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Impact & Process Evaluation

EnergyWise & Income Eligible Multifamily Programs

National Grid Rhode Island

Developed For

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Executive Summary

National Grid offers energy efficiency services to multifamily customers in Rhode Island through both its EnergyWise Multifamily (EWMF) and Income-Eligible Multifamily (IEMF) Programs. The programs are similarly structured and delivered through a single lead vendor. Both programs offer whole-building energy assessments during which trained assessors and technicians directly install a variety of no-cost efficiency measures and identify opportunities for deeper savings measures, such as common area lighting, weatherization, heating systems, and custom projects. In the past three years, the MF programs have served more than 400 multifamily facilities across the state.

Why Evaluation?

National Grid uses evaluation to retrospectively assess the performance of its programs and estimate savings for future program years. In March 2020, National Grid contracted with Cadeo and ILLUME Advising, third-party energy efficiency program evaluators, to complete an impact and process evaluation of both MF programs as implemented in 2017, 2018, and 2019. The evaluation produced verified energy savings for most measures, which are applicable for both EWMF and IEMF, and yielded insights and recommendations for better serving multifamily customers.

Key Impact Findings

The evaluation team used three complementary methods - billing analysis, engineering algorithms, and building simulation - as part of the impact evaluation. Unfortunately, data quality issues - namely incomplete and inconsistent program tracking data - limited our team's ability to accurately develop savings estimates for several key natural gas and delivered fuel measures, including weatherization and heating systems. To better enable future evaluations, the evaluation team offered several recommendations for improving data management. As shown below, the evaluation team was able to evaluate both common area and in-unit lighting, the program's primary source of electric savings.

Common Area Lighting kWh/year

Using detailed pre- and post-retrofit wattages gathered by MF assessors and location-based hours-of-use values from a recent multifamily metering study in Massachusetts, the evaluation found higher savings for common area lighting than National Grid planned.

In-Unit Lighting kWh/year

Since it was not possible to estimate sufficiently precise billing analysis results for MF in-unit lighting, the evaluation team leveraged the results of the concurrent EnergyWise Single Family evaluation. This resulted in a decrease in savings relative to National Grid's assumed savings.

Key Process Findings

Process evaluation activities revealed that the program is running smoothly. Program satisfaction among participants is high (86%); stakeholders believe the program is working well and credit the quality of working relationships between key program implementers (i.e., contractors, assessors, and inspectors). One opportunity for program improvement came at the suggestion of MF stakeholders. Rather than completing paperwork via paper and pen, MF assessors and inspectors call for the digitization of paperwork processes so they can focus on other program delivery components.

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Executive Summary

This report details the findings of Cadeo and ILLUME's impact and process evaluation of National Grid's two residential multifamily programs in Rhode Island: EnergyWise Multifamily (EWMF) and Income Eligible Multifamily (IEMF). The programs, which National Grid delivers in tandem through a single lead vendor (RISE Engineering), offers multifamily participants similar efficiency measures – albeit under different incentive structures. Given the similarity and coordinated delivery of the programs, this report summarizes the impact and process findings for both programs. Throughout this report we refer to both programs, collectively, as the "multifamily" or "MF" program.

The scope of our gross impact evaluation included MF participants that received their energy assessment in 2017 or 2018. To minimize recall bias associated with our surveys, our net-to-gross (NTG) analysis focused on the EWMF participants that had their assessment more recently (Q2 2018 through the end of 2019). Our team did not estimate NTG ratios for any IEMF measures, which are deemed at 1.0. Our process evaluation also focused on 2019 MF participants.

Key Impact Findings

The two key MF measures are common area and in-unit lighting, which collectively generated nearly three-quarters of the program's 2019 electric savings.

Common Area Lighting kWh/year

Using detailed pre- and post-retrofit wattages gathered by MF assessors and location-based hours-of-use values from a recent multifamily metering study in Massachusetts, the evaluation found higher savings for common area lighting than National Grid planned.

In-Unit Lighting kWh/year

Since it was not possible to estimate sufficiently precise billing analysis results for MF in-unit lighting, the evaluation team leveraged the results of the concurrent EnergyWise Single Family evaluation. This resulted in a decrease in savings relative to National Grid's assumed savings.

Issues with the program's tracking data limited our team's impact evaluation. Evaluating multifamily programs is notoriously problematic due to the diversity and complexity of the participating facilities, as well as the need to track measure and consumption data at the account, dwelling unit, building and facility levels. Our team encountered some of these common issues during our impact evaluation. Specifically, missing data, inconsistencies, and ambiguities in the provided MF data prevented our team from developing the MF-specific building simulation models we'd planned to create, as well as calibrating those models using participant-specific heating, cooling, and baseload energy consumption data. This, in turn, limited our ability to report reliable ex post savings for certain MF measures.

Key Process Findings

Overall program satisfaction among participants is high. Among residents, 86% reported that they were very, somewhat, or moderately satisfied with the program overall. Building owners and managers are also satisfied with the program overall .

Contractors, assessors, and inspectors believe the program works well, and report satisfaction with these relationships. Stakeholders did not have many suggestions for program improvement, suggesting that program processes are generally working well. Program stakeholders described the trusting relationships that they have with one another, and how this contributes to their overall satisfaction.

RISE assessors and inspectors reported that the MF paperwork is burdensome. This is, in part, because MF assessors and inspectors must still complete all program paperwork in hard copy, via paper and pen. By contrast, EWSF digitized its paperwork a year ago with the introduction of iPads, which EWSF assessors noted had substantially increased their efficiency. MF assessors noted the improvement for EWSF and speculated that a similar transition to digital paperwork would yield similar benefits for the MF program.

Some program participants reported needing more help to overcome health and safety barriers. These participants wanted additional support, including more specific guidance on how and who could help them remediate the identified health and safety barriers so they could move ahead with their efficiency upgrades. As the program continues to mature, it may become more important to help these types of participants, in order to unlock future energy savings opportunities.

Some participants expressed frustration that they did not receive certain measures that they expected, particularly related to smart thermostats and lighting. While participants receive a report that includes the measures they qualify for, the report does not explicitly detail measures customers did *not* qualify for. This information tends to be communicated verbally by MF staff, which led to confusion, uncertainty, or disappointment among participants.

A subset of residents expressed concerns about their experience with their installation contractor. Almost one in five surveyed residents noted messes left behind, a lack of professionalism, and the inability of their installers to answer questions. While the current inspection process tracks and reports installation quality-related issues, further, the program also conducts customer satisfaction surveys and program staff report that RISE follows up with contractors who get poor customer reviews.

The program quickly transitioned to virtual assessments in response to the COVID-19 pandemic. Program stakeholders generally think there is a role for virtual assessments in future versions of the MF program. In fact, MF inspectors suggested that there might even be an expanded role for virtual work in certain types of inspections. However, nearly all program stakeholders also expressed some level of skepticism about virtual assessments, primarily about the program's ability to accurately assess complex buildings without a physical inspection.

National Grid program staff are interested in exploring alternative program models. The Massachusetts Program Administrators have transitioned to a residential coordinated delivery structure that integrates single-family and multifamily solutions. As described in this report, some customers fall into a "gray" area in terms of service – specifically, customers within what are technically classified as multifamily condominium properties, yet the individual condominium homes are single family-style homes. The goal of a potential new structure in Rhode Island would be to identify and develop better solutions for these customers.

Recommendations

In response to these, and other findings detailed later in the report, our team developed eight recommendations for National Grid to consider as part of future MF delivery. The first three focus on potential improvements to program data tracking identified as part of the impact evaluation, while the last five result from the process evaluation.

Table 1. Summary of Recommendations

#	Recommendation	Details
1	**Add data consistency checks to multifamily program data entry tool**	We recommend that the program add automated checks to the data entry process notify assessors when the dwelling unit, building, and facility data hierarchy is violated (e.g., when the entered square footage of a building larger than that of the facility). This will give assessor an opportunity to make corrections right away. Similarly, adding minimum or maximum thresholds (with associated alert) may prevent assessors from entering data into the wrong level of the participant hierarchy (e.g., unit level for a building). Given the wide variety in participating buildings, it is important assessors can override alerts. However, the fact that assessors have to explicitly acknowledge and override the alert will likely avoid issues and give future evaluators greater confidence in outlying values.
2	**Keep an accounting of total building tenant counts, participation, and opt-outs**	The data that our team received tells only a partial story of the measures that were installed and the accounts they are associated with. There is a greater context that is missing that would support more robust evaluation and/or data quality checks. By accounting for all dwelling units, independent of program participation data, including explicit accounting of whether a dwelling unit participated in the program, will give future evaluators more certainty when aggregating consumption and program data to support impact tasks.
3	**Collect more tenant emails addresses**	E-mail is the most cost-effective method for evaluators, as well as the program and National Grid, to follow up with participants. For multifamily buildings, the account holder is not always the tenant and may not be able to best answer questions regarding the program. Collecting email addresses from all served tenants would allow for more informed unit level responses as part of future evaluations. However, this is not always possible as many tenants are not present during the assessment or when the program is installing measures. In some cases, property contact can provide the program with tenant e-mail addresses, but some property contacts are, understandably, unwilling to share tenant's contact information. Acknowledging these constraints, the program should work with tenants and the building contact to gather as many e-mails as possible for tenants that received MF program measures in their dwelling unit. National Grid could also leverage the program gathered e-mail addresses to fortify their customer information system, which is less populated with e-mails for multifamily customers than single-family customers.
4	**Digitize processes for assessors and inspectors**	The MF programs should consider a transition to digitized paperwork, like what has already been done for the EWSF program.

5	**Increase facilitation of health and safety barrier remediation**	There are many strategies that National Grid could consider to further facilitate health and safety remediation, including direct referrals to remediation contractors or firms, developing partnerships with remediation firms, or offering various types of incentives through these partnerships to encourage properties to have this work conducted in a timely manner.
6	**Set clearer expectations with participants**	To set clearer expectations, we suggest that National Grid add language to assessment reports explicitly detailing the measures that customers did and did not qualify for, specifically related to smart thermostats and lighting, and, if possible, the rationale as to why they did not receive certain measures. This additional documentation may prevent some of the dissatisfaction observed through this evaluation and, in doing so, increase the likelihood that these participants would recommend the program to other MF property owners or managers.
7	**Identify the optimal long-term role for virtual assessments**	National Grid should work on identifying the optimal role for virtual assessments within the Multifamily programs' offerings. For example, virtual work may be most useful for certain customer or building types, or specific inspection types. Identifying the optimal role for virtual work may result in greater efficiencies, freeing up time for assessors to access or assess more sites and do more customer follow-up. Future evaluations could embed more research specifically related to virtual assessments and virtual program components overall. While this evaluation was largely done to plan for the next three-year evaluation cycle, embedded evaluation research focused on this specific issue could help inform program design and delivery issues. Specifically, having an assessment of the virtual assessment platform and processes conducted for multi-family (as well as single-family) could be important in identifying what is working well, what could be improved, and whether the virtual processes being implemented for assessments could be leveraged for other program components. This type of assessment impacts both process and impact evaluation components, given issues related to direct versus self-install of specific measures.
8	**Use future research to explore optimal program delivery models**	Future research should seek to identify the optimal lead vendor and program delivery model for Rhode Island. This could include identifying logic models and goals of transitioning to a residential coordinated delivery model, using some of the lessons learned around this model type in Massachusetts. Developmental research may also be useful to determine whether a different model structure is needed in Rhode Island. This could be accomplished via workshop and design strategy sessions, focusing on the unique needs of Rhode Islanders and the Rhode Island programs.

