri.org/housing-and-community-development/pages/woonsocket-housing-assistance-programs
Community Development Glock Grant	Pawtucket Department of Planning and Redevelopment (funds are from HUD)	Can be used for a variety of purposes including rehabilitation of privately owned and publicly owned homes, lead reduction/clearance, code enforcement, etc	Gross annual household income must be 80% of the median income set by HUD	Not specified; the City will receive about $1.8 million for July 2022 through June 2023.	n/a	https://pawtucketri.com/planning-redevelopment/community-development-block-grant

Home Energy Action Report

Rhode Island Energy™
a PPL company

888-633-7947 | EnergyWiseInfo@RISEengineering.com

CLIENT # 000000
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401-479-0631

This action plan was developed for you through Rhode Island Energy's EnergyWise Program. The program is designed to increase comfort while reducing energy usage and bills. For more information about the EnergyWise Program please call us at 888-633-7947 or visit our Web site at www.rienergy.com.

Your Energy Specialist has evaluated your home for opportunities to make it more comfortable, efficient, durable, healthful, and affordable. Our recommendations have been tailored specifically to your home, based, when possible, on your actual energy consumption from your utility bills. Each recommended measure is presented with a description, its cost, and an estimate of the savings that could be realized.

The EnergyWise Program urges you to take action on these recommendations, and start living more efficiently and comfortably today.

energy HOME PERFORMANCE WITH ENERGY STAR

Working to deliver whole-house energy savings to improve comfort and help protect the environment.

Money-Saving Improvements

Rhode Island Energy™
a PPL company

Weatherization Barriers

The following issues concerning the health and/or safety of your home have been identified by your Energy Specialist. For your safety, these will need to be addressed before you add insulation and other weatherization measures to your home.

Rhode Island Energy offers incentives and 0% financing towards offseting your expense to repair most of these pre-weatherization issues. We have noted when they are applicable.

CRAWLSPACE HEIGHT RESTRICTION

Your home's crawlspace cannot be safely accessed to cover the earthen areas with a vapor barrier, due to height restrictions. Consequently, all planned weatherization measures in the other areas of the home will need to be put on hold until the proper control of the crawlspace humidity is addressed.

Contact a general contractor to address the issue.

VERMICULITE HAZARD

We have noted the presence of vermiculite insulation in your home which might contain asbestos fibers, a known carcinogen. Weatherization work cannot proceed in the areas of your home with vermiculite until it is removed.

You might be eligible to be reimbursed up to 55% with a maximum reimbursement amount of $4,934 from the Zonolite Attic Insulation Trust. For more information, please see: www.zonoliteatticinsulation.com

Contact an asbestos abatement contractor to address this issue. For a list of in-state asbestos contractors go to: www.health.ri.gov/find/asbestos and select Find - Abatement Contractors

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CARBON MONOXIDE HEATING SYSTEM

We have detected elevated levels of carbon monoxide (CO) gas in the exhaust of your heating system. Elevated carbon monoxide levels inside a home are dangerous and potentially deadly. To address this issue, call a contractor to repair or replace the system and retest it to be sure that the undiluted flue gasses do not exceed 400 parts per million (ppm) air-free carbon monoxide.

Weatherization work cannot proceed until this is fixed. You can use the $250 Weatherization Barrier Incentive towards the cost to professionally evaluate and remediate the high carbon monoxide levels.

Call your HVAC contractor to address this issue.

CARBON MONOXIDE - OVEN 225ppm

We have detected levels of carbon monoxide (CO) gas in the exhaust of your oven at over 225 parts per million, which is dangerous and potentially deadly. To address this issue, have the oven tuned up and retested. If levels continue to exceed 225 ppm, a range hood that is vented to the outdoors should be present and capable of 100 cfm air flow.

Weatherization work cannot proceed until this is fixed. There is a $250 Weatherization Barrier Incentive you can use toward the cost to professionally evaluate and remediate the high carbon monoxide levels.

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CARBON MONOXIDE - WATER HEATER

We have detected elevated levels of carbon monoxide (CO) gas in the exhaust of your water heating system. Elevated carbon monoxide levels inside a home are dangerous and potentially deadly. To address this issue, call a contractor to repair or replace the system and retest it to be sure that the undiluted flue gasses do not exceed 400 parts per million (ppm) air-free carbon monoxide.

Weatherization work cannot proceed until this is fixed. You can use the $250 Weatherization Barrier Incentive towards the cost to professionally evaluate and remediate the high carbon monoxide levels.

Call your HVAC contractor to address this issue.

ELECTRICAL HAZARD

We have identified a hazardous condition which may cause electrical shock or fire. Remediation is necessary for continuing with weatherization work and for ensuring the health and safety of your home.

Contact your own electrician to address this issue, or RISE can arrange an electrician to fix the issue before the insulation is installed. Please let your Energy Specialist know how you would like to proceed.

GAS LEAK

We have detected a gas leak in your home, which is a very serious matter. Please contact your natural gas utility's Gas Leak center, immediately, at 800-640-1595 to address this issue.

Weatherization work cannot proceed until this is repaired.

INDOOR AIR QUALITY

Based on the size, style and age of your home, we estimate the amount of natural ventilation (fresh air movement) in your home is not sufficient enough to withstand the additional tightening up from the weatherization work we are recommending. When a home is under-ventilated, it impacts the safety of the indoor air quality by increasing the exposure to indoor air contaminants. Additionally, under-ventilation contributes to higher moisture levels which impact your home's long-term durability.

Based upon standards set by ASHRAE (American Society of Heating Refrigeration and Air Conditioning Engineers) we

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recommend you consider installing a controlled ventilation source capable of providing a continuous exhaust of (0) cfm (cubic feet per minute) to help remove the pollutants and increase the natural ventilation of fresh air. A mechanical ventilation system can either be a dedicated whole-house ventilation source such as an HRV (heat recovery ventilator), an ERV (energy recovery ventilator), or the addition of automated controls (Smart Switch) on a new or existing bathroom or kitchen exhaust fan.

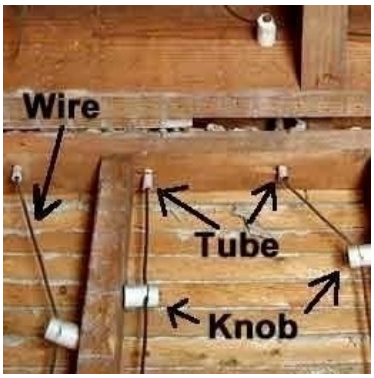
The mechanical ventilation must be in place before the insulation can be scheduled.

KNOB & TUBE WIRING

We have identified the potential existence of knob and tube wiring in your home. This wiring might be active and, if it were covered by insulation, it could over-heat and become a hazard.

Do not add insulation until first having a licensed electrician ensure the knob and tube wiring is no longer active in the area to be insulated.

You can finance up to $10,000 of the expense to fix your home's Knob & Tube wiring using the 0% fnancing. You are also eligible for a $250 Weatherization Barrier Incentive towards the cost to professionally evaluate and/or remediate the Knob & Tube wiring.



UNVENTED APPLIANCE

Your home currently has an unvented combustion appliance in the living space. In addition to the dangerous combustion byproducts, vent-less combustion appliances also release significant amounts of water vapor into the air, which increases indoor humidity levels.

This appliance needs to be removed or properly vented out of your home before weatherization work can proceed.

Call an HVAC contractor to general contractor to address this issue.

DEPRESSURIZATION HAZARD

We performed a draft test on the heating system and/or water heater in your home, which is done by running all the exhaust equipment (bathroom and kitchen fans, clothes dryer, any AC air handlers) to create the most negative air pressure possible. In doing so, we found there is a strong potential your home would have an insufficient draft (air pressure) to move the flue gases up the chimney to properly vent these fumes outside, if you were to go forward with any of our weatherization recommendations.

Weatherization work cannot proceed until this is fixed. You can use the $250 Weatherization Barrier Incentive towards the cost to professionally evaluate and remediate this problem.

Call an HVAC contractor to address this issue.

Money-Saving Improvements

Rhode Island Energy™
a PPL company

INDOOR AIR QUALITY

Diagnostic tests indicate your home cannot withstand weatherization work due to insufficient natural ventilation (fresh air movement) which increases your exposure to indoor air contaminants and contributes to higher moisture levels in your home.

To achieve the energy savings we have outlined in this Action Plan, your home would require a controlled ventilation source able to provide a continuous exhaust of 0 cfm (cubic feet per minute) to help remove the pollutants and increase the natural ventilation of fresh air.

Hire a licensed electrician or HVAC contractor to install an exhaust fan, which must be in place before the insulation can be scheduled.

RISE can install a Fantech FR100 Inline exhaust fan with a variable output of 0-110 cfm. This fan would be installed in your attic by a licensed RISE electrician and ducted to the ceiling with a 4" discreet spot vent. Upon the completion of your weatherization work, RISE will assess the amount of airflow your home requires and adjust the settings to provide continuous operation at that level.

Installed Cost: $600 Incentive: $450 Net Cost: $150

INOPERABLE HEATING SYSTEM

Your heating system was inoperable at the time of our inspection. We will need to perform a complete combustion safety test on your system before moving forward with any weatherization work.

Call an HVAC contractor to address this issue.

Once your heating system is operable, please contact RISE to schedule the combustion safety test.

Money-Saving Improvements

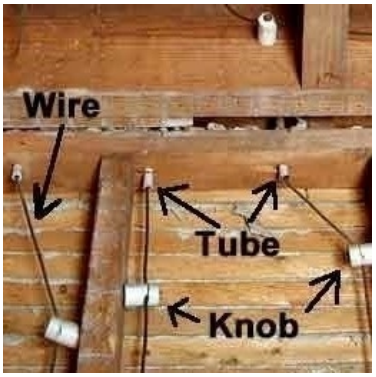
Rhode Island Energy™
a PPL company

KNOB & TUBE WIRING

The knob and tube wiring we identified in your home appears to be inactive. A licensed electrician will need to verify the knob and tube wiring is inactive before insulation can be installed.

A RISE licensed electrician can conduct an evaluation of the knob and tube wiring.

Cost: $250 Incentive: $250 Net Cost: $0



MOISTURE

We have recognized conditions related to moisture which can adversely affect health, comfort and building durability.

Please refer to the EPA's Guide to Moisture for guidance.

Contact a general contractor to address this issue.

MOLD AND/OR MILDEW

Our inspection of your home has revealed what appears to be a mold or mildew-like substance. Weatherization work cannot proceed in your home until the mold and/or mildew-like substance is removed. Please refer to the EPA's Guide to Mold for guidance.

Contact a mold removal contractor to address this issue.

You can finance up to $4,000 of the expense for mold abatement using the 0% financing.

NAILED WALL PANELS

Some of your home's interior wall sheathing was fastened with nails, instead of screws, and consequently would not be able to withstand the pressure from adding blown-in wall insulation.

Contact a general contractor to address this issue.

Once you have these walls secured with screws, contact RISE to schedule the weatherization work.

Money-Saving Improvements

Rhode Island Energy™
a PPL company

PEST INFESTATION IN ATTIC

We have identified the presence of a pest infestation in your attic, which would pose a biohazard to our installers. Contact an exterminator to address this issue.

Once this is removed, please contact RISE to schedule the weatherization work.

COMBUSTION GAS SPILLAGE

We have determined that under certain conditions your combustion appliance(s) spill dangerous exhaust gases into the air in your home.

Weatherization work cannot proceed until this is fixed. You can use the $250 Weatherization Barrier Incentive towards the cost to professionally evaluate and remediate this problem.

Contact an HVAC contractor to address this issue.

INDOOR AIR QUALITY

Diagnostic tests indicate your home cannot withstand weatherization work due to insufficient natural ventilation (fresh air movement) which increases your exposure to indoor air contaminants and contributes to higher moisture levels in your home.

To achieve the energy savings we have outlined in this Action Plan, your home would require a controlled ventilation source able to provide a continuous exhaust of 0 cfm (cubic feet per minute) to help remove the pollutants and increase the natural ventilation of fresh air.

To address this issue, hire a licensed electrician or HVAC contractor to install a new Smart Switch to replace your existing on/off switch. The Smart Switch would allow your existing bath exhaust fan to run continuously to provide better indoor air quality. This switch would need to be installed before the insulation can be scheduled.

Estimated Installed Cost: $200 This installation is eligible for the Weatherization Incentive of up to $250, as long as insulation is being installed.

Money-Saving Improvements

Rhode Island Energy™
a PPL company

Attic Ventilation

Proper attic ventilation consists of a balance between low air intake (at the eaves, soffits, or fascia) and high air exhaust (at or near the roof ridge, including the gable ends). In situations where low intake ventilation cannot be achieved, more high exhaust ventilation can be added.

Attic ventilation is an important component of proper weatherization. While attic ventilation alone will not eliminate moisture issues, prevent ice damming, or lower your air conditioning costs, it can reduce these issues when completed in conjunction with proper air sealing and increased insulation.

Additional ventilation should not be added to an under-insulated attic. Incentives for ventilation measures are only available when attic weatherization is simultaneously being installed.

The following recommendations are for the proper ventilation of your home's attic(s).

RIDGE VENTILATION

Your roof has a ridge vent at the peak to allow upper ventilation of your attic. Unfortunately, the roof sheathing was not cut back to allow the air to move out through the ridge vent.

Your roof might be under warranty, consider reaching out to your roofing contractor to get this fixed.

ATTIC VENTILATION

Your home would benefit from the professional installation of attic ventilation. Proper attic ventilation balances high air exhaust (at or near the roof ridge, gable vents) with low air intake (at the eaves, soffits, fascia and drip edge). Talk to your roofing contractor about the best options available for your home.

Weatherization work cannot begin until proper ventilation is in place.

Special Offers and Your Next Step

Rhode Island Energy™
a PPL company

Now that you have an Action Plan for the weatherization of your home, Rhode Island Energy can help you take the next step. Some of your recommended measures might be eligible for an Energy Efficiency Incentive from the EnergyWise Program and if so, they are noted within the report.

Use an EnergyWise approved contractor to install any or all of the recommended weatherization measures and you could receive an incentive of 75% or more off the cost of the insulation work up to $4,000, and 100% off the cost of air sealing, per calendar year.

YOUR NEXT STEPS:

- Sign your contract for the work you want completed.
- Send the paperwork back to RISE via email, fax, or mail.
- Fix any barriers identified on your contract.

ONCE RISE RECEIVES YOUR PAPERWORK:

- RISE will contact you to schedule a convenient date and time to have the work completed.
- The weatherization work will be scheduled within 2-3 weeks after contacting you.
- Once the work is completed, RISE will contact you to schedule a final review of the work.
- Once your home passes final review, RISE will mail you an invoice for final payment.
- CMC Energy Services, an outside quality assurance contractor hired by Rhode Island Energy, may also contact you to conduct a review of your weatherization process.

Now that we have identified the ways that you can save energy, reduce expenses, and increase your comfort, take the time in the next week to review this action plan. If you need assistance in this process, please call our office or, contact your Energy Specialist listed at the top of this Action Plan.

With Rhode Island Energy's assistance, your home can become more comfortable while saving you energy.

Your Energy Efficiency Team,
RISE
1341 Elmwood Avenue
Cranston, RI 02910
401-784-3700
401-784-3710 fax
EnergyWiseInfo@RISEengineering.com

You have the option to contract directly with any of the independent installation contractors that appear on the list of approved contractors provided with this Action Plan. Or, you may sign a contract with your Energy Specialist and we will assign your work to one of these qualified contractors.

Rhode Island

Weatherization Barrier Incentive

Rhode Island Energy™
a PPL company

Based on your Energy Specialist's recommendations, your home can benefit from insulation and/or air sealing improvements. Before moving forward, please follow all the instructions below to remediate your weatherization barriers.

CUSTOMER INSTRUCTIONS

1. Hire a qualified, licensed contractor to evaluate and/or remediate the weatherization barrier(s).
2. **Submit signed and completed copies of this form and a copy of the paid contractor invoice(s)** within 60 days of your Home Energy Assessment to: **Weatherization Barrier Incentive, c/o RISE**
   1341 Elmwood Ave, Cranston, RI 02910
   or email to EnergyWiseInfo@RISEengineering.com
3. The weatherization barrier incentive will be deducted from the customer co-payment amount of the weatherization work. A rebate check will be issued in the event the amount exceeds the customer's co-payment amount.
4. Complete the recommended weatherization improvements.

CUSTOMER INFORMATION

Customer Name:	Client # :		
Ima Test-Landlord	000000		
Site Address:	**City:**	**State:**	**Zip:**
123 Main Street	Cranston	RI	02910
Phone Number:	**Email:**		
401-290-8444	ebarrett@RISEengineering.com		
Customer/Homeowner Signature:	**Date:**		

☑ A. KNOB AND TUBE WIRING

To determine if there is any active knob and tube wiring, the contractor will evaluate the following areas where eligible weatherization recommendations have been made:

■ Attic ☐ Slopes ☐ Attic Floor ☐ Kneewall Floor ■ Exterior Walls ☐ Basement ☐ Other(s): _____

For Contractor:

☐ I have performed my inspection and determined there is no active knob and tube wiring in the areas selected below.

☐ Attic ☐ Slopes ☐ Attic Floor ☐ Kneewall Floor ☐ Exterior Walls ☐ Basement ☐ Other(s): _____

☐ I have read and agree to the Terms and Conditions on page 4 of this form.

Contractor Name:

Address: | City: | State: | Zip:

Company Name: | License Number:

Contractor Signature: | **Date:**

☐ B. MECHANICAL SYSTEM BARRIERS (To be filled out by licensed contractor.)

Incentives available for evaluations and system corrections only. Full equipment replacements do not qualify for the weatherization Barrier Incentive. However, there may be other rebates available for equipment replacements.

High Carbon Monoxide: Contractor is to service and re-evaluate the selected mechanical system(s) and reduce the carbon monoxide level, as measured in the undiluted flue gas, to below 100 parts per million (ppm).

Draft Failure: Contractor is to correct the draft in the selected flue(s). Refer to table on page 4 for acceptable draft ranges.

	High Carbon Monoxide		Draft Failure	
	Existing CO ppm:	Revised CO ppm:	Existing Draft:	Revised Draft:
Heating System				
Water Heater				
Other				

Spillage: Contractor is to correct the spillage of flue gases in the selected mechanical system(s). Must not spill after 60 seconds of operation.

☐ Heating System ☐ Water Heater ☐ Other:_____

☐ I have performed my inspection and have corrected the items noted in the areas selected above.

☐ I have read and agree to the Terms and Conditions on page 4 of this form.

Contractor Name:

Address: | City: | State: | Zip:

Company Name: | License #:

Contractor Signature: | **Date:**

☐ C. VENTILATION

Exhaust Fan for Fresh Air: Contractor to install bath exhaust fan to provide measured, continuous or intermittent whole building ventilation. The required rate of flow must be capable of providing _____ CFM (measured at fan).

For Contractor:

☐ I have installed an exhaust fan to the specifications noted above.

☐ I have read and agree to the Terms and Conditions on page 4 of this form.

Contractor Name:

Address: | City: | State: | Zip:

Company Name: | License #:

Contractor Signature: | **Date:**

☐ D. IC RATED RECESSED LIGHT CONTRACTOR EVALUATION

During your Home Energy Assessment, recessed light fixtures were noted by your Energy Specialist in the areas where insulation is being recommended. If you decide to have these fixtures covered by insulation, a Rhode Island licensed electrician must certify the fixtures are insulation contact (IC) rated.

An electrician's certification is not required if you choose not to have the recessed lighting covered with insulation. In this case, the recessed lights will be left exposed.

You will receive 100% of the cost (up to $250) to evaluate and replace ten (10) or more non-IC rated recessed lights with IC rated models. The incentive amount will be deducted from the customer co-payment amount of the weatherization contract. A rebate check will only be issued in the event that the incentive amount exceeds the customer co-payment amount.

Energy Specialist Evaluation

Name: ISAIAH GONSALVES | Phone Number: 401-479-0631 | Email: igonsalves@RISEengineering.com

IC rated recessed light verification is needed in the following areas:

☐ Open attic ☐ Enclosed floor cavity ☐ Enclosed interior slope ☐ All recessed lights

Notes: _____

Electrician's Certification

Company Name: | Electrician's Name: | License #:

Address: | City: | State: | Zip:

Phone Number: | Email:

I have performed an inspection of the lighting fixtures and have verified that all recessed lights are IC rated in the following areas:

Open attic	Enclosed floor cavity	Enclosed interior slope	All recessed lights
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

The licensed electrician is responsible for properly identifying the specific locations of all IC rated and non-IC rated lighting in the area(s) being insulated. Failure to do so will make this form invalid.

Electrician Signature: | Date:

TERMS AND CONDITIONS

Eligibility Requirements: These Terms and Conditions may be changed or the offer(s) may be terminated by Rhode Island Energy at anytime without notice. Applicant must (1) be a residential customer of Rhode Island Energy, (2) must participate in the Rhode Island Energy Energy*Wise* Home Energy Assessment Program, and (3) must be a resident or owner of a 1-4 family home. The qualifying barrier must be identified at the time of the Home Energy Assessment as a barrier preventing the installation of proposed weatherization improvements. **Customer must complete the recommended weatherization improvements to receive the applicable incentive. Customer must submit the completed Contractor Evaluation Report including a copy of the dated and itemized invoice from the licensed contractor on company letterhead postmarked within 60 days of the Home Energy Assessment. If contractor invoice is not provided within 60 days, the applicable weatherization barrier incentive may be forfeited.** Customer participation does not guarantee the barrier will be cleared.

Application Form: This application must be filled out completely, truthfully and accurately. The customer must date and submit the completed application along with all required documentation for specific rebates. By submitting the rebate application, the customer agrees to abide by these Terms and Conditions.

Contractor Responsibilities and Acknowledgement: In performing any work in connection with the Weatherization Barrier Incentive (as set forth in detail below), the contractor shall: (i) abide by all local, state and federal guidelines, applicable laws (including, but not limited to all applicable environmental laws), building codes, regulations (including, but not limited to EPA Lead Safe and any and all other applicable environmental regulations) and licensing requirements; and (ii) stop work and immediately notify the customer in any case where existing or possible health and/or safety problems exist. The contractor must complete the testing results in the appropriate place on this form and provide their signature. Contractor shall remain solely and fully responsible for their confirmations and notes that they provide on this form and with respect to the Contractor Responsibilities set forth above.

A. Knob & Tube Wiring Evaluation (up to $250 incentive): The knob and tube wiring that has been noted cannot be determined inactive at the time of the Home Energy Assessment performed by the Energy Specialist. Even if the observed wiring appears to be inactive, there might still be active circuits located in inaccessible areas of the home (i.e. walls, etc.). The Rhode Island Energy Energy*Wise* Program requires that a licensed electrician verify the absence or inactivity of the knob and tube wiring in the areas of your home where we are proposing insulation be installed. We advise you to share this form with your electrician before hiring them to inspect your home to ensure they agree to the terms. The Energy*Wise* Program will rely on the electrician's certification and will not be liable if inaccurate.

B. Mechanical System Evaluation (up to $250 incentive): Combustion safety testing has been conducted on all the heating and water heating equipment (also known as "mechanical systems") in this home. These tests are conducted with all the exhaust equipment running simultaneously, creating a "worst-case" depressurization of the building. If a problem was identified, repairs to correct the problem must be completed by a qualified HVAC contractor. Any and all mechanical system barriers are considered one barrier, which is eligible for an incentive of up to $250. The problems and corrections are as follows:

1. Carbon monoxide levels exceed 100 ppm in the undiluted flue gases. After a clean and tune, or other applicable service, the measurement(s) of undiluted flue gas of carbon monoxide are to be recorded on page 2 of this Contractor Evaluation Report where program rules state the maximum allowable concentration is 100 ppm.
2. During your Home Energy Assessment it was discovered that the identified mechanical system(s) was continuously spilling exhaust gases into the home. This condition is also known as back draft and should end within 60 seconds of system operation in order to be considered acceptable. The contractor must service the system(s) to correct the spillage problem in the selected flue(s), and certify by signature on page 2 of this form that the spillage condition has ceased after 60 seconds of operation.
3. During your Home Energy Assessment it was discovered that the identified mechanical system(s) are not creating sufficient draft. This condition is where exhaust gases are not moving through the chimney at a fast enough rate. The contractor must service the system(s) to correct the draft problem in the selected flue(s). New draft results must be provided on the front of this form and within acceptable draft ranges as described in Table 1.

Table 1 - Acceptable Draft Test Ranges

Outside Temp (°F)	Minimum Draft Pressure (Pa)
<10	-2.5
10-90	(outside Temp/40) -2.75
>90	-0.5

C. Exhaust Fan Installation (up to $250 incentive): Our testing may determine that your home will need an increase in fresh air flow before undertaking any further weatherization work. Rhode Island Energy provides a weatherization barrier incentive for the installation of an exhaust fan to provide this additional air flow. Your Energy Specialist will calculate the necessary flow rate and provide recommendations.

D. IC Rated Recessed Lights:

Certification: The electrician's sign-off is not necessary in order to move forward with most program-eligible work. It only needs to be completed if the homeowner would like insulation to be blown over and in contact with existing recessed lighting fixtures in the areas designated by the Energy Specialist.

Insulation Contract: Your Energy Specialist has specified on your insulation contract to add "damming" material around your existing recessed lights to keep any new insulation from coming in contact with the impacted recessed lighting. If your electrician signs this form to certify the recessed lights are IC rated, then your contract will be revised to have this line item removed.

Liability: Due to the liability involved with signing this type of form, we suggest you show or describe this form to your Rhode Island licensed electrician prior to hiring him/her, to be sure he/she is willing to sign it. RISE Engineering and Rhode Island Energy's Energy*Wise* Home Energy Assessment Program will rely on the licensed electrician's determination and certification and will not be liable if it is inaccurate.

These Terms and Conditions may be changed or the offer(s) may be terminated by Rhode Island Energy at anytime without notice.

PUC 1-60
Pre-weatherization barriers

Request:

On Bates page 244, the Company writes "the Company is considering using energy efficiency funds to address pre-weatherization barriers on a project-by-project basis or program-by-program basis so long as the project or program remains cost-effective." Regarding this statement, please explain the following:

a. Please describe this "project-by-project basis or program-by-program" funding strategy in greater detail. How does the Company plan on executing a case-by-case funding strategy for the remediation of pre-weatherization barriers?

b. How will customers be made aware of "project-by-project basis or program-by-program" funding for pre-weatherization and their ability to qualify for such ad hoc funding?

c. Does the proposal to disburse pre-weatherization funding on a "project-by-project basis or program-by-program" basis apply to the pre-weatherization funding included in the 2024 Plan budget, or is the Company proposing to start the "project-by-project basis or program-by-program" disbursement of pre-weatherization funding after 2024?

d. Is the Company proposing to deny pre-weatherization funding to a single project if it is determined that including such funding in the total cost of the project would make the project no longer cost-effective? If yes, explain who would make this determination and when the determination would be made. If no, please clarify what the Company means by "so long as the project or program remains cost-effective."

Response:

a. The Company does not have details regarding a funding strategy at this time. The proposal to disburse pre-weatherization funding on a "project-by-project basis or program-by-program" basis was conceptual in nature and would therefore not apply to the pre-weatherization funding included in the 2024 Plan budget. The Company's reference on Bates page 244 to "project-by-project" or "program-by-program" strategies was only intended as possible approaches under consideration. In continuing to assess and analyze the problem of pre-weatherization barriers (PWBs), it is clear to the Company that these are very complicated issues with many obstacles. While the Company does not have a specific "project-by-project" or "program-by-

program" proposal, it intends to continue to analyze the issues surrounding PWBs and work to find solutions.

b. Please see the Company's response in (a).

c. Please see the Company's response in (a) regarding the Company's reference to "project-by-project" or "program-by-program" strategies. The Company's 2024 Plan budget does include funding for addressing pre-weatherization barriers (PWBs) in some homes, especially where it can help to ensure the equitable distribution of program benefits to households with high energy barriers. However, this would be a continuation of standard and historical approaches to PWBs. The proposal to disburse pre-weatherization funding on a "project-by-project basis or program-by-program" basis was conceptual in nature and would therefore not apply to the pre-weatherization funding included in the 2024 Plan budget.

d. Please see the Company's response in (a). These ideas were conceptual in nature and due to further analysis, it is clear that the problem is a complex one which requires further analysis as well as collaboration with third parties.

PUC 1-61
Benefit Cost Analysis

Request:

In Schedule A, Attachment 1, the Company provides the results of its cost-effectiveness tests for the 2024-2026 Three-Year Plan after performing a sensitivity analysis for benefits that are shared between Rhode Island Energy and other jurisdictions vs. benefits that are only allocated to Rhode Island Energy, consistent with section 1.3.C.ii of the Least Cost Procurement Standards adopted in Docket No. 23-07-EE. Below each of the tables that presents the results of the "intrastate" cost-benefit analysis (on Bates pages 121, 123, and 125) is a note that reads "Rest-of-Pool DRIPE and PTF transmission are excluded from the "total benefit" column." Please explain how the Company determined it was appropriate to exclude those two benefit categories for purposes of the sensitivity analysis and provide the methodology used by the Company to calculate the specific value to exclude.

Response:

The Company reviewed all of the benefits categories described in Attachment 4 and determined that it was appropriate to exclude Rest-of-Pool DRIPE and PTF Transmission as benefits shared with other jurisdictions. Rest-of-Pool DRIPE is by definition distinct from intrastate RI DRIPE and PTF Transmission represents regional transmission costs. As such, efficiency achievements in Rhode Island that create these benefits are shared with other jurisdictions. The Company confirmed this determination with the Consultants representing the EERMC.

Rest-of-Pool DRIPE and PTF Transmission are separate and unique benefit streams identified by the Avoided Energy Supply Components in New England: 2021 Report" (2021 AESC Study), thus they are easily isolated in the Company's benefit cost model, enabling the presentation referenced in the question.

Prepared by or under the supervision of: Brett Feldman

PUC 1-62
Benefit Cost Analysis

Request:

Comparing Table E-6B to Table E-6 in the 2024 Annual Electric Efficiency Plan, please confirm that the accuracy of the following interpretation: the Company proposes that the total benefits of the 2024 Electric portfolio that will be allocated to Rhode Island Energy (on behalf of its customers) are roughly $27 million less than the total benefits that will be delivered into the New England region.

Response:

The Company confirms the accuracy of the interpretation stated in the request, that the total benefits of the 2024 Electric portfolio that will be allocated to Rhode Island Energy (on behalf of its customers) are roughly $27 million less than the total benefits that will be delivered into the New England region.

Prepared by or under the supervision of: Brett Feldman

PUC 1-63
Benefit Cost Analysis

Request:

Table 12 on Bates page 226 categorizes "non-embedded carbon" benefits as electric utility system benefits and allocates 100% of their value to the electric PIM calculation. Such categorization and PIM benefit allocation is inconsistent with Table E-8A on Bates page 411, which indicates that 0% of carbon benefits are allocated to the PIM calculation. Please reconcile this inconsistency.

Response:

Table 12 on Bates page 226 is incorrect in identifying "non-embedded carbon" benefits as electric utility system benefits, and Table E-8A on Bates page 411 is correct. The Company can confirm that 0% of carbon benefits are allocated to the PIM calculation in Table E-8A and no correction to the calculation is needed. The Company will file an updated Table 12 to reflect this correction.

Prepared by or under the supervision of: Brett Feldman

PUC 1-64
Benefit Cost Analysis

Request:

On Bates page 363, the Company estimates non-PTF capacity value as $11.89/kW-yr and explains that it developed this estimate "using the ICF model." Please provide the underlying workpapers and calculations to support this estimate.

Response:

Please see Attachment PUC 1-64 for the calculations of the non-PTF transmission capacity value.

Prepared by or under the supervision of: Brett Feldman

Rhode Island Energy - Non-PTF Transmission Marginal Avoided Cost Model

Introduction

This workbook calculates non-PTF transmission marginal avoided costs using three primary items: the incremental investments into non-PTF transmission systems, the carrying charge of these systems, and the incremental growth in peak demand.