Introduction

This report details the findings from Cadeo and ILLUME's impact and process evaluation of National Grid's EnergyWise & Income Eligible Multifamily programs in Rhode Island.

About EnergyWise & Income Eligible Multifamily Programs

National Grid offers energy efficiency services to multifamily customers in Rhode Island through both its EnergyWise Multifamily (EWMF) and Income-Eligible Multifamily (IEMF) Programs (collectively referred to as the "Multifamily programs" throughout this report). The programs are similar in their structure and delivery. Both programs offer:

Assessments: program staff assess multifamily buildings for energy savings opportunities. Assessors do not assess every single unit within MF buildings; instead, they assess a sample of units that are representative of unit types within the building. In the case of condominiums, assessors may assess a sample of single-family style homes that represent the condominium types within the community. Prior to COVID-19, program staff conducted all assessments in-person.[1] As described later in this report, one MF assessor reported having some experience with virtual assessments for the MF programs.

No-cost direct install measures: Program staff install no-cost direct install measures in residents' homes. These measures include in-unit lighting, smart strips, thermostats, showerheads, and aerators. Often, a first assessment is done to identify overall energy saving measures; during this, a sample of individual units may also be assessed.

Deeper retrofit measures: Based on the assessment results, properties may be eligible for deeper retrofit measures, both within common areas and within individual units. These measures include common area lighting (bulbs and fixtures), air sealing, insulation, refrigerators, demand controllers, and outdoor reset controls.

Multifamily properties are eligible for the EWMF program if they are:

- Residential buildings with 5+ units; and/or
- Residential properties consisting of four or more 1-4-unit buildings that are both (1) connected or adjacent to each other, or to a 5+ unit building, and (b) are owned by the same individual or firm.

Buildings that meet the EWMF criteria are eligible for no-cost direct install measures and deeper retrofits, for which incentives vary (e.g., incentives for insulation are 75% per unit up to $2,000, whereas incentives for common area lighting fixtures include a $25 copay).

Multifamily properties are eligible for the IEMF program, which funds 100% of the project cost[2] if they meet the above conditions and at least one of the following conditions:

[1] Since March 2020, the program integrated virtual implementation to overcome health concerns related to Covid-19. When the program restarted after the initial program shut down in March, only virtual assessments were allowed. Our understanding is that, as of the writing of this report, both in-person and virtual assessments are allowable by the program. In-person assessments are subject to new health and safety requirements, including PPE requirements.

[2] Multifamily Services: Rhode Island Residential and Commercial Incentives. Last accessed 20 July 2020. Available at: https://www.nationalgridus.com/media/pdfs/bus-ways-to-save/ri-multifamilyprogram-incentives.pdf

- They are owned by public housing authorities or community development corporations
- Receive affordable tax credits or low-income funds or subsidies from state or federal governments
- Consist of units where most customers qualify as income eligible customers (who are less than 60% of the Area Median Income)[3]
- Have 5+ units

Through the Multifamily programs, property managers and owners are served in addition to renters and owners of units within multifamily properties. For the EWMF program, condo-style multifamily properties are also served, though these properties may be single-family style homes with the participant being the condo occupant. Throughout this report, we refer to renters and owners collectively as "residents".

RISE Engineering implements the program and is responsible for program administration and oversight, including assessing properties and units, bidding work to contractors when applicable, and conducting inspections. RISE responsibilities include, but are not limited to:

Bidding process for contractors & general contractor management
Program assessment scheduling and completion
Income qualification of multifamily properties
Inspections of customer homes
Cost-effectiveness and pricing adjustments for all program measures

CMC, a third-party auditor, also conducts independent, third-party inspections of 10% of projects to ensure the quality of the work.

Measures

The scope of the MF evaluation included the following 21 measures associated with seven measure groups. Nearly half of these measures are lighting—various LED screw-in lamp types or fixtures—installed in tenant units and building common areas. With very few exceptions, each of the listed measures are installed as part of EWMF and IEMF. Please note that the scope of this evaluation did not include custom measures.

[3] To meet this standard, program staff report that 50% of units within a multifamily property must qualify as income-eligible for the facility to be qualify for the IEMF program.

Table 2. MF Measures and Measure Groups

Measure Group	Measure
Domestic Hot Water	• Aerators • Showerheads • Pipe Wrap/Insulation • TSV Showerheads
Lighting (Common Area)	• LED Bulbs (i.e., General Service Lamps) – Interior • LED Bulbs – Exterior • LED Reflectors – Interior • LED Reflectors – Exterior • LED Fixtures – Interior • LED Fixtures – Exterior
Lighting (In-Unit)	• LED Bulbs (i.e., General Service Lamps) • LED Reflectors • LED Fixtures • LED Specialty/EISA Exempt Bulb
Controls	• Programmable Thermostats • Wi-Fi Thermostats
Appliance & Plug Load	• Refrigerator Rebate (for replacing existing refrigerator with an ENERGY STAR-qualified model) • Smart Power Strips
Weatherization	• Weatherization (i.e., air sealing and/or insulation)
Heating System	• Boiler (Residential) • Boiler (Commercial)

Participation Summary

According to National Grid's 2019 reporting, weatherization (36%) is responsible for the largest share of multifamily savings across all fuel types. Followed by domestic hot water[4] (25%), controls (20%), and lighting (18%), which combined represent 99% of the multifamily program's electric, natural gas, and oil savings.[5]

[4] Domestic hot water is a much higher percentage of program savings in 2019 compared to prior years due to one very large DHW pipe wrap installation in the EWMF program.

[5] As a percent of program savings included in this evaluation. The team did not evaluate custom measures or certain HVAC measures which the program also reported savings.

Figure 1. Savings by Measure Group (MMBTU, 2019)

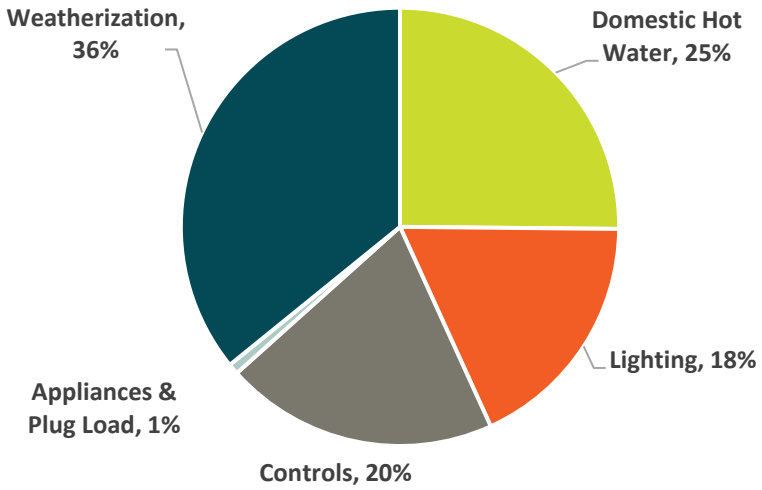
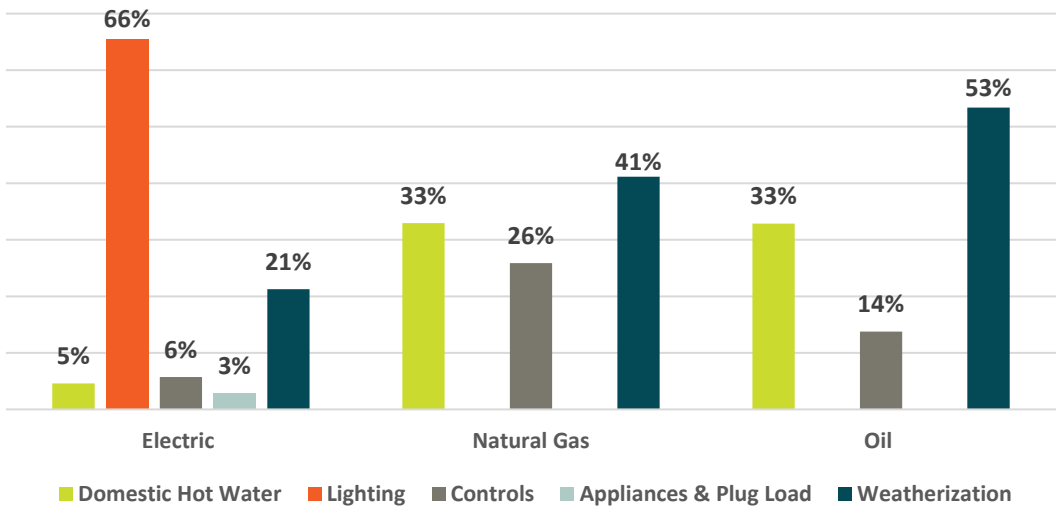


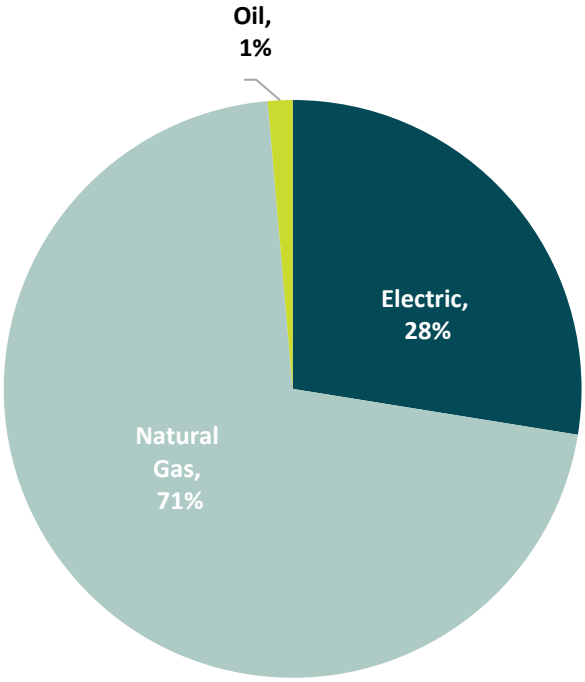
Figure 2 looks at the savings from these same measure groups by fuel type. Not surprisingly, most of the electric savings come from lighting, whereas weatherization, DHW, and controls are relatively even among gas savings and weatherization is responsible for over half of oil savings.