Definitions

Acronym	Unabbreviated Term
NEP	New England Power
NECO	Narragansett Electric Company

Color Key for Subsequent Tabs

Input
Calculation 1
Calculation 2
Calculation 3
Calculation 4

Inputs

Item	Value	Source
Number of Historical Years	5	User
Number of Forecast Years	6	User
General Inflation	1.3%	2024-26 RI BCR Model
For carrying charge inputs see tabs Trans Carrying Charge and Dist Carrying Charge		
For T&D O&M inputs see tab Appendix		

Summary

Transmission			
Item	**Units**	**Value**	**Source**
Incremental Investments in Transmission Systems Caused by Load Growth	US$	$19,619,381	Trans Invmt
Annual Carrying Charge of Transmission Capital Investments	%/yr	11.8%	Trans Carrying Charge
Transmission Incremental Growth in Peak Demand	MW	195	Peak Growth
Marginal Cost of Non-PTF Transmission Capacity	$/kW-yr	**$11.89**	

Transmission Investment

Item	Units	Nominal Non-PTF NEP and NECO Value	Real Non-PTF NEP and NECO Adjusted Value
Historical Incremental Investments into Transmission Systems	US$	$136,308,458	$129,675,968
Forecast Incremental Investments into Transmission Systems	US$	$101,418,750	$119,168,726
Total Incremental Investments into Transmission Systems	US$	**$237,727,208**	**$248,844,694**
Historical Incremental Investments Caused by Load Growth	US$		$10,223,896
Forecast Incremental Investments Caused by Load Growth	US$		$9,395,485
Total Incremental Investments Caused by Load Growth	US$		**$19,619,381**

Transmission Carrying Charge

Item	Units	NEP Value	NEP Source	NECO Value	NECO Source	Total Value
After Tax Cost of Financing (WACC)	**%**	**6.7%**		**6.7%**		**6.7%**
Share of project financed through debt	%	50.0%	Assumption	50.0%	Assumption	50.0%
Real Interest Rate on Debt	%	3.7%		3.7%		3.7%
Nominal Interest Rate on Debt	%	5.1%	Assumption	5.1%	Assumption	5.1%
Expected After Tax Real Return on Equity	%	10.5%		10.5%		10.5%
Expected After Tax Nominal Return on Equity	%	12.0%	Assumption	12.0%	Assumption	12.0%
State Income Tax Rate	%	0.0%	Adael Acosta, Director, U.S. Indirect and Employment Tax, 8/30/21	0.0%	Adael Acosta, Director, U.S. Indirect and Employment Tax, 8/30/21	0.0%
Federal Income Tax Rate	%	21.0%	FERC Form 1, pages 122-123, Statutory Rate Reconciliation	21.0%	FERC Form 1, pages 122-123, Tax Cuts and Jobs Act	21.0%
Effective State and Federal Income Tax Rate	%	23.8%	FERC Form 1, pages 122-123, Statutory Rate Reconciliation	21.0%		21.7%
Property Taxes Expense	**%**	**0.1%**		**1.6%**		**0.8%**
Total Plant Annual Property (Real Estate) Taxes	MM$	$2.1	FERC Form 1, pages 320-323, line 164, column b	$46.8	FERC Form 1, pages 320-323, line 164, column b	$48.9
Net Book Value of Total Plant	MM$	$3,520.2		$2,916.9		$6,437.1
Insurance Expense	**%**	**0.0%**		**1.9%**		**0.9%**
Total Plant Annual Insurance Costs	MM$	$0.0	FERC Form 1, pages 320-323, line 185, column b	$55.2	FERC Form 1, pages 320-323, line 185, column b	$55.2
Net Book Value of Total Plant	MM$	$3,520.2	FERC Form 1, pages 200-201, line 15, column c	$2,916.9	FERC Form 1, pages 200-201, line 15, column c	$6,437.1
Depreciation Expense (using Sinking Fund Factor Approach)	**%**	**1.4%**		**1.4%**		**1.4%**
Depreciation Life of Transmission Plant	Yr	27	Assumption	27	Assumption	27
Operation and Maintenance Expense	**%**	**0.5%**		**1.9%**		**0.9%**
Annual Transmission Operation and Maintenance Expenses	MM$	$14.1		$17.1		$31.2
Net Book Value of Transmission Plant	MM$	$2,709.4		$919.6		$3,629.0
Electric Plant in Service	$	$3,482,625,130	FERC Form 1, pages 204-207, line 58, column g	$1,136,859,994	FERC Form 1, pages 204-207, line 58, column g	$4,619,485,124
Accumulated Depreciation	$	$773,212,272	FERC Form 1, page 219, line 25, column b	$217,262,822	FERC Form 1, page 219, line 25, column b	$990,475,094
Income Taxes Expense	**%**	**1.4%**		**1.2%**		**1.2%**
Gross up factor for taxes	%	76.2%		79.0%		78.3%
Annual Real Carrying Charge of Capital Investments	**%**	**10.0%**		**14.7%**		**11.8%**

Peak Growth

Item	Units	NECO Value
Total incremental growth in peak demand	MW	195

Appendix: Transmission Operation and Maintenance Cost Avoidable Expenses

Operation Transmission Expenses

Item	Total NEP Value	NEP Source	Total NECO Value	NECO Source	Share Avoidable	Source	Avoidable NEP Value	Avoidable NECO Value	Avoidable Total Value
(560) Operation Supervision and Engineering	$5,434,831	FERC Form 1, pages 320-323, line 83, column b	$1,482,514	FERC Form 1, pages 320-323, line 83, column b	0%	Assumption	$0	$0	$0
(561) Load Dispatching	$7,638,635	FERC Form 1, pages 320-323, lines 85-92, column b	$6,967,034	FERC Form 1, pages 320-323, lines 85-92, column b	0%	Assumption	$0	$0	$0
(562) Station Expenses	$4,325,508	FERC Form 1, pages 320-323, line 93, column b	$383,312	FERC Form 1, pages 320-323, line 93, column b	10%	Assumption	$432,551	$38,331	$470,882
(563) Overhead Lines Expenses	$1,309,456	FERC Form 1, pages 320-323, line 94, column b	$335,880	FERC Form 1, pages 320-323, line 94, column b	20%	Assumption	$261,891	$67,176	$329,067
(564) Underground Lines Expenses	$102,312	FERC Form 1, pages 320-323, line 95, column b	$0	FERC Form 1, pages 320-323, line 95, column b	20%	Assumption	$20,462	$0	$20,462
(565) Transmission of Electricity by Others	$11,386,336	FERC Form 1, pages 320-323, line 96, column b	$75,360,507	FERC Form 1, pages 320-323, line 96, column b	20%	Assumption	$2,277,267	$15,072,101	$17,349,369
(566) Miscellaneous Transmission Expenses	$11,954,710	FERC Form 1, pages 320-323, line 97, column b	$2,234,051	FERC Form 1, pages 320-323, line 97, column b	50%	Assumption	$5,977,355	$1,117,026	$7,094,381
(567) Rents	$2,028,294	FERC Form 1, pages 320-323, line 98, column b	$30,168	FERC Form 1, pages 320-323, line 98, column b	0%	Assumption	$0	$0	$0
Total	$44,180,082		$86,793,466				$8,969,527	$16,294,634	$25,264,161

Maintenance Transmission Expenses

Item	Total NEP Value	NEP Source	Total NECO Value	NECO Source	Share Avoidable	Source	Avoidable NEP Value	Avoidable NECO Value	Avoidable Total Value
(568) Maintenance Supervision and Engineering	$427,723	FERC Form 1, pages 320-323, line 101, column b	$75,530	FERC Form 1, pages 320-323, line 101, column b	0%	Assumption	$0	$0	$0
(569) Maintenance of Structures	$73,815	FERC Form 1, pages 320-323, lines 102-106, column b	-$2,063	FERC Form 1, pages 320-323, lines 102-106, column b	20%	Assumption	$14,763	-$413	$14,350
(570) Maintenance of Station Equipment	$2,357,608	FERC Form 1, pages 320-323, line 107, column b	$319,060	FERC Form 1, pages 320-323, line 107, column b	20%	Assumption	$471,522	$63,812	$535,334
(571) Maintenance of Overhead Lines	$19,306,858	FERC Form 1, pages 320-323, line 108, column b	$3,501,393	FERC Form 1, pages 320-323, line 108, column b	20%	Assumption	$3,861,372	$700,279	$4,561,650
(572) Maintenance of Underground Lines	$3,933,307	FERC Form 1, pages 320-323, line 109, column b	$237,585	FERC Form 1, pages 320-323, line 109, column b	20%	Assumption	$786,661	$47,517	$834,178
(573) Maintenance of Miscellaneous Transmission Plant	$12,650	FERC Form 1, pages 320-323, line 110, column b	$1,597	FERC Form 1, pages 320-323, line 110, column b	50%	Assumption	$6,325	$799	$7,124
Total	$26,111,961		$4,133,102				$5,140,643	$811,994	$5,952,636

Total Transmission Expenses

Item	Total NEP Value	NEP Source	Total NECO Value	NECO Source	Share Avoidable	Source	Avoidable NEP Value	Avoidable NECO Value	Avoidable Total Value
Total Operation and Maintenance Transmission Expense	$70,292,043		$90,926,568				$14,110,169	$17,106,628	$31,216,797

PUC 1-65
Benefit Cost Analysis

Request:

On Bates page 362, the Company estimates the marginal distribution cost (MDC) as $174.41/kW-year. Please provide the underlying workpapers and calculations to support this estimate. Please also explain the specific factors that have caused the MDC to increase from $121.58/kW-year in 2023 to $174.41/ kW-year in 2024.

Response:

Please see Attachment PUC 1-65 for the calculations of the marginal distribution cost (MDC) value.

The driving factor that caused the MDC to increase from $121.58/kW-year in 2023 to $174.41/ kW-year in 2024 was the decrease in the incremental growth in peak demand from 248,947 kW in 2023 to 194,898 kW in 2024. In calculating the MDC, the Company looks at the incremental growth in peak demand across an 11-year analysis period that includes five historical and six forecast years. Between the calculation of the 2023 and 2024 MDC values, the difference between the largest forecast and smallest historic annual peak demands within the 11-year analysis period decreased from 248,947 kW to 194,898 kW when shifting the study period forward by one year.

Prepared by or under the supervision of: Brett Feldman

Rhode Island Energy - Distribution Marginal Avoided Cost Model

Introduction

This workbook calculates distribution marginal avoided costs using three primary items: the incremental investments into distribution systems, the carrying charge of these systems, and the incremental growth in peak demand.

Definitions

Acronym	Unabbreviated Term
NEP	New England Power
NECO	Narragansett Electric Company

Color Key for Subsequent Tabs

Input
Calculation 1
Calculation 2
Calculation 3
Calculation 4

Inputs

Item	Value	Source
Number of Historical Years	5	User
Number of Forecast Years	6	User
General Inflation	1.3%	2024-26 RI BCR Model
For carrying charge inputs see tabs Trans Carrying Charge and Dist Carrying Charge		
For T&D O&M inputs see tab Appendix		

Summary

Distribution			
Item	**Units**	**Value**	**Source**
Incremental Investments in Distribution Systems Caused by Load Growth	US$	$248,654,679	Dist Invmt
Annual Carrying Charge of Distribution Capital Investments	%/yr	13.7%	Dist Carrying Charge
Distribution Incremental Growth in Peak Demand	MW	195	Peak Growth
Marginal Cost of Distribution Capacity	$/kW-yr	**$174.41**	

Distribution Investment

Item	Units	NECO Nominal Value	NECO Real Value
Historical Incremental Investments into Distribution Systems	US$	$554,437,135	$521,961,897
Forecast Incremental Investments into Distribution Systems	US$	$919,712,718	$1,054,958,311
Total Incremental Investments into Distribution Systems	US$	**$1,474,149,853**	**$1,576,920,207**
Historical Incremental Investments Caused by Load Growth	US$		$82,304,905
Forecast Incremental Investments Caused by Load Growth	US$		$166,349,774
Total Incremental Investments Caused by Load Growth	US$		**$248,654,679**

Distribution Carrying Charge

Item	Units	NECO Value	NECO Source
After Tax Cost of Financing (WACC)	**%**	**6.7%**	
Share of project financed through debt	%	50.0%	Assumption
Real Interest Rate on Debt	%	3.7%	
Nominal Interest Rate on Debt	%	5.1%	Assumption
Expected After Tax Real Return on Equity	%	10.5%	
Expected After Tax Nominal Return on Equity	%	12.0%	Assumption
State Income Tax Rate	%	0.0%	Adael Acosta, Director, U.S. Indirect and Employment Tax, 8/30/21
Federal Income Tax Rate	%	21.0%	FERC Form 1, pages 122-123, Tax Cuts and Jobs Act
Effective State and Federal Income Tax Rate	%	21.0%	
Property Taxes Expense	**%**	**1.6%**	
Total Plant Annual Property (Real Estate) Taxes	MM$	$46.8	FERC Form 1, pages 320-323, line 164, column b
Net Book Value of Total Plant	MM$	$2,916.9	
Insurance Expense	**%**	**1.9%**	
Total Plant Annual Insurance Costs	MM$	$55.2	FERC Form 1, pages 320-323, line 185, column b
Net Book Value of Total Plant	MM$	$2,916.9	FERC Form 1, pages 200-201, line 15, column c
Depreciation Expense (using Sinking Fund Factor Approach)	**%**	**1.4%**	
Depreciation Life of Distribution Plant	Yr	27	Assumption
Operation and Maintenance Expense	**%**	**0.9%**	
Annual Distribution Operation and Maintenance Expenses	MM$	$11.4	
Net Book Value of Distribution Plant	MM$	$1,297.3	
Electric Plant in Service	$	$2,091,924,128	FERC Form 1, pages 204-207, line 75, column g
Accumulated Depreciation	$	$794,651,338	FERC Form 1, page 219, line 26, column b
Income Taxes Expense	**%**	**1.2%**	
Gross up factor for taxes	%	79.0%	
Annual Real Carrying Charge of Capital Investments	**%**	**13.7%**	

Peak Growth

Item	Units	NECO Value
Total incremental growth in peak demand	MW	195

Appendix: Distribution Operation and Maintenance Cost Avoidable Expenses

Operation Distribution Expenses

Item	Total NECO Value	NECO Source	Share Avoidable	Source	Avoidable NECO Value
(580) Operation Supervision and Engineering	$4,809,341	FERC Form 1, pages 320-323, line 134, column b	0%	Assumption	$0
(581) Load Dispatching	$1,377,442	FERC Form 1, pages 320-323, line 135, column b	0%	Assumption	$0
(582) Station Expenses	$1,153,890	FERC Form 1, pages 320-323, line 136, column b	10%	Assumption	$115,389
(583) Overhead Line Expenses	$1,362,803	FERC Form 1, pages 320-323, line 137, column b	20%	Assumption	$272,561
(584) Underground Line Expenses	$97,783	FERC Form 1, pages 320-323, line 138, column b	20%	Assumption	$19,557
(585) Street Lighting and Signal	$252,647	FERC Form 1, pages 320-323, line 139, column b	0%	Assumption	$0
(586) Meter Expenses	$2,512,976	FERC Form 1, pages 320-323, line 140, column b	0%	Assumption	$0
(587) Customer Installations Expenses	$175,844	FERC Form 1, pages 320-323, line 141, column b	0%	Assumption	$0
(588) Miscellaneous Expenses	$9,213,935	FERC Form 1, pages 320-323, line 142, column b	50%	Assumption	$4,606,968
(589) Rents	$153,755	FERC Form 1, pages 320-323, line 143, column b	0%	Assumption	$0
Total	$21,110,416				$5,014,474

Maintenance Distribution Expenses

Item	Total NECO Value	NECO Source	Share Avoidable	Source	Avoidable NECO Value
(590) Maintenance Supervision and Engineering	$418,026	FERC Form 1, pages 320-323, line 146, column b	0%	Assumption	$0
(591) Maintenance of Structures	$76,990	FERC Form 1, pages 320-323, line 147, column b	20%	Assumption	$15,398
(592) Maintenance of Station Equipment	$1,297,564	FERC Form 1, pages 320-323, line 148, column b	10%	Assumption	$129,756
(593) Maintenance of Overhead Lines	$26,890,750	FERC Form 1, pages 320-323, line 149, column b	20%	Assumption	$5,378,150
(594) Maintenance of Underground Lines	$2,016,071	FERC Form 1, pages 320-323, line 150, column b	20%	Assumption	$403,214
(595) Maintenance of Line Transformers	$400,888	FERC Form 1, pages 320-323, line 151, column b	20%	Assumption	$80,178
(596) Maintenance of Street Lighting and Signal	$561,513	FERC Form 1, pages 320-323, line 152, column b	0%	Assumption	$0
(597) Maintenance of Meters	$63,937	FERC Form 1, pages 320-323, line 153, column b	0%	Assumption	$0
(598) Maintenance of Miscellaneous Distribution Plant	$784,474	FERC Form 1, pages 320-323, line 154, column b	50%	Assumption	$392,237
Total	$32,510,213				$6,398,933

Total Distribution Expenses

Item	Total NECO Value	NECO Source	Share Avoidable	Source	Avoidable NECO Value
Total Operation and Maintenance Distribution Expense	$53,620,629				**$11,413,407**

PUC 1-66
Benefit Cost Analysis

Request:

On Bates page 325, the Company states that it will participate in the development of the 2024 update to the Avoided Energy Supply Costs (AESC) study. The Company writes "the study kicked off in August 2023 and a final report is scheduled to be delivered in the first quarter of 2024." Have any draft results of the 2024 update been publicly released? If yes, please provide a copy of the draft results.