Figure 2. Savings by Measure Group and Fuel Type (2019)



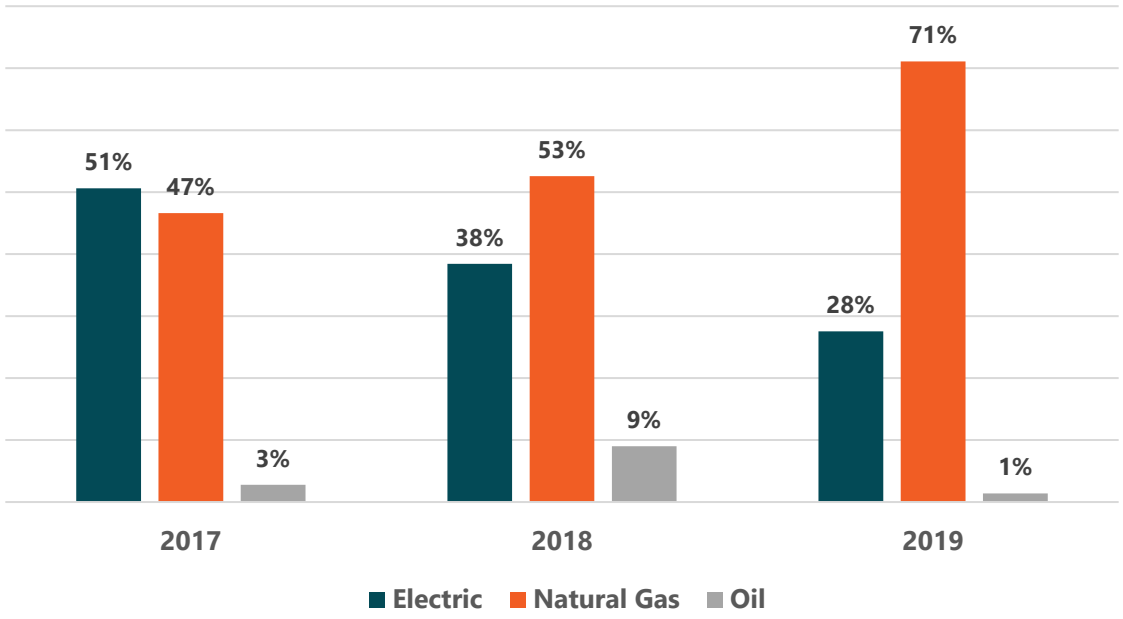
The team also investigated how each fuel type—electricity, natural gas, and oil—contribute to the program's overall savings. As evident in Figure 3, gas savings (71%) are the largest source of program savings in 2019, followed by electric (28%) and oil (1%). 2019 gas savings are bolstered by 75,524 Therms of weatherization savings which, on their own, constitute 29% of total 2019 multifamily program savings.

Figure 3. Savings by Fuel (MMBTU, 2019)



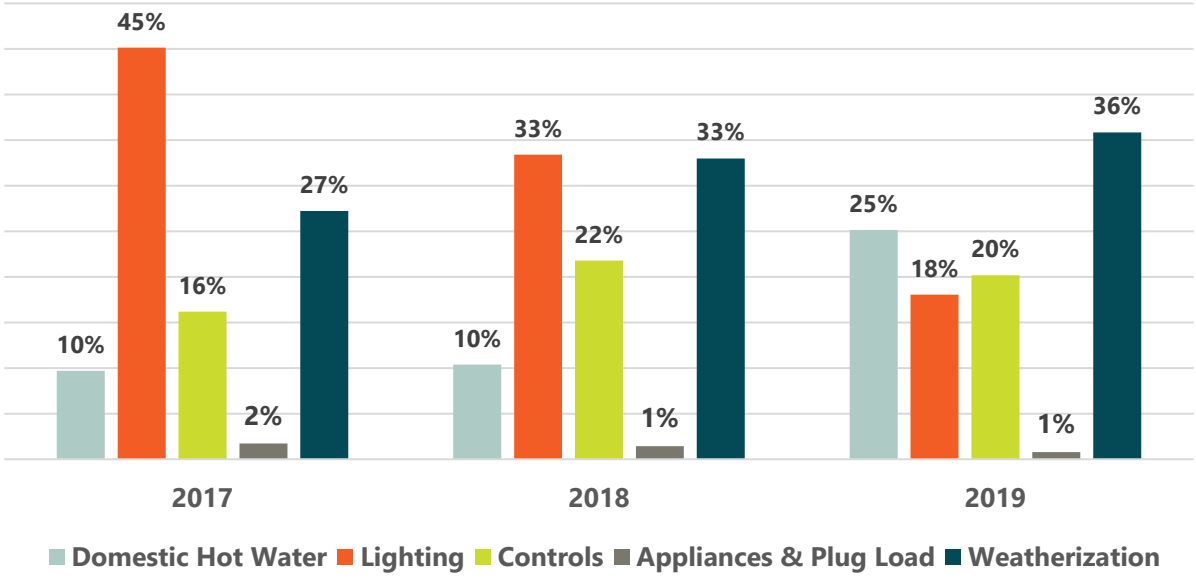
Natural gas has consistently grown as a portion of total program savings over the past three years, increasing from 47% in 2017 to 71% in 2019. However, as alluded to earlier in this section, gas savings are particularly high in 2019 due to a large DHW pipe wrap insulation project. In fact, DHW pipe wrap accounted for 26% of the MF gas savings in 2019, compared to between 2 and 3% in 2017 and 2018. In addition to the increase in gas savings, Figure 4 below shows the general shift away from electric savings relative to other fuel types.

Figure 4. Savings by Fuel by Year (MMBTU, 2017-2019)



The shift from electric to non-electric savings is also clearly reflected in the change in measure group savings between 2017 and 2019. Figure 5 shows how lighting savings have decreased from 45% to 18% of savings while weatherization and controls (i.e., programmable and Wi-Fi thermostats) have both increased.

Figure 5. Savings by Measure Group and Year (MMBTU, 2017-2019)



Key Terminology

The evaluation team uses the language defined in Table 3 throughout the report to explain key impact evaluation concepts.

Table 3. Summary of Key Evaluation Terminology

Term	Definition
Participant	Refers to a either a customer that lives in a building (with five or more units) that received a MF energy assessment in 2017, 2018, or 2019 or the individual (i.e., building owner, manager, or maintenance staff) that engaged with the programs and/or made subsequent installation decisions.
Tenant	A customer that lives in an individual unit at a facility served by the MF program in 2017, 2018, or 2019. The tenant may rent or own the unit. In some cases, the tenant is the decision-maker regarding which MF efficiency improvements are made within their unit/building; in other cases, those decisions are made by the program's building contact. We also refer to tenants in the report as multifamily "residents".
Building Contact	The individual that was the program's primary contact at a facility that participated in the MF program in 2017, 2018, or 2019. The building contact may be the owner, manager, or facility staff of the facility. In some cases, particularly for participating condominiums, the building contact also a tenant and received program services within their unit.
Unit	A living space (i.e., apartment or condominium) treated by the program.
Building	A building, compromised of multiple units and common areas, treated by the program.
Facility	A property, made up of one or more buildings each with multiple units, treated by the program.
Ex Ante Savings	Savings assumed by National Grid prior to an evaluation, usually based on the prior MF impact evaluation and/or the Rhode Island TRM.
Ex Post Savings	Savings determined through this evaluation.
Gross Savings	Savings generated by the program without consideration for whether the participant would have taken the same/similar actions absent the MF program.
Net Savings	Savings generated by the program that account for the participant's likely action in the absence of the program. In the case of this MF evaluation, net savings are determined using either tenant/building contact self-report surveys or, for select in-unit lighting, through billing analysis.
Impact Factors	Other factors, such as in-service rate (also known as removal rate, measure retention rate, or savings persistence rate) that impact the savings generated by program measures.
Treatment Group	The MF participants for whom the team estimated ex post savings: customers who received MF measures in program year 2017 or 2018. The treatment group for the billing analysis was limited to participants prior to October 2018, to ensure a full heating season in the post-installation period after accounting for a blackout period around the measure installation date.[6]
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.

[6] 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 outlines the evaluation methodologies used. For key MF measures, such common area lighting, the Evaluation Summary includes a detailed explanation of how our 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 reference the **Supporting Documentation workbook**. The Supporting Documentation workbook includes a tab for each MF measure that was evaluated using an engineering approach (i.e., either 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 set of participant, housing stock, and engineering assumptions, which ensures consistency across measures. Readers interested in accessing the Supporting Documentation workbook should request access from the National Grid's EWSF evaluation manager.

The third and final part of this evaluation is the **Appendix,** which contains all the interim deliverables our team created as part of this evaluation process. The appendix includes:

A. Evaluation Scope of Work
B. Impact Analysis Plan
C. Net-to-Gross Methodology Memo
D. Additional Spillover Analysis Details
E. Program Manager Interview Guide
F. Stakeholder Interview Guide
G. Participating Building Contact Survey
H. Additional Building Contact Survey Results
I. Participating Tenant Survey
J. Additional Tenant Survey Results

Methodology

Activities

The evaluation team completed a total of six complementary impact and process tasks to evaluate the MF program.

We used three of the tasks (billing analysis, engineering algorithms, building simulation) to estimate the **gross** and **net savings** associated with electric, natural gas, and oil efficiency measures delivered through the MF program. We used these approaches to estimate in-unit and common area measures alike.

For electric and natural gas measures, our team attempted to rely on billing analysis for select measures since the approach accounts for the myriad of factors (pre-conditions, uninstallation, and behavioral change) that impact savings. However, we were unable to generate sufficiently precise savings via billing analysis. As a result, our team turned to one of the two engineering approaches (building simulation or engineering algorithms). For some measures, our team leveraged multiple approaches and/or relevant billing analysis results from the concurrent EnergyWise Single Family evaluation.

Due to lack of accessible billing data, our team could not attempt a similar billing analysis for oil measures. For oil measures, our team relied on engineering approaches that factored in oil space heating and water heating system efficiencies.

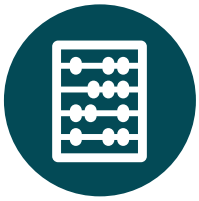
Three other tasks—program data review, stakeholder interviews, and participant surveys—informed both impact and process findings, while our review of program materials and stakeholder interviews primarily yielded process insights.

Table 4 briefly summarizes each task.