Response:

No draft results of the 2024 AESC update have been publicly released at this time.

Prepared by or under the supervision of: Michael O'Brien Crayne

PUC 1-67
Benefit Cost Analysis

Request:

On Bates page 362, the Company writes "in addition to the traditional valuation of electric generation capacity, for which results are provided in Appendix B, the 2021 AESC study also valued the capacity of short duration measures that are not actively bid into the FCM." Later on that same page, the Company explains "the deferred capacity valuation methodology for uncleared capacity is used to determine the avoided electric generation capacity value for these [short duration] measures based on the values provided in Appendix J of the 2021 AESC study." Commission staff notes that in prior years, the Company used this "deferred capacity valuation methodology for uncleared capacity" to value the avoided capacity benefits from the ConnectedSolutions demand response program. It appears that the Company has removed such program from the 2024 Annual Plan and the 2024-2026 Three Year Plan. Given that, please clarify whether any of the avoided capacity benefits included in either the 2024 Annual Plan or the 2024-2026 Three Year Plan were calculated using the "deferred capacity valuation methodology for uncleared capacity," or whether this methodology is no longer used by the Company since the ConnectedSolutions program has been removed from these Plans.

Response:

The avoided capacity benefits for the electric Home Energy Reports program in the 2024 Annual Plan and 2024-2026 Three Year Plan were calculated using the "deferred capacity methodology for uncleared capacity."

Prepared by or under the supervision of: Brett Feldman

PUC 1-68
Benefit Cost Analysis

Request:

Referencing Table E-6, non-resource benefits appear to comprise 16% of total benefits from the proposed 2024 Annual Electric Efficiency Plan, excluding economic development. Referencing Table G-6, non-resource benefits appear to comprise 35% of total benefits from the proposed 2024 Annual Gas Efficiency Plan, excluding economic development. Please confirm that the non-resource benefit category comprises the value of non-energy impacts. Then, for each individual non-energy impact included in the calculation of total non-resource benefits for either the electric or gas efficiency program, please provide the following information:

a. Name of the non-energy impact

b. Explanation of whether the non-energy impact is calculated on a per-measure basis, a per savings basis, or something else

c. Explanation of whether the non-energy impact is calculated as a recurring benefit or a one-time benefit

d. Age of the evaluation study from which the value of the non-energy impact was derived

Response:

The non-resource benefit category is comprised of the value of non-energy impacts in the 2024 Annual Electric and Gas Efficiency Plans. Please see Table 1 below for the individual non-energy impacts included in the calculation of total non-resource benefits for the electric and gas efficiency programs.

Please note the following for part (d):

- The Study Sector or Program Focus is included in Table 1 to identify the specific sector or program of the NEI evaluation study.

- Where the entry in part (d) is "MA Assumption," the source of the NEI is the Massachusetts 2022-24 benefit-cost model where the primary source of the NEI was not specifically identified but is likely one of the other NEI sources. This MA BC model was developed in 2021.

Prepared by or under the supervision of: Brett Feldman

PUC 1-68, Page 2
Benefit Cost Analysis

Table 1. Non-Energy Impacts in the 2024 Annual Electric and Gas Efficiency Plans

(a) NEI Name	(b) NEI Calculated per measure or per savings basis	(c) Recurring Benefit or One-time Benefit	Study Sector or Program Focus	(d) Age of Evaluation Study
Admin costs (may include material handling, material movement, other costs, other labor costs, O&M, product spoilage, rent revenue, sales revenue, waste disposal)	Calculated per savings	Recurring Benefit	Commercial and Industrial	MA Assumption
	Calculated per savings	Recurring Benefit	Commercial and Industrial	2021
Arrearages	Calculated per measure	Recurring Benefit	Residential and Income Eligible	2011
Bad Debt Write-offs	Calculated per measure	Recurring Benefit	Residential and Income Eligible	2011
Combustion stove NOx, asthma related impacts	Calculated per measure	One-time Benefit	Residential New Construction	2021
	Calculated per measure	Recurring Benefit	Residential New Construction	2021
Customer Calls and Collections	Calculated per measure	Recurring Benefit	Residential and Income Eligible	2011
	Calculated per measure	Recurring Benefit	Income Eligible	MA Assumption
Equipment Maintenance	Calculated per measure	Recurring Benefit	Residential	MA Assumption
	Calculated per measure	Recurring Benefit	Income Eligible Multifamily	2018
Equipment Maintenance Reliability Due to Thermostats	Calculated per measure	Recurring Benefit	Residential and Income Eligible	MA Assumption
ERV/HRV reduction of formaldehyde, asthma related impact	Calculated per measure	One-time Benefit	Residential New Construction	2021
	Calculated per measure	Recurring Benefit	Residential New Construction	2021
Health Benefits	Calculated per measure	Recurring Benefit	Residential and Income Eligible	MA Assumption
	Calculated per measure	Recurring Benefit	Income Eligible Multifamily	2018
Home Productivity	Calculated per measure	Recurring Benefit	Income Eligible Multifamily	2018
IE MF Heating	Calculated per measure	Recurring Benefit	Income Eligible Multifamily	MA Assumption
Improved Safety	Calculated per measure	Recurring Benefit	Income Eligible	MA Assumption

PUC 1-68, Page 3
Benefit Cost Analysis

(a) NEI Name	(b) NEI Calculated per measure or per savings basis	(c) Recurring Benefit or One-time Benefit	Study Sector or Program Focus	(d) Age of Evaluation Study
	Calculated per measure	Recurring Benefit	Income Eligible Multifamily	2018
Lighting Quality and Lifetime	Calculated per measure	One-time Benefit	Residential	MA Assumption
	Calculated per savings	Recurring Benefit	Residential	MA Assumption
Noise Reduction	Calculated per measure	One-time Benefit	Residential New Construction	2021
	Calculated per measure	Recurring Benefit	Residential and Income Eligible	MA Assumption
	Calculated per measure	Recurring Benefit	Residential New Construction	2021
Notices	Calculated per measure	Recurring Benefit	Residential and Income Eligible	2011
O&M	Calculated per savings	Recurring Benefit	Commercial and Industrial	MA Assumption
	Calculated per measure	Recurring Benefit	Residential	MA Assumption
	Calculated per savings	Recurring Benefit	Commercial and Industrial	2021
O&M, H&S	Calculated per savings	Recurring Benefit	Commercial and Industrial	MA Assumption
O&M, Non-O&M	Calculated per savings	Recurring Benefit	Commercial and Industrial	2021
Price Hedging	Calculated per savings	One-time Benefit	Income Eligible	2012
	Calculated per savings	One-time Benefit	Income Eligible Multifamily	2018
	Calculated per savings	Recurring Benefit	Income Eligible	2012
Property Durability	Calculated per measure	Recurring Benefit	Income Eligible Multifamily	2018
	Calculated per measure	Recurring Benefit	Residential and Income Eligible	MA Assumption
	Calculated per savings	Recurring Benefit	Income Eligible	MA Assumption
Property Value Increase	Calculated per measure	One-time Benefit	Income Eligible	MA Assumption
	Calculated per measure	Recurring Benefit	Residential	MA Assumption

PUC 1-68, Page 4

Benefit Cost Analysis

(a) NEI Name	(b) NEI Calculated per measure or per savings basis	(c) Recurring Benefit or One-time Benefit	Study Sector or Program Focus	(d) Age of Evaluation Study
Rate Discounts	Calculated per savings	Recurring Benefit	Residential and Income Eligible	2011
	Calculated per savings	Recurring Benefit	Income Eligible	MA Assumption
Reduced Tenant Complaints	Calculated per measure	Recurring Benefit	Residential and Income Eligible	MA Assumption
Rental Unit Increased Property Value	Calculated per measure	One-time Benefit	Income Eligible	MA Assumption
Rental Units Marketability	Calculated per measure	Recurring Benefit	Residential	MA Assumption
	Calculated per measure	One-time Benefit	Residential and Income Eligible	MA Assumption
	Calculated per measure	Recurring Benefit	Residential and Income Eligible	2011
Safety Related Emergency Calls	Calculated per measure	Recurring Benefit	Residential and Income Eligible	2011
	Calculated per measure	Recurring Benefit	Income Eligible Multifamily	2018
	Calculated per savings	Recurring Benefit	Residential and Income Eligible	2011
Terminations and Reconnections	Calculated per measure	Recurring Benefit	Residential and Income Eligible	2011
Thermal Comfort	Calculated per measure	One-time Benefit	Residential New Construction	2021
	Calculated per measure	Recurring Benefit	Residential and Income Eligible	MA Assumption
	Calculated per measure	Recurring Benefit	Income Eligible Multifamily	2018
	Calculated per measure	Recurring Benefit	Residential New Construction	2021
Window Air Conditioner Replacement	Calculated per measure	Recurring Benefit	Income Eligible	MA Assumption

PUC 1-69
Benefit Cost Analysis

Request:

Of the $30.9 million of non-resource benefits proposed to be delivered by the 2024 Annual Electric Efficiency Plan, how much of that value is derived from one-time non-energy impacts vs. annual non-energy impacts?

Response:

Of the $30.9 million of non-resource benefits proposed to be delivered by the 2024 Annual Electric Efficiency Plan, one-time non-energy impacts makes up 0.3% or $97,854 of the total non-resource benefit value and annual non-energy impacts make up 99.7% or $30,856,177 of the total non-resource benefits.

Prepared by or under the supervision of: Brett Feldman

PUC 1-70
Benefit Cost Analysis

Request:

Please explain the factors that contribute to the value of non-resource benefits increasing from $29 million in the 2023 Annual Electric Efficiency Plan (Table E-6 in the Updated Compliance Filing, Docket No. 22-33-EE) to $30.9 million in the 2024 Annual Electric Efficiency Plan (Table E-6).

Response:

The factors that contributed to the value of non-resource benefits increasing from $29 million in the 2023 Annual Electric Efficiency Plan to $30.9 million in the 2024 Annual Electric Efficiency Plan are related to the addition of non-energy impacts (NEIs) to measures identified in the Consultant Team's review of the Benefit Cost Analysis Model. The addition of these NEIs was motivated by the desire for consistency of NEIs among similar measures. In particular, the assignment of the weatherization NEI to the EnergyWise Single Family "Weatherization, Oil" measure resulted in a large increase of $2,226,892 or about 94% in net lifetime per unit non-resource benefits from 2023 to 2024. Other measures that were assigned NEIs during the review include:

- EnergyWise Multifamily:
    - Aerators – Other, Insulation – Other, Programmable Thermostat
- Income Eligible Multfamily:
    - Air Sealing – Other, Insulation – Other, Showerhead – Other, TSV Showerhead – Other
- EnergyWise Single Family and Income Eligible Single Family:
    - Weatherization, Other

Prepared by or under the supervision of: Brett Feldman

PUC 1-71
Benefit Cost Analysis

Request:

Of the $27.8 million of non-resource benefits proposed to be delivered by the 2024 Annual Gas Efficiency Plan, how much of that value is derived from one-time non-energy impacts vs. annual non-energy impacts?

Response:

Of the $27.8 million of non-resource benefits proposed to be delivered by the 2024 Annual Gas Efficiency Plan, one-time non-energy impacts makes up 0.5% or $146,634 of the total and annual non-energy impacts makes up 99.5% or $27,671,400 of the total.

Prepared by or under the supervision of: Brett Feldman

PUC 1-72
Benefit Cost Analysis

Request:

Please explain the factors that contribute to the value of non-resource benefits decreasing from $33.7 million in the 2023 Annual Gas Efficiency Plan (Table G-6 in the Updated Compliance Filing, Docket No. 22-33-EE) to $27.8 million in the 2024 Annual Gas Efficiency Plan (Table G-6).

Response:

The factors that contributed to the value of non-resource benefits decreasing from 2023 to 2024 are mainly related to differences in quantities of planned measures in 2023 and 2024 and differences in planned savings in the C&I program for certain measures, as described below.

- For the C&I measures, there was an approximately $3,322,000, or about a 28%, decrease in non-resource benefits from 2023 to 2024. Approximately 77% of the decrease was attributed to the reduction in savings for the "Fryer, Upstream" measure. The reduction in savings for this measure is based on the results from the RI 2023 Commercial Food Service Equipment Industry Standard Practice (ISP) Study.

- For the Income Eligible Residential measures, there was an approximately $2,047,800, or about a 14%, decrease in non-resource benefits from 2023 to 2024. Approximately 79% of the reduction in non-resource benefits for Income Eligible is attributed to the decrease in quantities of the Income Eligible Single Family "Weatherization" measure.

- For the Residential measures, there was an approximately $545,600 or about a 7%, decrease in non-resource benefits from 2023 to 2024. The differences in planning quantities were the main cause of the decrease in non-resource benefits for Residential measures.

Prepared by or under the supervision of: Brett Feldman

PUC 1-73
Benefit Cost Analysis

Request:

Please provide a copy of the "Economic Impacts of Rhode Island Energy's 2023 Annual Energy Efficiency Plan" that was prepared for the Company by the Brattle Group in 2023 and referenced on Bates page 378 of the filing.

Response:

Please see Attachment PUC 1-73.

Prepared by or under the supervision of: Michael O'Brien Crayne

Economic Impact Analysis of Rhode Island Energy's Annual Energy Efficiency Plan for 2023

PREPARED BY
Dr. Wonjun Chang
Dr. Mark Berkman
Shivangi Pant

PREPARED FOR
Rhode Island Energy

AUGUST 8, 2023

Brattle

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I. Executive Summary

The Brattle Group was asked by Rhode Island Energy (RIE) to assess the economic impacts of implementing RIE's Annual Energy Efficiency Plan for 2023, as part of Rhode Island Public Utilities Commission's Total Resource Cost Effectiveness Standard evaluation. In this report, we assess the economic impacts of 14 energy efficiency programs based on their impact on regional gross domestic product (GDP). We also provide program-specific economic multipliers that capture the regional economic benefits relative to the cost of each program.

To provide a comprehensive assessment of economy-wide impacts, we couple two modeling frameworks – benefit-cost (BC) and economic impact assessment. The results output by each framework are used as separate measures that quantify different aspects of the programs' contribution to economic growth. The BC analysis assesses the direct costs and benefits to RIE and its ratepayers for each program. Economic impact analysis measures how those direct impacts, along with subsequent ripple effects that take place in the rest of the economy, affect gross regional product in Rhode Island.

To assess economic impacts, we use BEYOND, Brattle's proprietary macroeconomic model of the US. BEYOND uses open-source government data to simulate interactions among key institutions in the US economy (industries, households and government), while preserving transparency in the model's input data. To provide reliable estimates of future economic impacts over the time horizon of RIE's programs, we calibrate GDP growth in Rhode Island to most recent projections based on government data. Accounting for the growing scale of the economy is important in capturing the magnitude of program impacts, particularly given the near three-decade time horizon over which RIE's energy efficiency benefits are experienced. Our analysis also provides GDP impacts in the rest of New England to demonstrate that increased economic activity driven by energy efficiency in Rhode Island creates growth in neighboring states through trade.

We find that economic impacts at the program level are all positive, indicating that all energy efficiency and demand response programs are expected to create GDP growth in Rhode Island's economy. Within Rhode Island, all programs with the exception of one gas program, create economic benefits that are greater than total program costs. When economic growth in the rest of New England is considered, economic benefits exceed total costs for all programs.