Table 4. Evaluation Tasks

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, which was only possible for in-unit lighting
- Combined customer billing records with weather and measure installation data to get a complete perspective of each customer's energy consumption drivers; attempted at the tenant- and building-level
- Conducted a structured screening process to ensure that the model uses only those customers with sufficient billing data and without spurious billing records
- Specified and refined a monthly post-program regression (PPR) model
- Disaggregated billing data into specific end uses (heating, water heating, and baseload)



Engineering Algorithms

- Relied primarily on the algorithms documented in 2020 Rhode Island TRM[7]
- Relied on recent studies from other jurisdictions (notably Massachusetts) where the Rhode Island TRM did not specify a savings algorithm or specific input value
- Leveraged detailed MF program data to calculate baseline and efficient cases for each measure; assessed for differences between EWMF and IEMF
- Relied on regionally appropriate secondary data sources and other relevant studies when program data was not collected or unavailable (sources included the 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

[7] http://rieermc.ri.gov/wp-content/uploads/2019/11/ngrid-ri-2020-trm.pdf

Building Simulation

- Modeled using BEopt (Building Energy Optimization) software developed by the National Renewable Energy Laboratory
- Constructed baseline building geometry and building characteristics using inputs like square footage, number of floors, and baseline infiltration rates from MF program data or, when MF program data was incomplete and/or inconsistent, secondary data such as the Energy Information Administration's Residential Energy Consumption Survey (RECS).
- Simulated twelve different scenarios reflecting various building types, heating fuels, heating system combinations, and cooling scenarios
- Calibrated, to the extent possible, each model using MF participant billing data. The team attempted to calibrated to multiple scenarios including different heating systems (boiler, gas furnace, electric furnace, and electric radiant) and cooling configurations (Central AC, window AC, and no AC).
- Weighted the result of the twelve models into a statewide average using the building type, heating fuels, heating type, and cooling type characteristics of 2017 and 2018 MF participants. In instances where program data could not inform heating or cooling type saturations the team relied on secondary sources (e.g. RECS).

Materials Review

- Requested and reviewed program materials from National Grid and RISE including the materials provided to participants before, during, or after their energy assessment, marketing materials, and program tracking and participation reports
- Helped our team become more familiar with the MF programs, which in turn allowed us to ask more nuanced questions during the stakeholder interviews and participant survey
- Enabled our team to better contextualize and interpret statements made during the interviews and survey

Stakeholder Interviews

- Focused interview topics on MF program design, delivery, and perceived participant experience
  - Completed 17 interviews with:
    - National Grid Strategy and Implementation Managers (n=1)
    - Lead Vendor (RISE) Managers (n=1)
    - Lead Vendor In-Home Assessors (n=3)
    - Installation Contractors (n=9)
    - Lead Vendor Internal QA/QC Auditors (n=1)
    - Third-Party QA/QC Manager and Auditors (n=2)

Participant Surveys

- Completed 98 web surveys with tenants in participating EWMF buildings[8]
- Completed 23 web surveys with MF building contacts (19 and 4 for EWMF and IEMF, respectively)[9]
- Determined smart strip installation rates, the only MF instant savings measure not directly installed by assessors during the assessment; left behind for the participant to install in identified locations
- Calculated measure-specific in-service rates (also known as measure retention or savings persistence rates) for all direct install measures
- Estimated net-to-gross ratios for each EWMF measure group using a combination of tenant and building contact responses that reflects both group's installation making authority and the savings associated with those installation.[10]

Data Sources

National Grid has provided the following datasets, which our team will use to inform our evaluation activities.

MF Program Data. These data, which National Grid provided via its InDemand tracking system, included information at three levels (unit, building, and facility) for 2017, 2018, and 2019 EWMF and IEMF participants. The comprehensive dataset included contact and utility account information for the program's building contacts, and to a lesser extent, tenants. It also included information regarding the MF measures (type, quantity, savings) installed at participating facilities, as well as the characteristics of each facility (e.g., space and water heating type, presence of air conditioning, number of tenant units, and square feet). The MF data provided by National Grid included measures associated with the C&I portion of the MF program that services common areas and central heating/cooling systems.

Cross-Program Participation Data. As an assessment program, MF can serve as a gateway to participating in other, complementary National Grid residential programs. Since it is critical to account for participation in other programs when estimating savings, we flagged cross-program participants so that we can control for the energy savings from other programs as part of our billing analysis. To enable this, National Grid provided participation data for four of its other residential programs: Natural Gas Heating and Water Heating, ENERGY STAR HVAC, ENERGY STAR products, and the Home Energy Reports behavioral program.[11]

[8] Due to limited e-mail availability, our team was unable to complete a similar set of web survey with IEMF tenants. Our team is currently contacting IEMF tenants via phone. Those surveys will inform our concurrent MF process evaluation but will not influence the impact evaluation as we will not be asking IEMF tenants net-to-gross questions.

[9] To maximize response rate, our team also contacted all EWMF and IEMF building contacts via phone. RISE's MF assessors, on behalf our team, also sent e-mails to all MF buildings encouraging them to respond to our team e-mail and phone outreach and complete the evaluation survey.

[10] See the Net Savings section for more details.

[11] Excludes upstream lighting since that program does not collect customer information that would allow for mapping cross-participation. As noted later in the document, the exclusion of upstream lighting means, among other factors, that users of this evaluation should interpret the billing analysis results for lighting measures as net savings.

Billing Data. National Grid provided monthly energy consumption data ranging from January 1, 2012 to December 31, 2019.[12] These data include billed, gas and electric energy consumption for all National Grid Rhode Island's residential customers. The team did not attempt to gather any information regarding delivered fuels (i.e., heating oil and propane).

Program Materials. At the evaluation's outset, the team requested program materials from National Grid and RISE. This included materials provided to participants before, during, or after their assessment and program marketing materials, including the program website and brochures available on the website. We reviewed these materials to gain program-specific insight that allowed us to ask more informed questions during the interviews with program staff, RISE assessors, RISE inspectors, program contractors, and CMC inspectors.

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

Weather Data. The team acquired contemporaneous, hourly weather data from NOAA for all weather stations in Rhode Island. We used these data to calculate weather normalized consumption for program participants, which we then used to calibrate building simulations and to determine weatherization energy savings for a typical meteorological year (TMY3).

[12] The billing data provided by National Grid will also support our team's concurrent Home Energy Reports (HER) impact evaluation. The HER analysis spans a much longer participation period, which is why National Grid provided consumption data as far back as 2012.

Impact Evaluation Findings

In this section, our team summarizes the gross (EWMF and IEMF) and net (EWMF-only) savings determined for MF measures and measure groups.

Data Quality

As noted, the MF data provided by National Grid was hierarchical, providing participant and program information at the three, interrelated levels: the unit-level, the building-level (comprised of multiple tenant units and common areas within a given building), and the facility-level (when relevant reflecting multiple buildings at a participating property). In theory, these data levels are additive and internally consistent. For example, the sum the square footage associated with all the buildings at a given participating facility should equal the size of the entire facility.

However, in practice, our team often found these hierarchical relationships to be inconsistent. In many instances, information, such as square footage, was either the same for at the unit and building level or appeared (based the magnitude of the value) to be associated with the wrong level (e.g., unit square footage of 10,000 square feet, which is more reasonable for a building or facility).

Our team attempted to identify and triage these inconsistencies. Specifically, we attempted to:

- **Recalculate**, i.e., divide, for example, what appeared to be a building square footage (based on the magnitude) into unit-level square footage using the number of units reported for that building
- **Reassign**, i.e., reclassify a square footage clearly too large to be a unit-level value as the building-level square footage
- **Filter**, i.e., remove values for a given field determined, based on either professional judgement or the range of other values observed in the data, as likely to be inaccurate.

Unfortunately, we found one or more of these remedies to be fraught. It was often not possible to confidently recalculate and/or reassign values because doing so required confidence in a related data element (such as the number of units in a building) that also had some uncertainty associated with it. While filtering produced average results that our team was more confident in, dropping data points from a program with a relatively small number of participants lead to problematically small sample sizes. This was particularly true when our team wanted to assess information at a more granular level (i.e., heating loads for electrically heated buildings, which are a subset of all participants).

Our team has provided more specifics about these data inconsistencies – as well as recommendations for addressing them - in the Additional Details: Data Quality section later in the report. In general, the data quality issues limited our team's ability to develop, as well as calibrate, building simulation models tailored to the specific characteristics and usage of MF program participants. As a result, our team created models based on our notion of "typical" multifamily buildings and rely more heavily on secondary sources to assess the reasonableness of our model assumptions and outputs. Examples of these secondary sources include RECS and recent evaluations in

New England that also modelled multifamily buildings using building simulation[13].

Gross Savings

Table 5 presents the ex post gross results for each MF measure.[14] The table also indicates which methodology the evaluation team used to estimate savings. Since our team did not identify any meaningful differences in the pre-conditions and/or mix of efficient measures installed through EWMF and IEMF, we present a single set of MF program results reflecting measures installed through either program.

Most of the measures offered through MF are also offered through National Grid's EnergyWise Single Family program, which our team concurrently evaluated. To ensure consistency across programs/sectors (where relevant) we tried to use similar methodologies for measures offered to SF and MF customers. While the methodologies are often consistent, our team leveraged MF-specific information (when possible – see Data Quality section above) to ensure the results below are tailored to MF program participants.

As shown in Table 5, our team used engineering algorithms to evaluate most measures. Since our team was unable to estimate sufficiently precise MF-specific billing analysis savings for in-unit lighting, our team leveraged the concurrent EWSF billing analysis; that effort, which also focused on directly installed LEDs in residential living spaces, produced robust estimates of lighting savings. Our team believes leveraging the EWSF billing analysis result offers a more realistic estimate of in-unit MF lighting savings than using an algorithmic approach, which was shown to overestimate savings (relative to the billing analysis result) as part of the EWSF evaluation.

In addition, the evaluation team—due to the data quality issues noted above—was unable to generate reliable ex post savings for weatherization and boilers. We have designated these measures with a "CV" in the table below, which stands for "current value". Since our team was unable to independently estimate reliable ex post savings for these measures, we defaulted to an engineering review of the ex ante savings to assess reasonableness. We found the current values, using the information available to us (see Data Quality section above), to be reasonable. We therefore suggest that National Grid continue to leverage the vendor-calculated savings for weatherization and boilers until improvements in MF program data collection and management enable future evaluators to reliably generate ex post savings.

[13] http://ma-eeac.org/wordpress/wp-content/uploads/MA-Lighting-Interactive-Effects-Results-Memo_15June2016-Final.pdf

[14] Except for the four in-unit lighting measures, which are reflect net savings. This is explained in more detail later in this section.

Table 5. MF - Ex Post Gross Savings by Measure and Fuel[15]

Measure Group	Measure	Electric (kWh/year)	Natural Gas (therms/year)	Oil (MMBtu/year)
Domestic Hot Water	Aerators	38	2.0	0.2
	-Water Savings (gal)	359	359	359
	Showerhead	246	13	1.4
	-Water Savings (gal)	1,786	1,786	1,786
	TSV Showerhead	296	15	1.6
	-Water Savings (gal)	2,130	2,130	2,130
	Pipe Wrap/Insulation (per foot)	8.3	.5	.05
Lighting (Common Area)	LED Fixture (Interior)	206		
	LED Bulbs (Interior)	179		
	LED Reflector (Interior)	140		
	LED Fixture (Exterior)	503		
	LED Bulbs (Exterior)	162		
	LED Reflector (Exterior)	210		
Lighting (In-unit)	LED Bulbs	18		
	LED EISA EXEMPT	15		
	LED Reflectors	19		
	LED Fixtures	34		
Controls	Programmable Thermostat (Heating Savings)	249	15	1.6
	- Fan/pump Savings (kWh)	14	14	14
	-Cooling Savings[#] (kWh)	15	15	15
	Wi-Fi Thermostat (Heating Savings)		23	
	-Fan/pump Savings (kWh)		22	
	-Cooling Savings[#] (kWh)		9	
Appliances & Plug Load	Refrigerator Rebate	914		
	Smart Strip	105		
	Weatherization (Heating Savings)	CV	CV	CV
Heating System	Boiler (Residential & Commercial)		CV	

[#]Per-unit savings weighted to reflect prevalence of CACs for MF participants

Key

- Billing Analysis
- Engineering Algorithm
- Building Simulation
- Engineering Adjusted Billing Analysis
- Current Value (Could not be evaluated)

Table 6 and Table 7 compare the ex post savings presented in the previous table with the program's ex ante savings. Table 6 focuses on electric measures, while Table 7 compares natural gas, oil, and propane measures. Both tables include a brief explanation of why ex ante and ex post savings may differ. As evident in the tables below, it was not possible to calculate realization rates for certain measures since National Grid utilizes a calculated savings approach (versus deemed savings) for many MF measures.

Our team provided National Grid with additional details regarding the specific inputs, assumptions, and algorithms that we used to generate these savings in the evaluation's Supporting Documentation workbook, which complements this final report.

[15] Again, except for the four in-unit lighting measures, which are reflect net savings.

Table 6. Comparison of MF Ex Ante and Ex Post Savings – Electric Measures (kWh/year)

Measure Group	Measure	Ex Ante	Ex Post	RR	Details
Domestic Hot Water	Aerators	Calc	38	NA	It is not possible to directly compare ex ante savings (determined through a % savings algorithm as part of the previous MF evaluation) and ex post savings (determined using engineering algorithm relying on program data and secondary resources) for any of the four domestic hot water measures due to methodological differences. It is worth noting that while the showerhead realization rate is high, the ex post savings are comparable to recent evaluations of similar programs in New England. Pipe wrap savings are also consistent with recent evaluations given the decrease in installed square footage of insulation for RI participants - tracked through program data.
	Showerhead^	129/217	246	191/ 113%	
	TSV Showerhead	335	296	89%	
	Pipe Wrap/Insulation (DHW) (Per Foot)	43	8.3	21%	
Lighting (In-Unit)*	LED Bulbs	33.3	18	54%	Since our team was unable to estimate sufficiently precise MF-specific billing analysis savings for in-unit lighting, our team leveraged the concurrent EWSF billing analysis; that effort, which also focused on directly install LED in residential living spaces, produced robust estimates of lighting savings. Our team believes leveraging the EWSF billing analysis result offers a more realistic estimate of in-unit MF lighting savings than using an algorithmic approach, which was shown to overestimate savings (relative to the billing analysis result) as part of the aforementioned EWSF evaluation. It is important to note that these savings, because they are billing analysis-based using a control group, reflect net savings, account for in-service rates, and interactive effects in electrically heated/cooled homes.
	LED Specialty/EISA Exempt	Calc	15	NA	
	LED Reflectors	Calc	19	NA	
	LED Fixtures	Calc	34	NA	
Lighting (Common Area)	LED Fixture (Interior)	Calc	206	-	The team could not compare ex ante and ex post values for common interior or exterior LED bulbs because there was no ex ante source listed in the TRM, and for other measures because savings are vendor calculated. Initially, our team attempted to estimate common area lighting savings via billing analysis. However, the analysis failed to yield sufficiently precise estimates, so the team relied on an algorithmic approach. We sourced delta wattage estimates from program tracking data and used deemed, location-based hours of use estimates from a recent MF lighting metering study in Massachusetts (RES 44), which found that vendor estimated HOUs did not correlate with actual lighting usage. Overall, RES 44 HOUs were ~40% higher than the vendor estimates in the tracking data, which lead to higher ex post savings.
	LED Bulbs (Interior)^	119/304	179	151 / 59%	
	LED Reflector (Interior)	Calc	140	-	
	LED Fixture (Exterior)	Calc	503	-	
	LED Bulbs (Exterior)^	142/115	162	114 / 140%	
	LED Reflector (Exterior)	Calc	210	-	

Table 6. Comparison of MF Ex Ante and Ex Post Savings – Electric Measures (kWh/year), Continued

Measure Group	Measure	Ex Ante	Ex Post	RR	Details
Controls	Programmable Thermostat^	281/257	278	99/ 108%	The slight difference in ex ante and ex post estimates for programmable thermostats stems from a difference in savings algorithm. Both algorithms assume a % savings relative to the participant's HVAC load, however the ex post assumption uses a more recent evaluation source (MA HES 2018 for ex post vs MA 2012 for ex ante). The team reviewed the literature review used to develop the ex ante savings for Wi-Fi thermostats and confirmed it was the best available savings source.
Appliance & Plug-Load	Refrigerator Rebate	Calc	914	NA	There were very few MF participants (<30) in the program data, thus our team leveraged the findings from the concurrent EWSF evaluation. To calculate single family savings our team relied on metered data from replaced refrigerators collected during home energy assessments, as well as the average consumption of the new ENERGY STAR unit (460 kWh). Ex post savings are high compared to other evaluations in New England, but reasonable since EWSF a) only replaces sufficiently inefficient refrigerators and b) the estimated average annual consumption of replaced units (1,392 kWh) is within reason for the older, inefficient units that qualify for replacement.
	Smart Strip	105	105	100%	Our team reviewed the ex ante source, a recent advanced smart strip study metering study (MA, 2018), and confirmed that it was the best available savings source.

^ Ex ante estimates and realization rates are listed as EWMF/IEMF in instances where they differ between programs

* Net, not gross, savings

Table 7. Comparison of MF Ex Ante and Ex Post Savings – Natural Gas (therms/year) and Oil (MMBTU/year)

		Natural Gas			Oil			
Measure Group	**Measure**	**Ex Ante**	**Ex Post**	**RR**	**Ex Ante**	**Ex Post**	**RR**	**Details**
Domestic Hot Water	Aerators	Calc	1.9	NA	0.86/ 0.28	0.2	23/ 71%	Similar to the electric domestic hot water measures above, it is not possible to directly compare ex ante savings and ex post savings due to methodological differences between evaluations. The team updated the savings algorithm for each of these measures to enlist an industry standard, more robust, algorithm than the ex ante estimate. We also utilized the same algorithm across fuel types to ensure consistency in savings calculation in this evaluation.
	Showerhead	Calc/ 10.7	12.8	NA / 120%	1.14 /1.07	1.4	120/ 128%	
	TSV Showerhead	16	15	96%	1.88	1.6	87%	
	Pipe Wrap/ Insulation (DHW) (per foot)	3.8	0.52	14%	.38	.05	14%	
Controls	Programmable Thermostat	Calc	15.3	NA	2.3	1.6	68%	Our team applied percent savings determined through a recent literature review in MA for programmable thermostats (3.6%) to the average heating load determined for EWSF participants heating with electricity. The ex ante savings estimate for programmable thermostats assumed a 6.2% savings and 36.5 MMBtu heating UEC, sourced from a 2007 study, this difference accounts for the change in savings. The team consulted the literature review used to develop the ex ante savings for Wi-Fi thermostats and confirmed it was the best available savings source (ex ante source estimated 5.5% savings).
	Wi-Fi Thermostat	Calc	23.4	NA	N/A	N/A	N/A	

^ Ex ante estimates and realization rates are listed as EWMF/IEMF in instances where they differ between programs.

Net Savings

Table 8 presents the NTG ratios for each EWMF measure group. Our team determined the ratios through surveys with residents and building contacts that recently participated in EWMF. As detailed in the separate NTG methodology finalized in May (provided in Appendix B), our NTG estimates considered both freeridership and spillover, and account for key factors such timing, quantity, and efficiency when considering the participant's self-reported action in the absence of EWMF. Appendix C provides additional detail on the spillover analysis.

The team surveyed both residents (who could be owners or renters) of participating multifamily units and building contacts (who could be property managers/building owners/maintenance staff) because the decision to install EWMF measures resided with both groups. At some EWMF properties, the residents decided what measures the program could install in their units, while a building or facility-level contact made decisions about whole-building measures such as weatherization or common area lighting upgrades. In other instances, such as at participating condominiums, residents were the primary decision maker for all EWMF measures or a building/facility-level decision-maker dictated what was installed in tenant units, as well as at the building level.

In recognition of this variation, our team began each EWMF survey by determining the set of EWMF measures (if any) that the respondent had decision-making authority over. Once determined, our team focused our freeridership questions on up to two of these measures.

The team found the lowest rate of freeridership and, relatedly, the highest NTG ratio, for the domestic hot water measures. This result is largely driven by property manager/building owners who reported that they would have been unlikely to install the measures on their own without the program. Residents were more likely to say they would install domestic hot water measures on their own.

Conversely, we found the highest freeridership (and lowest NTG) for programmable and wi-fi thermostats. The high likelihood of the property manager/building owners to install thermostats on their own within the next six months drove the higher freeridership.

As shown in Table 8, the number of respondents that answered freeridership questions for smart power strips and common area lighting was too low to generate reliable results. As a result, the team used the freeridership rate established through the concurrent EWSF evaluation for the smart power strip as that measure is directly installed in tenant units. For common area lighting, the team leveraged a freeridership rate established in an evaluation of the Massachusetts Multi-Family Program in 2017.[16]

[16] http://ma-eeac.org/wordpress/wp-content/uploads/RES-44_Multi-family-Program-Impact-Evaluation_FINAL_SO-Rates-Updated.pdf

Table 8. EWMF – Net-to-Gross Ratios (Measure Group)

Measure Group	Relevant Measures	Sample Size (EWMF)	Free-ridership	Sample Size* (Adjusted)	Freeridership* (Adjusted)	Spillover	NTG
Appliances & Plug Load	Smart Power Strips	2	0.32	163	0.31	0.01	0.70
Controls	Programmable & Wi-Fi Thermostats	19	0.48	-	-		0.53
Domestic Hot Water	Showerheads, Aerators, & Pipe wrap	25	0.08	-	-		0.93
Lighting - Common Area	LED bulbs or fixtures in common areas	1	0.40	72	0.23		0.78
Weatherization	Air Sealing & Insulation Types	28	0.33	-	-		0.68

*Because of the low n for these EWMF measure groups, the evaluation team used values from the EWSF evaluation for the Appliance and Plug Load measure group and values from the MA Res 44 evaluation for the Common Area Lighting measure group.