II. Introduction

The Brattle Group was asked by Rhode Island Energy (RIE) to assess the economic impacts of implementing RIE's Annual Energy Efficiency Plan for 2023 (2023 Annual Plan), as part of Rhode Island Public Utilities Commission's Total Resource Cost Effectiveness Standard evaluation. In this report, we assess the economic impacts of 14 energy efficiency (EE) and demand response (DR) programs based on their impact on regional gross domestic product (GDP). We also provide program-specific economic multipliers that capture the regional economic benefits relative to the cost of each program.

Brattle previously provided economic impact analyses of RIE's EE and DR programs in 2019.[1] Our current analysis builds on Brattle's 2019 analysis in three important ways. First, to assess economic impacts, we use BEYOND, Brattle's proprietary macroeconomic model of the US. BEYOND uses open-source government data to simulate interactions among key institutions in the US economy (industries, households and government), while preserving transparency in the model's input data. Second, to provide reliable estimates of future economic impacts over the time horizon of RIE's programs, we calibrate GDP growth in Rhode Island to most recent projections based on government data. Accounting for the growing scale of the economy is important in capturing the magnitude of program impacts, particularly given the near three-decade time horizon over which RIE's energy efficiency benefits are experienced. Third, our analysis expands the scope of impact assessment to estimate the GDP impacts in both Rhode Island and the rest of New England. We demonstrate that increased economic activity in Rhode Island created by RIE's programs can result in growth in neighboring states through trade.

Section III provides an overview of the RIE's EE and DR programs. Section IV provides details on the modeling methodology. In this section we provide an overview of the BEYOND model and how the model was calibrated to provide reliable results. We also describe how the EE and DR programs were modeled in BEYOND. Section V presents our model results and discusses the value of coupling benefit-cost with economic impact assessment in assessing the cost-effectiveness of energy efficiency programs. The appendix provides a detailed description of the BEYOND model.

[1] Berkman, Mark, Jürgen Weiss. "Review of RI Test and Proposed Methodology." The Brattle Group (2019).

III. Rhode Island Energy's Annual Energy Efficiency Plan for 2023

RIE's 2023 Annual Plan, which covers the third year of the 2021-2023 Three-year Energy Efficiency Plan, was designed to help Rhode Island's economy achieve greater efficiency while contributing to the state's COVID-19 pandemic recovery. We evaluate fourteen EE and DR programs across three program types: residential, income eligible and commercial and industrial programs. The majority of these programs are offered as both electric and gas efficiency programs. Below we provide a summary of each program under review.[2]

A. Residential Energy Efficiency Programs

1. EnergyWise Single Family

The EnergyWise program is a direct-to-customer in-home program that educates residents on how their home can become more energy efficient. The program offers single-family customers (buildings with 1-4 dwelling units) home energy assessments, weatherization services, and information regarding their energy usage. The program addresses base load electric use and heating, cooling, and water heating energy loads in all residential buildings. Participants receive energy efficiency recommendations and technical assistance, as well as financial incentives to upgrade inefficient items such as heating and water heating systems, thermostats, and insulation.

2. EnergyWise Multi-Family

The EnergyWise Multi-Family program offers comprehensive energy services for market-rate multifamily customers (buildings with 5+ dwelling units), including energy assessments, incentives for heating and domestic hot water systems, cooling equipment, lighting, and appliances. All types of multifamily properties are eligible.

[2] A more detailed description of each program is provided in the following document: Letter from Rhode Island Energy to the Rhode Island Public Utilities Commission, "Re: Docket No. 22-33-EE -- The Narragansett Electric Company's d/b/a Rhode Island Energy's Annual Energy Efficiency Plan for 2023," September 30, 2022

3. Residential New Construction

The Residential New Construction (RNC) program promotes the construction of high-performing energy efficient single family, multifamily, and income eligible homes, as well as the education of builders, tradespeople, designers, and code officials.

4. Home Energy Reports

The Home Energy Reports (HER) program encourages energy efficiency behavior through personalized print and email reports and a seamlessly integrated website. Each of the communication channels displays energy consumption patterns and contains a normative comparison to similarly sized and similarly heated homes, as well as to an energy reduction goal for each customer.

5. Residential Consumer Products

The Residential Consumer Products program promotes the purchase of high efficiency household appliances, including kitchen appliances and electronics carrying the ENERGY STAR® label. This program trains retail sales staff about products. The program also offers refrigerator, freezer, and dehumidifier recycling.

6. Residential High-Efficiency Heating, Cooling, and Hot Water (ENERGY STAR® HVAC)

The ENERGY STAR® HVAC program promotes the installation of high efficiency central air conditioners and eligible heat pumps for electric customers and new energy efficient natural gas related equipment including boilers, furnaces, windows, water heating equipment, thermostats, boiler reset controls, and water saving devices. Incentives for energy efficient air source heat pumps for space and water heating equipment are available for customers with electric resistance heating and hot water. Incentives are also available for air source heat pumps used as accessory heating and cooling devices in homes with a primary heating system that is natural gas, oil, or propane.

7. Residential ConnectedSolutions (Active Demand Response)

The Residential ConnectedSolutions program is RIE's active demand response program that sends control signals to customer owned electric devices to reduce peak energy use and improve power quality on the grid. Consumers with eligible controllable equipment (e.g., Smart

thermostats, batteries, and pool pumps) can enroll to participate in ConnectedSolutions. All electric consumers are eligible to participate in ConnectedSolutions.

B. Income Eligible Energy Efficiency Programs

1. Income Eligible Single Family

Income Eligible Single Family Services are delivered by local Community Action Program agencies. Three levels of home energy assessments are offered: lighting and appliance, heating and weatherization, and comprehensive assessment. Customers who qualify for the Low-Income Home Energy Assistance Program (LIHEAP) are eligible to receive all services and equipment upgrades at no cost.

2. Income Eligible Multi-Family

Comprehensive energy services for income-eligible multifamily customers (buildings with 5+ dwelling units) include energy assessments, incentives for heating and domestic hot water systems, air source heat pumps, cooling equipment, lighting, and appliances. In most cases, there are no costs to the customer for these services as most income eligible upgrades are covered at 100%.

C. Commercial and Industrial Programs

1. Large Commercial and Industrial New Construction and Building Energy Code Support

This program encourages energy efficiency in new construction, major renovations, planned replacement of aging equipment, and replacement of failed equipment through financial incentives and technical assistance to developers, manufacturers, vendors, customers, and design professionals. Commercial and industrial customers with annual electric consumption greater than 1,000,000 kWh per year are eligible.

2. Large Commercial and Industrial Retrofit

This program incentivizes the replacement of existing equipment and systems with energy efficient alternatives when the customer might otherwise not plan on making efficiency investments. This may include energy efficient equipment such as lighting, motors, and heating,

ventilation and air conditioning (HVAC) systems, thermal envelope measures, and custom measures in existing buildings. All commercial, industrial, and institutional customers are eligible to participate.

3. Small Business Direct Install

This is a retrofit program that provides turn-key solutions to customers that consume less than 1,000,000 kWh per year. As part of the program, customers receive a free onsite energy assessment and a customized report detailing recommended energy efficient improvements. Rhode Island Energy then completes retrofit installations at the customer's convenience. The program serves small businesses of all types from restaurants to non-profits, to small offices. Rhode Island Energy pays up to 70% of installation and equipment costs, and customers can finance the remaining share of the project over as many as 60 months.

4. Commercial ConnectedSolutions (Active Demand Response)

The Commercial Connected Solutions or Active Demand Response program is focused on reducing peak electric demand and associated costs for large and small commercial customers. All customers, regardless of size can participate. The program is technology neutral and provides a customer incentive for verifiable shedding of load in response to a signal or communication from the Company.

5. Commercial and Industrial Multifamily

Comprehensive energy services for market-rate multifamily customers (buildings with 5+ dwelling units) include energy assessments and incentives for heating and domestic hot water systems and weatherization. Coordinated services are offered for all types of multifamily properties.

IV. Methodology

A. BEYOND-BCR Framework

We provide a comprehensive assessment of cost effectiveness by coupling two modeling frameworks – benefit-cost (BC) and economic impact assessment. The direct costs and benefits to RIE and its ratepayers for each program are assessed in the BC model. State GDP impacts

that stem from each program's direct costs and benefits are calculated in our economic impact assessment (macroeconomic) model.

To assess GDP impacts, we use Brattle's proprietary macroeconomic model, BEYOND. BEYOND is a dynamic computable general equilibrium (CGE) model of the US economy that simulates interactions between key institutions in the economy (industries, households and government) based on the circular flow of economic activity. BEYOND uses open-source government data as model inputs to characterize the US economy. The model represents 50 states plus Washington, D.C.; 11 aggregate economic sectors that account for 71 industries; and five representative households defined by income levels.

The representation of regional economic sectors in the model, which is based on national level input-output data published by the Bureau of Economic Analysis (BEA), account for all commodity supply and use activities in the economy. National level input-output data are regionalized using data inputs such as the Commodity Flow Survey (CFS) from the Census Bureau. Economic behavior of households is modeled by income group using Statistics of Income (SOI) data from the Internal Revenue Service (IRS). Lastly, the State Energy Data System (SEDS) published by the Energy Information Administration (EIA) is used to accurately represent supply and demand of energy resources by final demand and sectors.

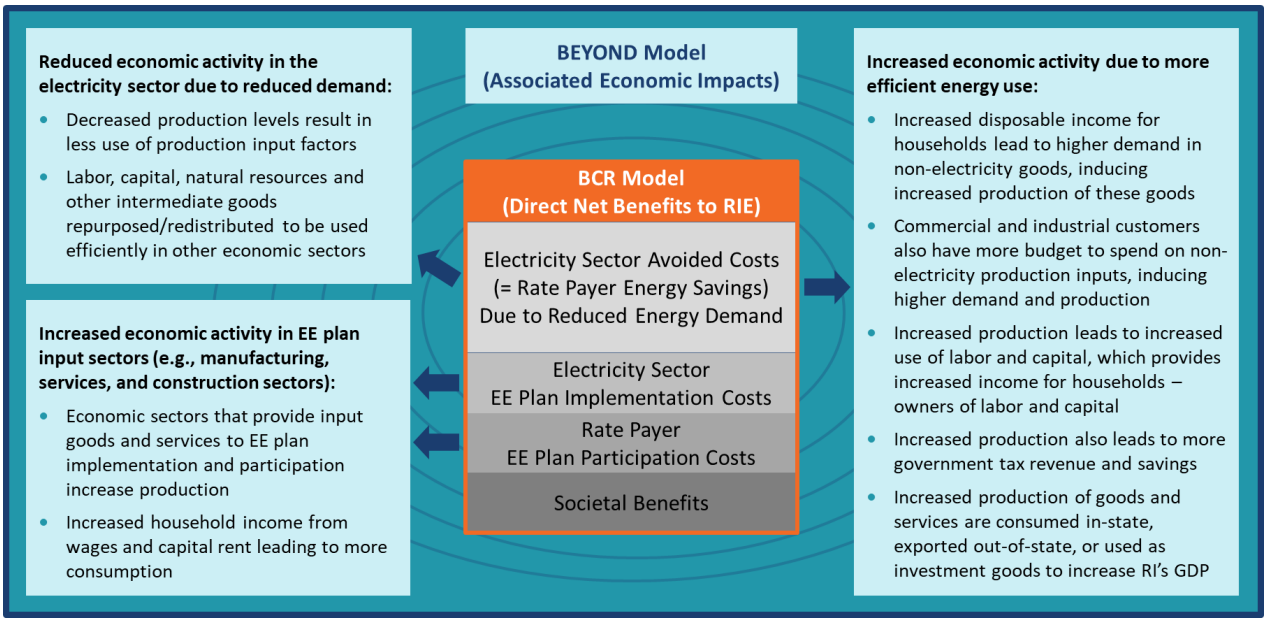
Standard BEYOND model outputs include gross domestic product, household consumption, labor income and wage rates, and sector specific output and prices. A more detailed description of the model is provided in the Appendix of this report.

The direct net benefits of each program for RIE and its ratepayers are assessed using RIE's Benefit-Cost Ratio (BCR) model. The BCR model's benefits include two types of benefits: avoided electricity sector costs due to reduced energy demand and associated environmental benefits. Avoided electricity sector costs are assumed to translate into bill savings for ratepayers. For costs, two types of costs associated with program implementation are calculated: program implementation costs incurred by RIE and program participation costs incurred by participants.

Economic impact analysis quantifies the ripple effects of these direct costs and benefits that go beyond RIE and its ratepayers (see Figure 1). Take for instance, the primary direct benefit of energy efficiency programs, reduced energy consumption. The macroeconomic model accounts for the bill savings associated with reduced energy consumption, but also subsequent economic transactions, including increased household consumption on non-energy goods due to

increased disposable income. Electric bill savings for companies also free up budget for non-electricity production inputs, contributing to higher production of goods and services in the economy. Costs incurred by RIE and program participants on the other hand, have the opposite effect. Added costs decrease available budget for final consumption and production inputs, reducing consumption in those goods and services. Those same costs however also increase economic activity in sectors of the economy that the costs are paid to. As such, the macroeconomic model assesses how the direct costs and benefits of RIE's programs impact gross regional product in Rhode Island.

FIGURE 1: COMPREHENSIVE IMPACT ASSESSMENT OF 2023 EE PLAN USING BEYOND-BCR



B. BEYOND Model Calibration

Economic benefits for most of RIE's programs are distributed over time. The BCR model shows that program benefits are experienced by participants over the next 27 years, from 2023 to 2049. Due to the long time horizon over which RIE's programs are evaluated, the projected growth of Rhode Island's economy during this period is an important factor to consider for accurate assessment of economic impacts. Assessing economic impacts of energy efficiency benefits using an outdated representation of the US economy will likely output unreliable results.

We hence calibrate the representation of the US economy in each model year (from 2023 to 2049 at annual time steps) using the EIA's projection of US real GDP growth. We also calibrate growth in GDP components (consumption, investment, government expenditure) and the size of the labor force.

Sector-specific production functions are also calibrated to incorporate realistic assumptions on how substitutable production inputs are. For instance, assumptions on the substitutability of gas, oil and electricity for household heating, or input factors such as labor, capital and natural resources for production, can make a material difference in economic impact assessment. We calibrate BEYOND's production functions to those of SAGE, a well-established CGE model of the US economy developed by the US Environmental Protection Agency.[3]

C. Modeling RIE's Energy Efficiency Plan

We model three key aspects of RIE's EE and DR programs. First is avoided costs. Avoided costs are determined in BEYOND based on each program's annual energy savings, relative to assumed energy consumption levels absent energy efficiency. To calculate annual energy savings for the average ratepayer, we calculated the annual reduction in energy consumption (electricity, gas, and oil and propane) for each measure within a program. The total reduction at the program level was obtained by summing the reduction amounts across all measures within a program. For programs that do not specify energy savings (e.g., active demand response programs), total utility avoided costs calculated by RIE's BCR model was used to represent avoided costs in the electricity sector. Utility avoided costs include avoided costs in both electric energy and capacity, as well as savings in non-electric resources such as natural gas, propane and water. Although we do not disclose annualized energy savings information by program in this report, total avoided costs by program, as calculated in RIE's BCR model, is presented in Table 1. Environmental benefits that are included as part of program benefits in the BCR model are excluded from program benefits modeled in BEYOND, since linkages between economic activities and environmental impacts are non-existent in conventional input-output accounts.

The second aspect is the implementation costs incurred by RIE. We assume that all of RIE's implementation costs are incurred in 2023, in the beginning of each program measure life. We also assume that all costs are allocated to the services sector, consisting of expenses relating to

[3] https://www.epa.gov/environmental-economics/sage-model-documentation-version-201

program planning, marketing, research, tech assist and training, and sales. This assumption is consistent with the assumption made in RIE's BC analysis. Although most implementation cost elements were program specific and hence were directly allocated to those programs, some cost elements were applied at the program type level (e.g., residential, income eligible, commercial and industrial) and not to specific programs. "Energy Efficiency Education" for instance, is associated with the residential sector but not with any specific program. We distributed these non-program-specific costs uniformly across programs within program types. General portfolio costs that were not tied to programs (or even program types) were also similarly distributed across relevant programs. The resulting implementation costs by program are presented in Table 2.