The measure groups in Table 8 do not include in-unit lighting because the team's ex post, per-unit lighting savings (via the EWSF billing analysis) reflect net savings.[17] Therefore, we did not apply a separate, standalone NTG ratio to in-unit lighting, as doing so would double count the freeridership effect in net lighting savings.

However, to provide National Grid with some insight into the relative extent of freeridership inherent in the lighting billing analysis results, our team asked surveyed EWMF participants to answer several freeridership questions related to the lamps and fixtures directly installed in their homes or buildings. Based on responses from 58 surveyed EWMF participants, almost one half (48%) of the program's direct install LEDs would have occurred absent the program.

Again, our team does not recommend that National Grid utilizes this value when determining net lighting savings and/or assessing cost-effectiveness; this information is for context and program planning purposes only.

Benchmarking

Prior to this evaluation, National Grid assumed an NTG ratio of 1.0 for all EWMF measures based on a 2008 EnergyWise Program Evaluation.[18]

[17] In general, billing analyses produce results on a spectrum between gross and net savings. The exact location on that spectrum for any given result depends on the type of customers in the control group and the efficiency measure being analyzed. Our team used billing analysis results (from EWSF) to report savings for EWMF in-unit lighting. The team's EWSF billing analysis results for lighting measures should be interpreted as net savings since it is likely that future participants, which were used for the control group, were installing LEDs prior to their home energy assessment.

[18] http://rieermc.ri.gov/wp-content/uploads/2018/03/energywise_final_report_08june_clean.pdf

Our study found lower NTG values than National Grid's 1.0 ex ante assumption for all measures.[19] The difference is relatively small for domestic hot water (0.08 less), but larger for the other measure groups – as much as 0.46 less (for thermostats).

Since there are not NTG results from previous EWMF studies completed in Rhode Island to benchmark against, our team looked to studies of similar programs in other New England states. The team referenced an impact and net-to-gross evaluation of the Massachusetts Multi-Family Program.[20] While this study also evaluated nonparticipant spillover, which was not within the scope of our evaluation, the results from that study offer regional context and a point of comparison for our team's NTG values.

Navigant found an overall freeridership rate of 0.22 for the program, which is similar to the overall rate of 0.27 our team estimated for EWMF (Table 9). However, the Navigant study found much higher levels of participant spillover than our team found for EWMF (0.13 versus 0.01) and also included an additional 0.17 for nonparticipant spillover. Collectively, the spillover savings in Massachusetts more than compensated for the higher rate of freeridership relative to EWMF and produced a much higher NTG ratio (1.09).

As evident in Table 9, the primary driver of the difference in the two NTG estimates is the scope of the spillover analysis and the magnitude of the resulting savings.

Table 9. EWMF – Net-to-Gross Benchmarking

NTG Element	RI (EWMF)	MA MF (RES 44)
Appliances & Plug Load	0.31	n/a
Controls	0.48	n/a
Domestic Hot Water	0.08	0.21
Lighting - Common Area	0.23	0.23
Lighting - In Unit*	0.45	
Weatherization	0.33	0.19
Overall Program FR (savings weighted)	**0.27**	**0.22**
Participant spillover	0.01	0.13
Nonparticipant spillover	Not included	0.17
NTG	**0.74**	**1.09**

*In unit lighting excluded from overall program FR and NTG since per-unit savings from billing analysis are net, included for MA

The participant spillover methodologies used in our study and the Navigant study appear to be very similar, with no differences that would account for the difference in results. However, we did screen out a higher percentage of potential spillover actions, with only 9% of reported actions qualifying as spillover compared to 28% (including actions reported by participants and nonparticipants) in the Navigant study. Additionally, the Navigant study had a larger sample of respondents that included a slightly higher concentration of building owners/property managers.

[19] Again, our team does not recommend applying an NTG value to our billing analysis-based in-unit lighting savings.
[20] http://ma-eeac.org/wordpress/wp-content/uploads/RES-44_Multi-family-Program-Impact-Evaluation_FINAL_SO-Rates-Updated.pdf

This seems to imply that differences in participant spillover between the two studies are driven at least partially by the rates at which participants reported installing energy efficient items influenced by the program, and the items they chose to install.

In-Service Rates

In addition to NTG, our team determined the in-service rate for each MF direct install measure group.[21] In-service rates below reflect the percentage of installed MF measures still in place and generating savings.[22]

We found high in-service rates for controls, i.e., programmable and Wi-Fi thermostats (95%), and a relatively high rate (90%) for domestic hot water measures. Due to limited MF sample sizes for smart power strips, our team leveraged the rate determined through the concurrent EWSF impact evaluation for that measure. The lower rate for smart strips is likely a reflection that MF assessors leave them behind for the participant to self-install after the assessment.

Table 10. MF – In-Service Rates (Measure Group)

Measure Group	Relevant Measures	Sample Size	Installed	Removed	In-Service Rate
Domestic Hot Water	Faucet Aerators, Showerheads, Pipe Wrap	27	69	7	90%
Appliances & Plug Load*	Smart power strip	246	415	66	84%
Controls	Programmable or Smart (Wi-Fi) thermostat	20	42	2	95%

*Based on the EWSF in-service rate due to insufficient EWMF responses for that measure group.

[21] The team did not assess in-service rates for either major measure because removing insulation and/or lighting fixtures is uncommon.

[22] As of the time of the survey (June 2020)

Additional Details: Common Area Lighting

This section provides more information regarding common area lighting, which, collectively represent 44% and 45% of EWMF and IEMF electric savings.

The term "common area" lighting invokes the image of the communal area at the entrance of many MF buildings. However, from the MF program's perspective, the term is a catch-all classification for all LED screw-in and fixtures installed outside of tenant's living space. In practice, common area lighting includes a wide range of lighting types (e.g., screw-in lamps, linear in-ceiling fixtures, wall packs, exterior pole lighting) and locations (e.g., hallways, offices, fitness centers, exterior walkaways) throughout participating MF facilities. In fact, the MF program listed 28 unique installation locations for "common area" lighting.

Given the wide variety, the program uses standardized, location-based HOU and customized, fixture-specific delta watts values – the two key lighting savings inputs - for all common area lighting.

Hours of Use

As noted above, MF assessors use location based HOU values to develop savings for every common area lamp/fixtures. These HOUs come from a metering study completed in 2017 in Massachusetts (RES 44). [23] The MF program shifted to these standardized, location-based HOU estimates after the study concluded that "vendor-reported common area HOU had no correlation with the logged HOU lighting". Based on this finding, the report recommended that Program Administrators in Massachusetts, including National Grid, use a set of standardized, location based HOUs for estimating common area lighting savings. In mid-2018, National Grid adopted this recommendation in Massachusetts and Rhode Island service territory by codifying the metering study HOU in their cross-state InDemand program tracking systems. Table 11 summarizes the recommended HOUs by RES 44.

Table 11. RES 44 – MF Common Area Spaces and Recommended HOUs

Space	Relevant MF Sub-Spaces	Recommended/Logged HOU (Hours/Day)
Interior, Circulation	Common Hall, Elevators, Lobby, Stairs	23
Interior, Other	Laundry, Mechanical Room, Management Office, Other	11
Parking Garage	Parking Garage	24
Exterior	**All exterior, non-parking garage locations**	**13**

Since this impact evaluation relied primarily on program data from 2017 and 2018, many of the program records for common area lighting predated National Grid's shift to using standardized, location based HOUs. Most of the program records provided to our team included HOU estimates that assessors developed based on experience and discussions with the MF property contact. When we compared the existing records with vendor HOU estimates to the standardized, metering study based HOUs, we found a

[23] http://ma-eeac.org/wordpress/wp-content/uploads/RES-44_Multi-family-Program-Impact-Evaluation_FINAL_SO-Rates-Updated.pdf

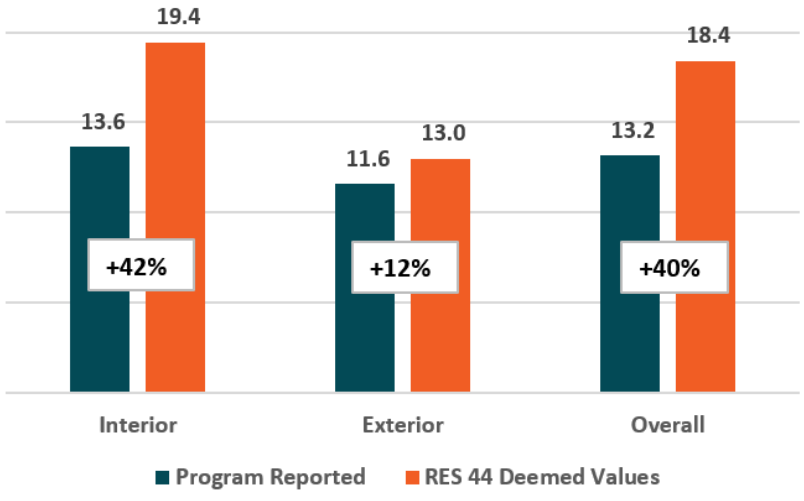
sizeable difference (i.e., greater than 20%) for five of the seven common area lighting types. With two exceptions – a small difference (-1%) for interior LED general service bulbs and large difference (-32%) but for a very small number of EISA-exempt lamps (less than 1% of installs) – the HOUs recommended by RES 44 were higher than those reported in the MF data. The largest difference (+53%) pertained to interior LED fixtures (19.2 versus 12.6), which also make up nearly three-quarters of the lighting units that the MF program installed in participating facility common areas.

Table 12. HOU Comparison: Program Reported and RES 44 (by Light Type)

Location	Light Type	% of Common Area Lighting	Program Reported	RES 44	Difference
Interior	LED Fixture	72%	12.6	19.2	53%
	LED Bulbs	9%	22.3	22.0	-1%
	LED Reflector	2%	12.1	17.4	44%
	LED EISA EXEMPT	0.4%	23.4	16.0	-32%
Exterior	LED Fixture	14%	10.5	13.0	24%
	LED Bulbs	1%	12.6	13.0	3%
	LED Reflectors	**1%**	**10.6**	**13.0**	**23%**

Figure 6 rolls up the light types in Table 12 based on their location. Driven by the higher HOUs from RES 44 across both interior (42%) and exterior (+12%) light types, the MF program tracking data under-reported common area lighting HOU – relative to RES 44 values –by 40%.

Figure 6. HOU Comparison: Program Reported and RES 44 (by Location)



To ensure that our evaluation results reflect National Grid's current delivery of the MF program and useful prospectively, our team applied the standardized, location-based HOUs (Table 11) when estimating per-

unit savings for MF common area lighting. By doing so, our team effectively updated the historical program records provided to match the MF program's current assumptions and most likely future savings.

Delta Watts

As noted above, MF program data also includes detailed information about the wattage of the existing and replaced screw-in lamps and fixtures. Our team reviewed these values to confirm their viability for use as part of our impact evaluation.

Our team leveraged this information to calculate the delta watts of the average MF program common area lamp/fixture as shown in Table 13. Before leveraging this information, our team reviewed the program data to ensure the delta watts reported by the program were reasonable. Specifically, we checked minimum and maximum existing and replacement wattages and spot checked the wattage listed for specific identified fixtures against available secondary sources. We found the wattages listed in the data to be reliable.

Table 13. Delta Watts by Location and Light Type

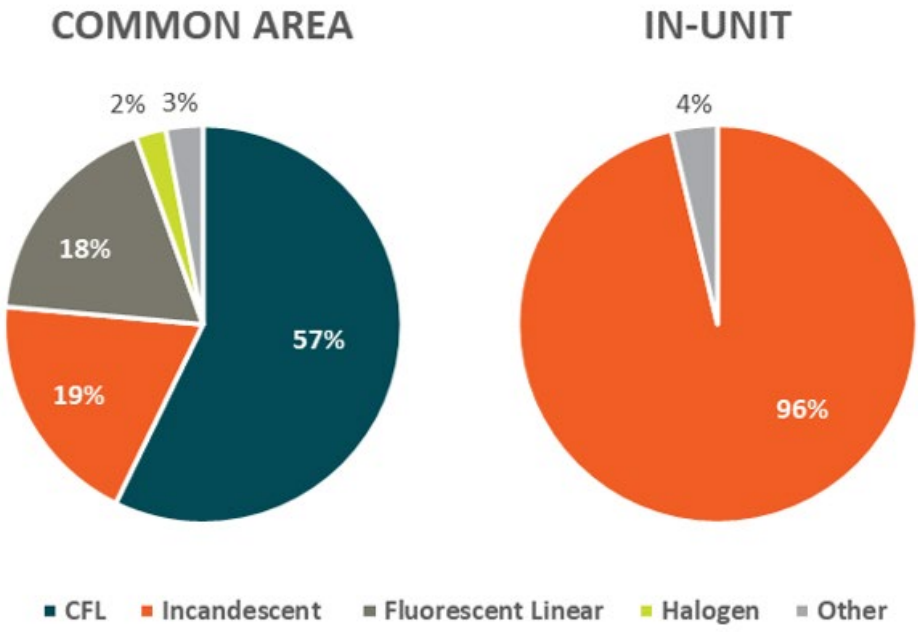
Location	Light Type	% of Common Area Lighting	Delta Watts (Average/Lamp/Fixture)
Interior	LED Fixture	72%	29.4
	LED Bulbs	9%	22.4
	LED Reflector	2%	22.1
	LED EISA EXEMPT	0.4%	35.1
Exterior	LED Fixture	14%	105.9
	LED Bulbs	1%	34.0
	LED Reflectors	1%	44.2

It is important to note that the delta watts values that our team calculated for common area screw-in lighting measure (using in MF program data) are, in general, lower than the delta watts assumption (from a secondary source[24]) that our team used to assess in-unit screw-in lighting using engineering algorithms.[25] The lower delta watts for common area screw-in lighting is driven by the different mix of pre-existing lighting technologies replaced by the program in common areas, which includes lower wattage technologies like CFLs. As shown in Figure 7, the mix of replaced lighting technologies replaced by MF program screw-in LED lighting is dramatically different for in-unit and common area lighting.

[24] http://ma-eeac.org/wordpress/wp-content/uploads/MA19R09-E-DeltaWattReport-Memo_FINAL_2020.03.26.pdf

[25] Our team completed the in-unit lighting engineering algorithm analysis solely to buttress the results of the billing analysis, the results of which was the primary methodology our team used to report savings for in-unit lighting (both screw-in lamps and fixtures).

Figure 7. Mix of Existing Technology Replaced by MF Program Screw-in LED Lighting[26]



Results

Table 14 utilizes the HOUs and delta watts detailed above to estimate annual electric savings for all common area lighting types. As evident in the table, the per-unit savings ranged from 140 kWh (interior LED reflectors) to 502 (exterior LED fixtures).

[26] While the program data indicates that 96% of LED screw-in lighting installed in-unit replaced incandescent lamps, it is highly likely – given the market share of halogens and the difficulty of easily differentiating between incandescent and halogens - that a subset of the replaced lamps were halogen.

Table 14. Delta Watts by Location and Light Type

Location	Light Type	Hours-of-Use (Daily)	Delta Watts (Average Watts/Lamp or Fixture)	Savings (kWh/Year)
Interior	LED Fixture	19.2	29.4	206
	LED Bulbs	22.0	22.4	179
	LED Reflector	17.4	22.1	140
	LED EISA EXEMPT	16.0	35.1	205
Exterior	LED Fixture	13.0	105.9	502
	LED Bulbs	13.0	34.0	161
	LED Reflectors	13.0	44.2	210

Additional Details: Data Quality

Our team identified several types of data quality issues that collectively impacted our ability to develop reliable ex post savings for certain Multifamily program measures. In this section, we summarize these data quality issues, describe how we used the data, and offer recommendations for future data management as follows.

- **Identified Issues.** Outlines the specific data issues that the team encountered
- **Our Approach.** Describes the steps that the team used to work around the data issues
- **Study Implications.** Details how the data issues affected the team's impact and process evaluation efforts
- **Recommendations.** Provides recommendations for National Grid to improve data quality for future multifamily evaluations

Identified Issues

Our team identified the following MF data issues during this evaluation.

1. Missing Building- and Account-level data
2. Inconsistent Building and Facility Characteristics
3. Unable to Map Dwelling Units to Energy Consumption
4. Inconsistent Dwelling Units Across Fuels
5. Missing Contact Information

Missing Building- and Account-level data

Approximately 7% of the measure-level program records were missing information regarding the facility, building, or account in which they were installed. In most cases, these measures with incomplete data were tied to a facility, but not associated with a building or, most importantly, a National Grid account number. Our team did not identify any clear pattern related to the measures that were missing data (i.e., certain type of measures or installation locations). We were also unable to attribute these measures to specific customers at a participating facility even when some customers were known for these facilities.

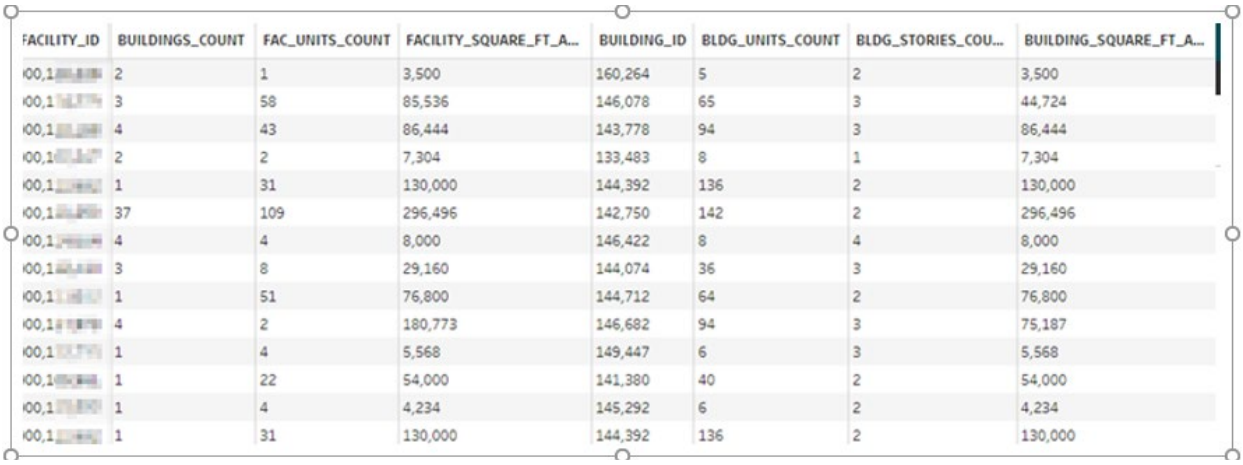
Inconsistent Building and Facility Characteristics

Our team also frequently encountered instances where key fields did not follow the established multifamily data hierarchy (i.e., dwelling units roll up to buildings, and buildings roll up to facilities).

In the multifamily data hierarchy, we expect the number of units in the facility to be equal or larger than the number of units reported for any building at that facility. Similar logic should hold for property square footage, which is provided at both the building and facility level.

Using a union of the three multifamily program datasets provided (Gas, Lighting, and Non-lighting), we identified 388 facilities that received an assessment in 2017, 2018, or 2019 and had associated building information (i.e., not missing information as described above). As part of our analysis, we found 109 facilities (28%) with at least one building listed as having *more* units than the entire facility. Figure 8 illustrates these facilities where BLDG_UNITS_COUNT (which is intended to reflect the number of unique dwelling units within a given participating building) is greater than FAC_UNITS_COUNT (a different column that represents total number of dwelling units within a facility.

Figure 8. Sample of Inconsistent Building/Facility Characteristics



FACILITY_ID	BUILDINGS_COUNT	FAC_UNITS_COUNT	FACILITY_SQUARE_FT_A...	BUILDING_ID	BLDG_UNITS_COUNT	BLDG_STORIES_COU...	BUILDING_SQUARE_FT_A...
[redacted]	2	1	3,500	160,264	5	2	3,500
[redacted]	3	58	85,536	146,078	65	3	44,724
[redacted]	4	43	86,444	143,778	94	3	86,444
[redacted]	2	2	7,304	133,483	8	1	7,304
[redacted]	1	31	130,000	144,392	136	2	130,000
[redacted]	37	109	296,496	142,750	142	2	296,496
[redacted]	4	4	8,000	146,422	8	4	8,000
[redacted]	3	8	29,160	144,074	36	3	29,160
[redacted]	1	51	76,800	144,712	64	2	76,800
[redacted]	4	2	180,773	146,682	94	3	75,187
[redacted]	1	4	5,568	149,447	6	3	5,568
[redacted]	1	22	54,000	141,380	40	2	54,000
[redacted]	1	4	4,234	145,292	6	2	4,234
[redacted]	1	31	130,000	144,392	136	2	130,000

Note: These data are directly from the Multifamily data provided to our team (i.e., our team did not modify any of these fields).