The third aspect is the participation costs incurred by program participants. As with implementation costs, participation costs were also assumed to be incurred in 2023. Assumptions on how participation costs are allocated across economic sectors is consistent with those used in the 2019 Brattle analysis. Participant costs by program and cost allocation weights across sectors are respectively shown in Tables 3 and 4.

TABLE 1: TOTAL AVOIDED COSTS BY PROGRAM

	Electric	Gas	DR
Residential			
Residential New Construction	$ 3,248,590	$ 1,032,109	
ENERGY STAR® HVAC	$16,958,161	$ 6,930,735	
EnergyWise Single Family	$15,488,815	$ 8,119,955	
EnergyWise Multi Family	$ 2,821,384	$ 4,497,501	
Home Energy Reports	$ 4,159,480	$ 726,563	
Residential Consumer Products	$ 5,512,401		
Residential ConnectedSolutions			$ 3,144,955
Residential Total	$48,188,830	$21,306,862	$ 3,144,955
Income Eligible			
Income Eligible Single Family	$18,177,479	$ 9,062,602	
Income Eligible Multi Family	$ 3,571,360	$ 8,595,972	
Income Eligible Total	$21,748,838	$17,658,573	
Commerical and Industrial			
Large Commercial New Construction	$24,945,181	$12,404,196	
Large Commercial and Industrial Retrof	$50,429,565	$ 9,203,431	
Small Business Direct Install	$ 6,534,532	$ 1,420,442	
Commercial ConnectedSolutions			$12,784,513
Commercial and Industrial Multi Family		$ 5,453,431	
Commercial and Industrial Total	$81,909,277	$28,481,499	$12,784,513

TABLE 2: IMPLEMENTATION COSTS BY PROGRAM

	Electric	Gas	DR
Residential			
Residential New Construction	$ 2,209,521	$ 859,003	
ENERGY STAR® HVAC	$ 5,958,346	$ 3,824,363	
EnergyWise Single Family	$ 16,202,831	$ 10,110,619	
EnergyWise Multi Family	$ 1,958,811	$ 1,722,887	
Home Energy Reports	$ 2,763,365	$ 597,983	
Residential Consumer Products	$ 3,106,633	$ -	
Residential ConnectedSolutions			$ 2,580,685
Residential Total	$ 32,199,506	$ 17,114,854	$ 2,580,685
Income Eligible			
Income Eligible Single Family	$ 12,376,356	$ 5,633,962	
Income Eligible Multi Family	$ 3,868,951	$ 3,420,403	
Income Eligible Total	$ 16,245,307	$ 9,054,364	
Commerical and Industrial			
Large Commercial New Construction	$ 9,365,096	$ 3,051,398	
Large Commercial and Industrial Retrof	$ 23,272,093	$ 4,872,336	
Small Business Direct Install	$ 8,648,087	$ 922,575	
Commercial ConnectedSolutions			$ 6,762,713
Commercial and Industrial Multi Family		$ 1,123,992	
Commercial and Industrial Total	$ 41,285,275	$ 9,970,302	$ 6,762,713

TABLE 3: PARTICIPATION COSTS BY PROGRAM

	Electric	Gas	DR
Residential			
Residential New Construction	$ 634,571	$ 301,051	
ENERGY STAR® HVAC	$ 2,464,497	$ 3,718,720	
EnergyWise Single Family	$ 2,790,635	$ 872,146	
EnergyWise Multi Family	$ 89,897	$ (150,143)	
Home Energy Reports	$ -	$ -	
Residential Consumer Products	$ 683,261	$ -	
Residential ConnectedSolutions			$ -
Residential Total	$ 6,662,861	$ 4,741,775	$ -
Income Eligible			
Income Eligible Single Family	$ -	$ -	
Income Eligible Multi Family	$ -	$ -	
Income Eligible Total	$ -	$ -	
Commerical and Industrial			
Large Commercial New Construction	$ 648,465	$ 60,465	
Large Commercial and Industrial Retrof	$ 10,315,471	$ 2,537,209	
Small Business Direct Install	$ 1,596,033	$ 166,338	
Commercial ConnectedSolutions			$ -
Commercial and Industrial Multi Family		$ 309,925	
Commercial and Industrial Total	$ 12,559,969	$ 3,073,937	$ -

TABLE 4: PARTICIPATION COST ALLOCATION

Cost Allocation	Electric	Gas
Wood Products	1%	1%
Nonmetallic mineral product manufacturing	1%	1%
Paper	1%	1%
Machinery manufacturing	6%	5%
Computer, electronic product manufacturing	2%	2%
Electrical equip, appliance manufacturing	6%	5%
Plastics, rubber prod manufacturing	2%	2%
Wholesale trade	1%	11%
Retail	9%	4%
Utilities	5%	1%
Construction	59%	61%
Professional services	8%	6%
Total	100%	100%

V. Results

We report the economic impacts of 14 energy efficiency programs based on their impact on GDP relative to a baseline GDP forecast of Rhode Island's economy. This allows the model to measure the net change in GDP attributable to the programs under consideration. We note that the baseline scenario excludes the implementation of programs under review.

Our analysis also provides program GDP impacts in neighboring states within New England. Model results show that increased economic activity in Rhode Island creates growth in neighboring states through trade. In general, a portion of goods and services produced in Rhode Island is consumed by neighboring states as final consumption goods or as intermediate goods used in production. Increased production driven by increased energy efficiency in Rhode Island increases supply of Rhode Island exports (goods and services produced in Rhode Island) to the rest of New England, hence contributing to economic growth in the region. Goods and services produced in the rest of New England are similarly consumed in Rhode Island. Increased economic activity driven by energy efficiency in Rhode Island hence increases demand for goods and services produced in neighboring states, also contributing to economic growth in those states.

Table 5 summarizes economic impacts by program type and region (Rhode Island, the rest of New England, and all of New England). All results are in 2023 dollars and are rounded to the

nearest $1000. We find that economic impacts, as measured by GDP, are positive for all program types at the state and regional level.

TABLE 5: ECONOMIC IMPACTS AS MEASURED BY GDP BY PROGRAM TYPE

All Programs	Economic Benefits (2023 Dollars)		
	RI	Rest of NE	NE Total
Electric Programs			
Residential Programs	$ 48,465,000	$ 13,633,000	$ 62,098,000
Income Eligible Programs	$ 27,293,000	$ 7,107,000	$ 34,401,000
Commercial & Industrial Programs	$ 125,967,000	$ 21,761,000	$ 147,728,000
Electric Program Total	**$ 201,725,000**	**$ 42,502,000**	**$ 244,227,000**
Gas Programs			
Residential Programs	$ 22,873,000	$ 3,896,000	$ 26,769,000
Income Eligible Programs	$ 15,707,000	$ 2,788,000	$ 18,495,000
Commercial & Industrial Programs	$ 35,239,000	$ 5,244,000	$ 40,483,000
Gas Program Total	**$ 73,819,000**	**$ 11,927,000**	**$ 85,747,000**
DR Programs			
Residential Programs	$ 4,418,000	$ 739,000	$ 5,156,000
Commercial & Industrial Programs	$ 16,949,000	$ 3,032,000	$ 19,981,000
DR Program Total	**$ 21,367,000**	**$ 3,771,000**	**$ 25,138,000**
Grand Total	**$ 296,912,000**	**$ 58,199,000**	**$ 355,112,000**

Tables 6 provides greater detail at the program level. We show that all economic impacts are positive for all programs. To capture the regional economic benefits relative to the cost of each program, we calculate program-specific economic impact multipliers. Economic impact multipliers are calculated as the total GDP impact over total program costs (the sum of participation and implementation costs). A multiplier value greater than unity indicates that economic benefits (GDP growth) exceed total program costs. Within Rhode Island, all programs, with the exception of the EnergyWise Single Family Gas Program, create economic benefits that are greater than total program costs. When economic growth in the rest of New England is considered, economic benefits exceed total costs for all programs.

We note that, in our 2019 analysis, the economic efficiency metric from the BC framework and the regional economic impact metric from the macroeconomic model were added together to provide one aggregate net benefits value. To use macroeconomic impacts as an additive term to the BC model's economic efficiency metric, the 2019 analysis adjusted the macroeconomic impact results to avoid double counting each programs' total net benefits.

In the current framework, the results output by the BC analysis and economic impact analysis are used as separate measures that quantify different aspects of the programs' contribution to economic growth. While the BCR model measures the direct net benefits to RIE and its ratepayers reflecting the economic efficiency of each program, BEYOND measures how those direct impacts, together with subsequent economic transactions that take place in the rest of the economy, affect gross regional product both within and outside of Rhode Island.

Considering the broader economy-wide impacts can be important especially when program costs, which generally contribute to lowering net benefits in a BC framework, create considerable economic activity in other sectors of the economy employed in the process of implementing those programs. The regional distribution of economic impacts within and outside of Rhode Island provides another assessment, one that indicates where the benefits are created, which may be important especially when benefits, while positive, fall disproportionately outside of Rhode Island. Indeed the Office of Management and Budget's current proposed revisions to benefit cost analysis recognize the need to examine distributional impacts (by location and other demographics) when evaluating government programs and investments.

Separating the BC analysis and economic impact assessment avoids the issue of "double counting" of net benefits that was considered in our 2019 report. The main issue has to do with whether the economic impact analysis captures benefits incremental to those accounted for in elements of the BC analysis. For instance, because the economic impacts calculated by BEYOND considers *all* economic activity involved in the implementation of RIE's EE and DR programs, the resulting macroeconomic impacts entail BC elements captured by the BCR model's direct net benefits (e.g., program expenses, energy savings). Concerns have hence previously been raised regarding whether GDP-based economic impacts can be added directly to the net benefits calculated through BC analyses.[4] Brattle's 2019 report provides a framework in which double counting of net benefits is mitigated when the two metrics are added together. We however avoid this issue altogether by separating the results of the BC and economic impact analysis.

[4] Woolf, Tim, Ben Havumaki, Steve Letendre, Caitlin Odom, Jamie Hall. "Macroeconomic Impacts of the Rhode Island Community Remote Net Metering Program." Synapse Energy Economics (2021).

TABLE 6: ECONOMIC IMPACTS AND MULTIPLIERS BY PROGRAM

Electric Programs	BEYOND Economic Impacts			Program Costs			Economic Multipliers	
	RI	Rest of NE	NE Total	Participation	Implementation	Total	RI	NE Total
Residential Programs								
Residential New Construction	$ 3,707,000	$ 1,024,000	$ 4,731,000	$ 634,571	$ 1,591,952	$ 2,226,524	1.66	2.12
ENERGY STAR® HVAC	$ 11,343,000	$ 3,714,000	$ 15,058,000	$ 2,464,497	$ 5,340,777	$ 7,805,274	1.45	1.93
EnergyWise Single Family	$ 21,536,000	$ 5,335,000	$ 26,871,000	$ 2,790,635	$ 15,585,262	$ 18,375,897	1.17	1.46
EnergyWise Multi Family	$ 2,823,000	$ 734,000	$ 3,557,000	$ 89,897	$ 1,341,243	$ 1,431,139	1.97	2.49
Home Energy Reports	$ 4,658,000	$ 1,418,000	$ 6,075,000	$ -	$ 2,145,796	$ 2,145,796	2.17	2.83
Residential Consumer Products	$ 5,584,000	$ 1,654,000	$ 7,238,000	$ 683,261	$ 2,489,065	$ 3,172,326	1.76	2.28
Residential ConnectedSolutions	$ 4,418,000	$ 739,000	$ 5,156,000	$ -	$ 1,963,117	$ 1,963,117	2.25	2.63
Low Income Programs								
Income Eligible Single Family	$ 19,762,000	$ 5,064,000	$ 24,826,000	$ -	$ 11,843,223	$ 11,843,223	1.67	2.10
Income Eligible Multi Family	$ 7,900,000	$ 2,130,000	$ 10,030,000	$ -	$ 3,335,818	$ 3,335,818	2.37	3.01
Commercial & Industrial Programs								
Large Commercial New Construction	$ 42,476,000	$ 7,320,000	$ 49,795,000	$ 648,465	$ 8,269,222	$ 8,917,688	4.76	5.58
Large Commercial and Industrial Retrofit	$ 66,860,000	$ 11,514,000	$ 78,373,000	$ 10,315,471	$ 22,176,219	$ 32,491,690	2.06	2.41
Small Business Direct Install	$ 17,987,000	$ 3,137,000	$ 21,124,000	$ 1,596,033	$ 7,552,214	$ 9,148,246	1.97	2.31
Commercial ConnectedSolutions	$ 16,949,000	$ 3,032,000	$ 19,981,000	$ -	$ 5,666,840	$ 5,666,840	2.99	3.53

Gas Programs	BEYOND Economic Impacts			Program Costs			Economic Multipliers	
	RI	Rest of NE	NE Total	Participation	Implementation	Total	RI	NE Total
Residential Programs								
Residential New Construction	$ 1,097,000	$ 169,000	$ 1,266,000	$ 301,051	$ 621,520	$ 922,572	1.19	1.37
ENERGY STAR® HVAC	$ 7,718,000	$ 1,288,000	$ 9,006,000	$ 3,718,720	$ 3,586,881	$ 7,305,601	1.06	1.23
EnergyWise Single Family	$ 9,391,000	$ 1,493,000	$ 10,884,000	$ 872,146	$ 9,873,136	$ 10,745,282	0.87	1.01
EnergyWise Multi Family	$ 3,769,000	$ 714,000	$ 4,483,000	$ 150,143	$ 1,485,405	$ 1,635,548	2.30	2.74
Home Energy Reports	$ 1,000,000	$ 219,000	$ 1,219,000	$ -	$ 360,501	$ 360,501	2.77	3.38
Low Income Programs								
Income Eligible Single Family	$ 8,301,000	$ 1,420,000	$ 9,721,000	$ -	$ 5,428,988	$ 5,428,988	1.53	1.79
Income Eligible Multi Family	$ 7,428,000	$ 1,369,000	$ 8,797,000	$ -	$ 3,215,429	$ 3,215,429	2.31	2.74
Commercial & Industrial Programs								
Large Commercial New Construction	$ 15,209,000	$ 2,418,000	$ 17,627,000	$ 60,465	$ 2,818,656	$ 2,879,121	5.28	6.12
Large Commercial and Industrial Retrofit	$ 13,797,000	$ 1,818,000	$ 15,615,000	$ 2,537,209	$ 4,639,594	$ 7,176,803	1.92	2.18
Small Business Direct Install	$ 2,141,000	$ 289,000	$ 2,430,000	$ 166,338	$ 689,833	$ 856,171	2.50	2.84
Commercial and Industrial Multi Family	$ 4,160,000	$ 724,000	$ 4,884,000	$ 309,925	$ 891,250	$ 1,201,175	3.46	4.07

** Economic multipliers were calculated as calculated as the total GDP impact over total program costs (participation and implementation costs)*

Appendix A: BEYOND Model

The BEYOND model is a dynamic computable general equilibrium (CGE) model of the US economy. It simulates the interactions between all key institutions in the economy (industries, households and government) based on the circular flow of economic activity. Households purchase goods and services using the income they earn from providing labor and capital to businesses; businesses produce goods and services demanded by the economy and pay wages and capital rent to households using the revenue earned from production; the government collects taxes from households and businesses to pay for government expenditures and provide subsidies and other benefits to the economy. CGE models are based on a well-established economic literature and are generally accepted as reliable modeling tools to estimate economic impacts.[5]

BEYOND uses open-source government data as model inputs to characterize the US economy. The model represents 50 states plus Washington, D.C.; 11 aggregate economic sectors that account for 71 industries; and five representative households defined by income levels. The build-stream used to create BEYOND's input data is based on the build-stream developed by the Wisconsin National Data Consortium (WiNDC), a research group that facilitates the creation and documentation of open source multisectoral economic datasets for US states.[6]

The representation of regional economic sectors in the model, which is based on national level input-output data published by the Bureau of Economic Analysis (BEA), account for all commodity supply and use activities in the economy. National level input-output data are regionalized using data inputs such as the Commodity Flow Survey (CFS) from the Census Bureau. Economic behavior of households is modeled by income group using Statistics of Income (SOI) data from the Internal Revenue Service (IRS). Lastly, the State Energy Data System (SEDS) published by the Energy Information Administration (EIA) is used to accurately represent supply and demand of energy resources by final demand and sectors.

[5] *See e.g.,* Wing, Ian Sue. "Computable general equilibrium models and their use in economy-wide policy analysis." Technical Note, Joint Program on the Science and Policy of Global Change, MIT (2004).

[6] Rutherford et al. https://windc.wisc.edu/

The dynamics of the model are determined by both exogenous and endogenous factors. Exogenous factors include reference scenario GDP growth, labor supply, and productivity growth. Savings and investment activities are determined endogenously.

An equilibrium is found by equating supply of goods to demand (market clearance condition for goods); supply of labor and capital to demand (market clearance condition for factors); household expenditures to income (income balance condition); and producer costs to revenue (zero-profit condition).

The economic sectors represented in BEYOND are as follows:

- Petroleum refineries
- Crude oil extraction
- Natural gas extraction
- Coal mining
- Electric power generation, transmission and distribution
- Transportation
- Construction
- Energy and emissions intensive sectors (embodied carbon greater than 0.5 kg/$)
- Manufacturing sectors
- Services sectors
- Rest of economy

Key model outputs include:

- US gross domestic product
- Household consumption
- Labor income and wage rates
- Economy-wide fuel consumption
- Sectoral output and prices

PUC 1-74
Benefit Cost Analysis

Request:

On Bates page 378, the Company clarifies that the "Economic Impacts of Rhode Island Energy's 2023 Annual Energy Efficiency Plan" study "did not contain updated job-year multipliers." Given that, please explain how, if at all, the study altered the Company's calculation of economic benefits for the 2024 Annual Electric and Gas Efficiency Plans and the 2024-2026 Three-Year Plan. Be specific in your response.

Response:

While the study did not contain updated job-year multipliers, the study did contain updated economic impact multipliers for each program. These updated economic impact multipliers were applied to the proposed program budgets to determine the estimated economic impacts of each program, listed as "Economic Benefits" in Tables E-5B and G-5B.

Prepared by or under the supervision of: Michael O'Brien Crayne

PUC 1-75
Benefit Cost Analysis

Request:

Table E-6 in the 2024 Annual Electric Efficiency Plan indicates the Plan will deliver $4.8 million in "other resource benefits." Please break out that total benefit by resource type (e.g. water, propane, etc.).

Response:

Please see the table below for the breakdown of "other resource benefits" by resource type:

Other Resource Benefit Category	**Value**
Propane	$4,153,709
Water – Residential measures	$646,420
Water – C&I measures	$6,615
Total	**$4,806,744**

Prepared by or under the supervision of: Brett Feldman

PUC 1-76
Benefit Cost Analysis

Request:

On Bates page 221, the Company writes "the fund balance [for 2024] does not currently include credits from shareholder funds, with interest, to the fund balance based on the Company's involvement in Docket 22-05-EE. All credits identified thus far in that process were accounted for in the 2023 Annual Plan." Please confirm whether this means that the full balance of the shareholder "credits identified thus far" has been already returned to customers.

Response:

Yes, the full balance of the shareholder credits identified thus far, including interest, was returned to customers as of the end of 2022.

Prepared by or under the supervision of: Brett Feldman

PUC 1-77
Benefit Cost Analysis

Request:

Comparing Table G-6 from the Updated Compliance Filing in Docket No. 22-33-EE to Table G-6 in the proposed 2024 Annual Gas Efficiency Plan, please explain how economic development benefits increased from $42.4 million to $66.9 million between 2023 and 2024 despite the total planned portfolio budget decreasing from $36.9 million to $34.2 million and the total benefits excluding economic benefits decreasing from $92.3 million to $80.2 million.

Response:

The economic impact study performed by the Brattle Group (provided in the response to PUC 1-73) provided new economic impact multipliers that the Company applied to the proposed 2024 program budgets to determine the estimated economic benefits. For many gas programs, the new economic multipliers are higher than the multipliers used in the 2023 Plan. The magnitude of these increases in multipliers is such that, even with the total gas portfolio budget decreasing between 2023 and 2024, the economic benefits increase between 2023 and 2024.

Prepared by or under the supervision of: Michael O'Brien Crayne

PUC 1-78
Workforce

Request:

What is the Company's proposal for total workforce-relating spending budget in the 2024 Annual Gas and Electric Efficiency Plans, and what is the Company's proposal for total workforce-relating spending budget in over the course of the 2024-2026 Three-Year Plan?

Response:

The Company is proposing workforce-related spending as follows:

- 2024: $532,000
- 2025: $535,408
- 2026: $485,955
- Total: $1,553,363

PUC 1-79
Workforce

Request:

Referencing Table E-2 of the Updated Compliance Filing in Docket No. 22-33-EE, the Company planned to spend $157,500 on Commercial Workforce Development through the 2023 Annual Electric Efficiency Plan. Referencing Table E-2 filed in Docket No. 23-35-EE, the Company is proposing to reduce that spending to $74,900 the 2024 Annual Electric Efficiency Plan. Please explain why the Company is proposing this reduction in commercial workforce spending.

Response:

There were two items in the 2023 C&I Workforce Development planned budget that the Company did not go forward with:

- Promote participation in existing manufacturer trainings ($50,000)
- Sponsor certifications for local trade allies ($100,000)

Therefore, while the planned budget for Workforce Development in the C&I sector has been reduced, the proposed spending has not.

Prepared by or under the supervision of: Brett Feldman

PUC 1-80
Workforce

Request:

Given the increasing demand for heat pump installations across the economy, including incremental demand that is being driven by OER's Clean Heat RI program, describe the Company's level of confidence that there is sufficient available workforce to deliver the proposed quantity of heat pump installations included in both the 2024 Annual Electric and Gas Efficiency Plans as well as the 2024-2026 Three-Year Plan. In your response, please explain what information or analysis the Company is relying on to make such an assessment.

Response:

The heat pump quantities planned for 2024 are in line with actual production through 2023. The unknown is the impact that Clean Heat RI and neighboring states will have on the contractors that supported the program in 2023. Since electric resistance heat is 8% of the heating population in RI, the majority of heat pump projects will have incentives paid by Clean Heat RI.

Based on Clean Heat RI's backlog and what the Company is hearing from Massachusetts Program Administrators, there is most likely a workforce shortage for heat pump installations. More concerning than just lack of workforce is knowledgeable, customer-oriented contractors that look for the best possible customer solution as opposed to just the earnings potential from the installations.

The 2023 Rhode Island Energy Workforce Development study conducted by BW Research addressed this question. Two of the main findings include:

- 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. Over 90 percent of businesses report difficulty in hiring energy efficiency workers generally, with extremely high numbers reporting significant difficulty in hiring heating, ventilation, and air conditioning (HVAC) technicians and heat pump installers. This is expanding the length of time it takes to hire a new worker, now anywhere from one to three months for HVAC technicians and heat pump installers. Two primary reasons given by employers for this difficulty are (1) a lack of labor supply overall and (2) a lack of prospective workers with the experience to immediately perform the job upon hire.

- 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

PUC 1-80, Page 2
Workforce

efficiency workforce ecosystem. According to the state leaders and experts who participated in interviews, Rhode Island is behind the curve in expanding its energy efficiency workforce to accommodate future growth. Stakeholders do not generally collaborate, and there is an overall lack of awareness about energy efficiency job opportunities.

The 2022 Rhode Island Clean Energy Industry Report, produced for OER and RI Commerce by BW Research, came to similar conclusions but also offers some forward-looking optimism:

- One of the primary challenges to clean energy sector growth is currently the supply of labor. 58% percent of clean energy employers reported that they did not have an adequate number of qualified clean energy employees to meet their current needs. Only four in ten surveyed clean energy employers (39 percent) indicated that they had an adequate number of qualified clean energy employees to meet their current needs.

- Following the pandemic-induced job losses in 2020, Rhode Island's clean energy labor market is making a slow but sure rebound with job numbers increasing across all technologies. The industry is well-supported by policy mechanisms and decarbonization goals, putting it on-track for long-term job growth. State-wide policy commitments (including the commitment to net-zero emissions by 2050), combined with significant federal funding anticipated through the Inflation Reduction Act point towards a positive future of clean energy employment growth for the state in coming years.

PUC 1-81
Workforce

Request:

On Bates page 287, the Company writes "the Company will support two BOC [Building Operator Certification] training courses in 2024. Each course targets between 22 participants." Regarding these training courses, please explain the following:

a. What is the cost of supporting these two training courses in 2024?

b. Bates page 287 summarizes the eligibility criteria to participate in the BOC training courses. Specifically, the Company notes "tuition reimbursement is available for facilities management professionals who… iii) have not taken the BOC Level 1 course within the last 5 years." Please explain why the Company is proposing to reimburse the tuition for facilities management professionals who may have already participated in the training (albeit years earlier).

c. In the larger context of workforce training and development, please explain how the Company determines the appropriate annual budget to allocate towards trainings of existing energy or facilities management professionals vs. recruiting new professionals into the energy efficiency workforce.

Response:

a. The cost of supporting two BOC training courses in 2024 with each course consisting of 22 participants would be $66,030, reflecting $24,340 for the annual fee plus 50% of the $1,895 course fee funded by the Company for up to 22 participants in each course.

b. The Company has proposed reimbursing 50% of the tuition for facilities management professionals who may have already participated in the training because past participants are able to refresh their knowledge of older building systems, operations technologies, and practices while also being trained and exposed to the ongoing advances in best practices and the technological evolution of building systems and operations during the last five years.

c. Historically, there was a fairly stable supply of lighting and HVAC professionals in the energy efficiency workforce. The main focus of energy efficiency program

PUC 1-81, Page 2
Workforce

administrators was to help train the existing workforce on specific technologies or policies related to the programs. There was always some level of helping to bring in new young professionals to replace retiring professionals through engagement with high schools, vocational schools, and colleges.

With the decline in lighting savings potential and the transition to heat pumps, there is more of a need to focus on recruiting new professionals to the energy efficiency workforce, in addition to re-training existing professionals on new technologies. There is still an ongoing requirement to train existing professionals to make sure that existing facilities and technologies continue to operate efficiently, as well as to stay up to date with building codes. However, different skills are needed to sell and install heat pumps than traditional HVAC systems and lighting. There are some new contractors that have entered the industry to focus specifically on heat pumps, and they train their own workforce. Traditional HVAC and lighting vendors need support to train employees on heat pumps, so energy efficiency program administrators can provide that support. This effort can also start with students as new educational programs emerge to prepare them for these new occupations.

Another factor is a focus on equity and diversity in the workforce. There is an opportunity to bring new people into the industry who may not have known about it before, and also who live in the communities that need energy efficiency services the most. This effort can be a win-win-win for the individual employees, the overall workforce, and the communities they live and work in.

PUC 1-82
Workforce

Request:

In Docket No. 22-33-EE, the Commission asked various data requests to the Company regarding Company staffing levels in the energy efficiency program. Please provide an update on the Company's internal staffing capabilities and any remaining vacancies on the energy efficiency team.

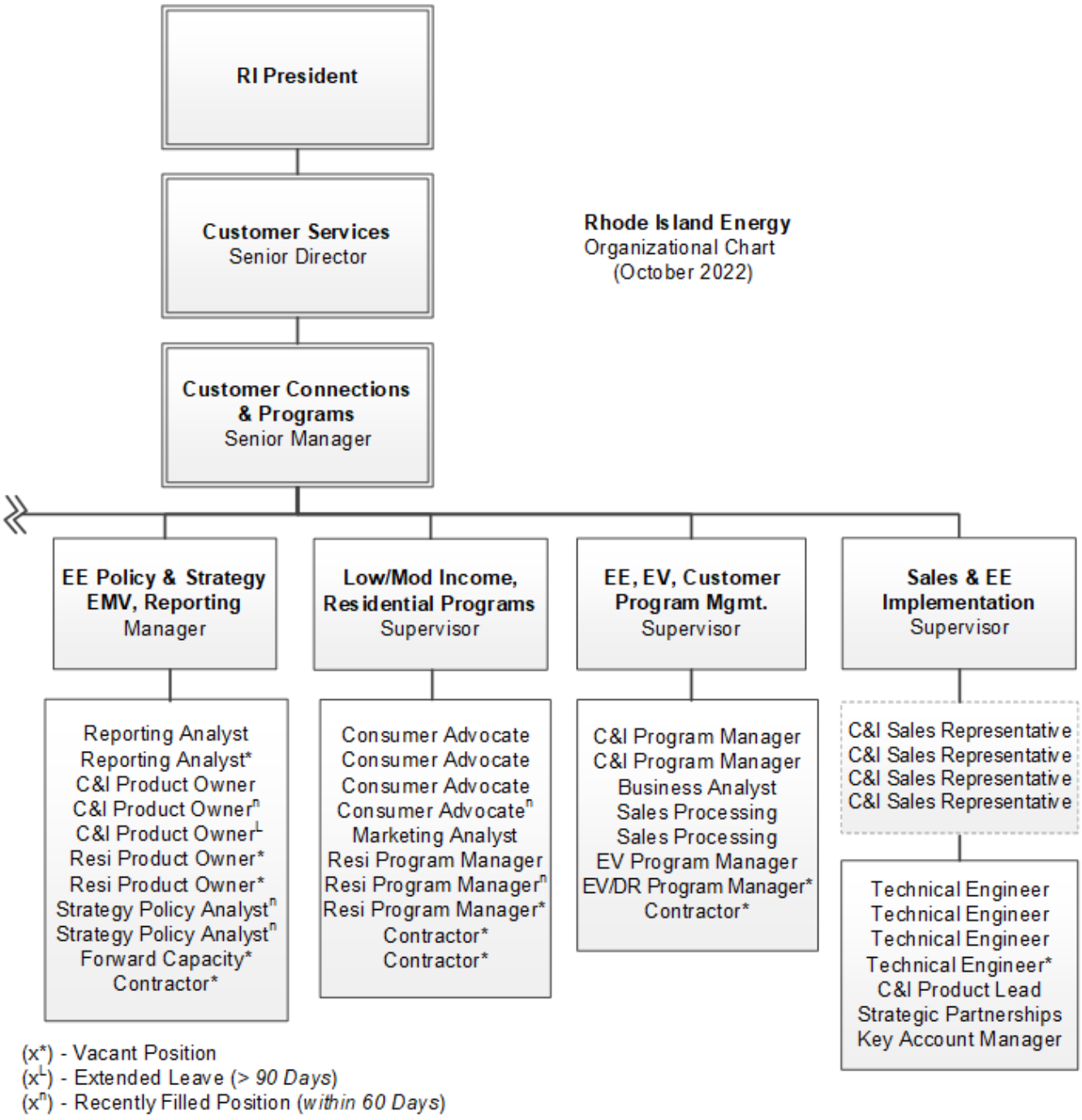
Response:

In 2022, the Company had seven vacancies and five positions that were recently filled as shown in Attachment PUC 1-82-1. Currently, within energy efficiency programs there are two remaining vacancies, and five positions filled in the past 60 days.

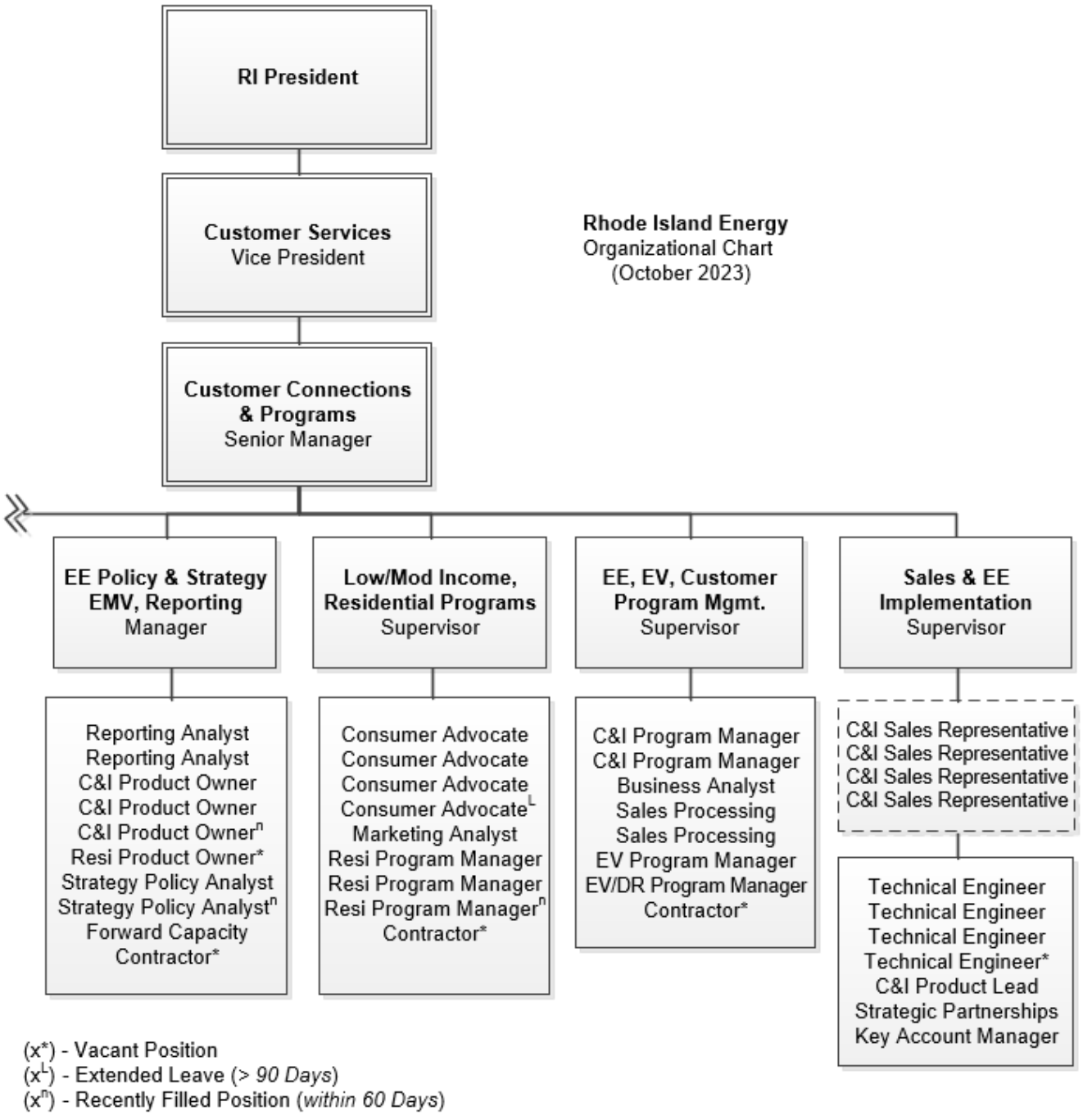
Additionally, between 2022 and present the Company had four employees leave, one of which represents the two remaining vacancies as displayed in Attachment PUC 1-82-2.

Prepared by or under the supervision of: David Moreira and Brett Feldman

Rhode Island Energy
Organizational Chart
(October 2022)



(x*) - Vacant Position
(x[L]) - Extended Leave (*> 90 Days*)
(x[n]) - Recently Filled Position (*within 60 Days*)



(x*) - Vacant Position
(x^{L}) - Extended Leave (> *90 Days*)
(x^{n}) - Recently Filled Position (*within 60 Days*)

PUC 1-83
Savings

Request:

Please update the response to PUC 1-73 in Docket No. 22-33-EE for the proposed 2024 Annual Electric Efficiency Plan. Separately, provide the requested information for the proposed 2024-2026 Three-Year Electric Efficiency Plan.

Response:

Please see the table below for the requested update to PUC 1-73 showing the distribution of lifetime MWh savings by measure life for the proposed 2024 Annual Electric Efficiency Plan.

Measure Life	Total Net Lifetime MWh	% of Portfolio
1 year	23,578	5%
2 to 5 years	47,905	9%
6 to 10 years	218,053	13%
> 10 years	439,758	73%
Total	***729,294***	***100%***

Please see the table below showing the distribution of lifetime MWh savings by measure life for the proposed 2024-2026 Three-Year Electric Efficiency Plan.

	2024		2025		2026	
Measure Life	**Total Net Lifetime MWh**	**% of Portfolio**	**Total Net Lifetime MWh**	**% of Portfolio**	**Total Net Lifetime MWh**	**% of Portfolio**
1 year	23,578	5%	23,567	5%	22,622	5%
2 to 5 years	47,905	9%	43,627	9%	41,579	9%
6 to 10 years	218,053	13%	212,018	13%	209,403	13%
> 10 years	439,758	73%	482,763	73%	515,180	73%
Total	***729,294***	***100%***	***761,975***	***100%***	***788,784***	***100%***

Prepared by or under the supervision of: Brett Feldman

PUC 1-84
Savings

Request:

Please update the response to PUC 1-74 in Docket No. 22-33-EE for the proposed 2024 Annual Gas Efficiency Plan. Separately, provide the requested information for the proposed 2024-2026 Three-Year Gas Efficiency Plan.

Response:

Please see the table below for the requested update to PUC 1-74 showing the distribution of lifetime MMBtu savings by measure life for the proposed 2024 Annual Gas Efficiency Plan.

Measure Life	Total Net Lifetime MMBtu	% of Portfolio
1 year	85,663	1%
2 to 5 years	161,455	4%
6 to 10 years	114,683	5%
> 10 years	2,956,143	90%
Total	***3,317,944***	***100%***

Please see the table below showing the distribution of lifetime MWh savings by measure life for the proposed 2024-2026 Three-Year Gas Efficiency Plan.

	2024		2025		2026	
Measure Life	**Total Net Lifetime MMBtu**	**% of Portfolio**	**Total Net Lifetime MMBtu**	**% of Portfolio**	**Total Net Lifetime MMBtu**	**% of Portfolio**
1 year	85,663	1%	85,663	1%	85,663	1%
2 to 5 years	161,455	4%	176,891	4%	193,872	4%
6 to 10 years	114,683	5%	125,833	5%	139,113	5%
> 10 years	2,956,143	90%	3,075,023	90%	3,182,559	90%
Total	***3,317,944***	***100%***	***3,463,410***	***100%***	***3,601,207***	***100%***

Prepared by or under the supervision of: Brett Feldman

PUC 1-85
Savings

Request:

Referencing Table E-6A of the 2023 and 2024 Annual Electric Efficiency Plans, it appears that annual oil savings decreased roughly 18% between 2023 and 2024. What is driving this decrease in planned oil savings? If this decrease is related to a reduction in planned quantities of certain measures, please specify which measures.

Response:

Most of the 18% decrease in annual oil savings between 2023 and 2024 is driven specifically by reductions in planned quantities of certain measures in the Residential HVAC and Income Eligible Single-Family programs. The oil savings per unit for these measures did not change between 2023 and 2024.

Please see the table below for information on these specific measures.

Program Name	**Measure Name**	**2023 Quantities**	**2024 Quantities**
Income Eligible Single-Family	Weatherization, Del Fuel	650	230
Residential HVAC	WiFi programmable thermostat with cooling (oil)	4,200	1,500

PUC 1-86
Savings

Request:

Bates pages 343-344 describe the draft results of the EnergyWise Single Family PY 2021 Weatherization Impact Evaluation Study. The Company explains that the savings impact from the study consists of a 42% increase in gas weatherization savings and a 27% increase in delivered fuel weatherization savings, as well as a 6.9% decrease in electric weatherization savings. Please explain the following:

a. Do the weatherization savings goals included in the proposed 2024 Annual Gas and Electric Efficiency Plans reflect these revised savings estimates?

b. Do the weatherization savings goals included in the proposed 2024-2026 Three-Year Plan reflect these revised savings estimates?

c. To what does the Company attribute the increase in savings from gas and delivered fuel weatherizations?

d. To what does the Company attribute the decrease in savings from electric weatherizations?

e. For every weatherization measure included in the proposed 2024 Annual Gas and Electric Efficiency Plans, please provide the benefit-cost ratio of the measure using the savings estimate from the prior program year (i.e. not adjusted for the results of the EnergyWise Single Family PY 2021 Weatherization Impact Evaluation Study) vs. using the updated savings estimate based on the results of the EnergyWise Single Family PY 2021 Weatherization Impact Evaluation Study.

Response:

a. Yes, the weatherization savings goals included in the proposed 2024 Annual Gas and Electric Efficiency Plans reflect these revised savings estimates.

b. Yes, the weatherization savings goals included in the proposed 2024-2026 Three-Year Plan reflect these revised savings estimates.

c. The Company attributes the increase in savings from gas and delivered fuel weatherizations to application of the results from the EWSF PY2021 Wx Impact Evaluation. The EWSF PY2021 Wx Impact Evaluation observed an increase in the

PUC 1-86, Page 2
Savings

installation of different types of insulation among natural gas participants, a small decrease in the participants' use of secondary heating post-weatherization, and found participants generally lived in newer and larger homes than the 2017-2018 cohort.

d. The Company attributes the decrease in savings from electric weatherizations to application of the results from the EWSF PY2021 Wx Impact Evaluation. The EWSF PY2021 Impact Evaluation observed that participants who electrically heat their home generally have better insulation prior to weatherization than natural gas participants and, therefore, install less insulation per square foot of home floor area during weatherization compared to natural gas participants.

e. Please see Table 1 below.

Table 1. EWSF Weatherization Measure BCR Comparisons

Weatherization Measure	**Portfolio**	**2024 BCR (Using Savings Based on EWSF PY2021 Wx Impact Evaluation)**	**2024 BCR (Using Savings from EWSF PY2017-18 Impact Evaluation)**
Weatherization, Electric	Electric	1.25	1.30
Weatherization, Oil	Electric	2.02	1.66
Weatherization, Others	Electric	2.84	2.27
Weatherization, Gas	Gas	1.19	0.93

PUC 1-87
Savings

Request:

Referencing Table E-7 in the Annual Plan, please explain why the proposed Annual Electric Energy Savings (MWh) from the 2024 Electric Efficiency Plan decrease by 2,153 MWh relative to the 2023 Annual Plan, but proposed Lifetime Electric Energy Savings (MWh) increase by 60,580 MWh.

Response:

The proposed annual and lifetime electric energy savings for the portfolio fluctuate year-to-year due to changes in measure-mix, new measure offerings, retired measure offerings, and updates to impact factors for various measures and programs. The combination of these increases and decreases results in the overall change in the total portfolio savings where annual savings decrease but lifetime savings increase compared to 2023.

As an example of how these changes combine and affect overall totals, Table E-7 shows significant decreases in annual and lifetime savings in the Residential EnergyWise Single Family and Residential Consumer Products programs and significant increases in annual and lifetime savings for the Residential HVAC program.

- The Residential HVAC program sees an increase in both annual and lifetime electric energy savings from 2023 to 2024. A significant factor is the increase in planned savings from the "Electric Resistance to MSHP" measure: annual electric energy savings increase from 1,997 MWh in 2023 to 5,085 MWh in 2024, and lifetime electric energy savings increase from 35,952 MWh in 2023 to 86,449 MWh in 2024. This increase is the result of planned measure quantities increasing from 337 in 2023 to 858 in 2024.

- The EnergyWise Single Family program sees a decrease in both annual and lifetime electric energy savings from 2023 to 2024. A significant factor is the decrease in planned savings from the "Smart Strip" measure: annual electric energy savings decrease from 751 MWh in 2023 to 536 MWh in 2024, and lifetime electric energy savings decrease from 3,753 MWh in 2023 to 2,680 MWh in 2024. This decrease is the result of planned measure quantities decreasing from 12,500 in 2023 to 8,925 in 2024.

- The Residential Consumer Products program sees a decrease in both annual and lifetime electric energy savings from 2023 to 2024. A significant factor is the decrease in planned savings from the "Refrigerator Recycling" measure: annual electric energy savings decrease from 1,584 MWh in 2023 to 1,262 MWh in 2024, and lifetime electric energy savings

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Savings

decrease from 12,674 MWh in 2023 to 5,046 MWh in 2024. This decrease is the result of planned measure quantities decreasing from 3,893 in 2023 to 3,100 in 2024, and the measure life decreasing from 8 years in 2023 to 4 years in 2024. The decrease in measure life results in the percentage decrease in lifetime MWh to be greater than the percentage decrease in annual MWh.

PUC 1-88
Savings

Request:

Please explain what factors contribute to the cents per lifetime kWh of savings from the electric Residential New Construction program decreasing from 16.9 in 2023 (Table E-5 Primary of the Updated Compliance Filing in Docket No. 22-33-EE) to 10.7 in 2024 (Table E-5 Primary of the filing in Docket No. 22-33-EE).

Response:

As noted in the Company's response to Division 1-16, the cost of saved energy is lifetime MWh savings (from Table E-6A) divided by the sum of Program Implementation Expenses and Participant Costs (from Table E-5). The change in the cost of saved energy for each of the programs in this question relative to the cost of saved energy for 2023 is due to changes to some or all of a number of factors; These factors are listed below.

- Lifetime MWh for a program is a function of measure quantities, savings per unit, and other impact factors (such as measure lifetimes, net-to-gross ratios, in-service rates, and realization rates) for each measure within the program; savings per unit changes could include the introduction of new evaluation results or new baselines.

- Program Implementation Costs are a function of measure quantities and incentives per unit for each measure in the program, as well as program administrative, marketing, evaluation, and sales, training, and technical assistance costs.

- Participant Costs in Table E-5 are an aggregation at the program level of the Participant Costs for the measures in the program. At the measure level, Participant Costs are the difference between the full cost of the measure and what the incentive covers. The aggregate is the sum of the products of measure quantities and Participant Costs for each measure in the program.

These factors interact and cannot be isolated from one another. For example, if a longer measure life was used for a measure in 2024 compared to what was used in 2023, if no other factor changed, then lifetime MWh would increase and the cost of saved energy for the measure (and the program) would decrease compared to 2023. If the baseline efficiency consumption was set to a lower level (in other words, what would be installed absent program intervention becomes more efficient), then, if no other factor changed, the savings per measure and lifetime savings would decrease and the cost of saved energy for the measure (and program) would increase

PUC 1-88, Page 2
Savings

compared to 2023. If both the measure life and baseline changed, the impacts on the cost of saved energy could be higher or lower, depending on the relative magnitude of the changes.

PUC 1-89
Savings

Request:

Please explain what factors contribute to the cents per lifetime kWh of savings from the electric EnergyWise Single Family program increasing significantly from 108.5 in 2023 (Table E-5 Primary of the Updated Compliance Filing in Docket No. 22-33-EE) to 127.3 in 2024 (Table E-5 Primary of the filing in Docket No. 22-33-EE). In the context of this significant increase in the cost of savings from this program, please also explain why the Company is proposing to increase the electric EnergyWise Single Family program budget from $15.5 million in 2023 to $16.2 million in 2024.

Response:

For the electric EnergyWise Single Family (EWSF) program, the Company planned 16,940 lifetime MWh in 2023 and 14,991 lifetime MWh in 2024. Additionally, as stated in the request, the program budget increased from $15.5 million in 2023 to $16.2 million in 2024. Therefore, an increase in spending and decrease in planned lifetime savings led to the increased cents per lifetime kWh for the EWSF program.

With LED lighting being phased out in 2024 electrical savings have become more expensive to acquire. This additional cost to acquire electrical savings can be seen, in part, in the additional focus on weatherization of electrically heated homes. The program budget has also been impacted by anticipated growth in participation and increases in quantities of installed measures and an increased number of weatherization installations.

The increase in the budget for the program of $0.7 million is a 4.5% increase over the 2023 budget. This is a reasonable increase to pursue savings that are still cost effective and an important element in the Company's energy efficiency programs contributing to meeting the state's carbon reduction targets.

Prepared by or under the supervision of: Spencer Lawrence

PUC 1-90
Savings

Request:

Please explain what factors contribute to the cents per lifetime kWh of savings from the electric Income Eligible Single Family program decreasing from 49.2 in 2023 (Table E-5 Primary of the Updated Compliance Filing in Docket No. 22-33-EE) to 33.2 in 2024 (Table E-5 Primary of the filing in Docket No. 22-33-EE).

Response:

For the electric Income Eligible Single Family (IESF) program, the Company planned 24,080 lifetime MWh in 2023 and 36,084 lifetime MWh in 2024. This increase in planned savings outweighs an increase in program budget from $11.8 million in 2023 to $12.2 million in 2024. Therefore, the IESF cents per lifetime kWh increased between 2023 and 2024.

The 2024 Plan focuses on greater electricity savings primarily driven by increased planned quantities in electric resistance to minisplit heat pump upgrades and accompanying electric weatherization. The Company saw many more appliances being replaced, measures that produce reasonable electric savings, in 2023 and planned accordingly for 2024.

Prepared by or under the supervision of: Spencer Lawrence