In addition, Figure 8 highlights issues with the reported square footage for many these participants. For several entries, the same square footage is listed at the building and facility level despite that fact the program data indicates there is more than one building at the facility. Separately, we identified 135 facilities (35%) for which an individual building square footage was listed equal to or larger than facility square footage.[27]

In total, we found that 206 of the 388 facilities (53%) exhibited building/facility unit count or square footage inconsistencies. We found the square footage inconsistency was similarly prevalent for both

[27] Being equal is only a violation when the facility contains more than 1 building. Query: ([BUILDING_SQUARE_FT_AMT]>[FACILITY_SQUARE_FT_AMT] or ([BUILDING_SQUARE_FT_AMT]=[FACILITY_SQUARE_FT_AMT] AND [BUILDINGS_COUNT]>1)

EWMF and IEMF programs, but that most of the unit count inconsistencies were associated with EWMF facilities.

Unable to Map Dwelling Units to Consumption Data

Our team's impact evaluation scope included estimating measure-level energy savings for individual program participants. However, the data to support the savings estimate sometimes does not fundamentally exist at this level. For example, while program and consumption data exist at the utility account level, multifamily buildings can have master metered accounts that make it challenging to properly attribute consumption to individual units.

For a variety of reasons, including tenant opt-outs and tenants not being available (i.e., physically present to authorize and allow access to their dwelling unit), the MF program frequently does not serve every tenant unit at a participating facility. To fully understand tenant level participation and consumption, we would need to know how many tenants are at the building and how many opted out. For individually metered units, the total number of units represented in the program data does not always match the number of reported units in the building. For example, if a facility contains 10 units, but only 2 accounts are associated with the building in the program data, our team does not know if only two units participated or if the two accounts reflect energy consumption for all 10 units. Without an accounting of the tenants and their participation, it is unclear whether the accounts included in the program data and the MF measure they received reflect all—or just a portion—of the building and/or facilities energy consumption.

Inconsistent Dwelling Unit Identifiers

The team received program data in three datasets that associated measures with utility accounts. However, the premise numbers issued for the gas measures are different than those from electric measures, which is not uncommon for dual-fuel utilities such as National Grid. Though there is consistency within a fuel, there is not a consistent key to link to the same customer/location across all fuels. The team also identified that alternate identifiers like customer names are repeated across multiple accounts and/or addresses and are often entered differently across different fuel data sources. As a result, the team could not consistently obtain a comprehensive view of what measures the programs delivered to a building or dwelling units within a building that many evaluation activities require.

Missing Contact Information

Part of our evaluation scope included contacting MF participants-building contacts and tenants to ask questions about their experience in the program, as well as to estimate impact factors such as net-to-gross and in-service rates. However, our team found that contact information was missing, entirely, for most tenants and, specifically, that very few e-mail addresses were available, which limited our team's ability to effectively deliver the evaluation's web-based surveys.

Our Approach

We employed three approaches to mitigate the multifamily program and billing data issues noted above.

1. Public Data Review
2. Rules-Based Filters
3. Manually Matching Across Data Sources

Public Data Review

The team first spot checked unit and square footage inconsistencies by reviewing publicly available data, including viewing a sample of problematic participating facilities using Google Maps. In some cases, we were able to deduce that facility-level information had been recorded under the building level data fields or vice versa. In other cases, we were not able to definitively determine the nature or cause of the discrepancy. However, conducting a public records review for all facilities that had unit or square footage inconsistencies was impractical and not within the scope of this evaluation.

Rules-Based Filters

The team also attempted to apply rule-based filters to determine whether the provided data—regardless of the data field in which it was recorded—represented the facility, building, or dwelling units.

Examples of these filters included:

1. Building unit counts above 150 suggest a facility, not building-level, value
2. Per-unit square footage between 300 and 3000 suggest a unit, not building or facility-level, value (Note: This filter was only possible when our team had confidence in the number of units reported)
3. Certain program measure counts (i.e., more than 45 lightbulbs) suggest a building, not dwelling unit, value

Although applying one or more of these filters would appear to clear up an immediate concern, we often found that subsequent analysis of other variables was often problematic for other reasons (such as the reliance on reliable unit counts to resolve square footage ambiguities). Thus, the cumulative and interrelated effects of these data quality issues across multiple fields made it difficult, if not impossible, for our team to confidently classify ambiguous data at the facility, building, or dwelling unit level.

Manually Matching Across Data Sources

We were unable to complete a manual matching process to identify unique dwelling units and assign them a consistent identifier across program data records. For the team's process evaluation, we used a combination of email address, customer names, and addresses to match a subset of customers for which we had email addresses. Email addresses were derived from multiple sources and were not always the same across datasets. The matching process allowed for many accounts match across all measure fuels.

Study Implications

These data issues collectively affected our team's ability to effectively and efficiently complete many of our impact and process evaluation tasks.

Impact on Building Simulation

The challenges noted above directly impacted our team's ability to confidently characterize the buildings that participated in the MF program, which is fundamental to the development of a building simulation model. Our inability to characterize the size (in terms of units and square footage) of MF participants using the provided program data led our team to develop building simulation models based on the notion of a "typical" multifamily buildings. In the end, our team leveraged inputs from secondary sources and other regional multifamily building simulation models to develop a simulation model prototype of a three-story garden-style building with 12 dwelling units.

The team was also unable to calibrate the energy consumption of prototype to actual billing data from program participating buildings. Specifically, our calibration was affected by the incomplete data noted above, as well as small sample sizes for combinations of heating and cooling equipment types. One way we attempted to mitigate this was by shifting from a building-level consumption estimate to per dwelling unit consumption estimates that we could roll up to the building level. However, this workaround requires confidence in the BLDG_UNITS_COUNT field, which as we discussed above, we did not have.

In addition, our team closely reviewed building-specific billing data in an attempt to identify a subset of usable buildings with reasonable estimates of energy consumption that we could use to calibrate the heating and cooling equipment combinations we wished to model. This process, in part due to the participation levels and in part due to the aforementioned data quality issues, led to small samples sizes. Even in these instances, we observed more variability in usage across buildings than expected which often prevented our team from using the culled dataset to calibrate.

Impact on Engineering Algorithms

Similarly, the uncertainty in both building and dwelling unit energy consumption hindered the team's ability to estimate savings for specific measures that depend on energy consumption as an input for their algorithms. One example is thermostats, where our team needed to estimate reliable unit-level heating and cooling loads to develop savings estimates. In these instances the team employed similar approaches to the building simulation described above: identifying a subset of usable billing data with a high degree of confidence in its accuracy, reliance on secondary sources, or simply used lead-vendor estimated energy savings as-is.

Impact on Process Evaluation

To inform process evaluation activities, the team used high-level summaries of program participation that typically included counts of unique dwelling units across the three program datasets. In a detailed manual review the team used email addresses to link participation records across the three program datasets that the team received. However, as noted above, many participants were missing e-mail addresses.

The lack of tenant level email addresses made it difficult to contact participating tenants. Our team, in conjunction with National Grid, was able to leverage e-mails from National Grid's customer information system. This matching process was time-consuming and not possible for all tenants.

Recommendations

In light of these issues and challenges, we offer National Grid three recommendations to improve data quality so that National Grid Rhode Island can obtain more robust results from future multifamily program evaluations.

Recommendation 1:

Add data consistency checks to multifamily program data entry tool.

We recommend that the program add automated checks to the data entry process to notify assessors when the dwelling unit, building, and facility data hierarchy is violated (e.g., when the entered square footage of a building larger than that of the facility). This will give assessors an opportunity to make corrections right away. Similarly, adding minimum or maximum thresholds (with an associated alert) may prevent assessors from entering data into the wrong level of the participant hierarchy (e.g., unit level for a building). Given the wide variety in participating buildings, it is important assessors can override alerts. However, the fact that assessors are required to explicitly acknowledge and override the alert will likely avoid issues and give future evaluators greater confidence in outlying values.

Recommendation 2:

Keep an accounting of total building tenant counts, participation, and opt-outs.

The data that our team received tells only a partial story of the measures that were installed and the accounts they are associated with. There is a greater context that is missing that would support more robust evaluation and/or data quality checks. In the data issues section above, we described an example building with 10 units, and program data for 2 accounts associated with the building. In this example, any of the following interpretations are plausible: 1) the value of 10 units listed for the facility could be an error, 2) only 2 of the 10 dwelling units participated, or 3) the facility uses 2 meters for all 10 dwelling units, and an unknown number of units opted out. By accounting for all dwelling units, independent of program participation data, including explicit accounting of whether a dwelling unit participated in the program, will give future evaluators more certainty when aggregating consumption and program data to support impact tasks.

Recommendation 3:
Collect more tenant e-mail addresses.

E-mail is the most cost-effective method for evaluators, as well as the program and National Grid, to follow up with participants. For multifamily buildings, the account holder is not always the tenant and may not be able to best answer questions regarding the program. Collecting email addresses from all served tenants would allow for more informed unit level responses as part of future evaluations. However, this is not always possible as many tenants are not present during the assessment or when the program is installing measures. In some cases, property contact can provide the program with tenant e-mail addresses, but some property contacts are, understandably, unwilling to share tenant's contact information. Acknowledging these constraints, the program should work with tenants and the building contact to gather as many e-mails as possible for tenants that received MF program measures in their dwelling unit. National Grid could also leverage the program gathered e-mail addresses to fortify their customer information system, which is less populated with e-mails for multifamily customers than single-family customers.

Process Evaluation Findings

Our findings draw upon all evaluation activities and cover the following key areas:

- About COVID-19
- Program Management and Delivery
- Program Satisfaction
- Outreach, Scheduling, and Communications
- Identified Opportunities for Improvement

Our program improvement recommendations appear in two places within this report. They are embedded in this section alongside the relevant findings and are also summarized in the Executive Summary. Also, while Cadeo offers official recommendations in this report, our team welcomes National Grid to act on or explore further any of the findings presented in this section that could result in the Multifamily programs' delivery improvements—regardless of whether our team offered an explicit recommendation.

About COVID-19

Our evaluation of MF programs occurred concurrently with the COVID-19 pandemic outbreak in early 2020. As a result of COVID-19, the landscape of National Grid's retrofit programs changed dramatically. At the time of the evaluation, EWMF and IEMF were not completing in-person energy assessments and RISE furloughed a significant portion of the programs' implementation team.

The findings discussed below pertain to program activities occurring before the outbreak of COVID-19. However, with the support of National Grid, the team adapted our evaluation strategy to inform future delivery of the programs after COVID-19 restrictions lessen– particularly assessing the implementation of virtual home assessments that National Grid offered during the pandemic to continue to provide no-cost energy services to customers. Through this process, our team adhered to National COVID-19 communication and policies when conducting the survey and interview outreach. We included National Grid-approved language in all customer and stakeholder outreach and aimed to demonstrate sensitivity to the situation in all our communications.

Program Management and Delivery

This section describes the overall management and delivery of the program. We present information on roles of different program stakeholders, their key responsibilities, how they implement the program and interface with customers. We discuss the Multifamily programs more broadly and delineate between EWMF and IEMF in certain areas. Below we describe the key actors that deliver the program: RISE Assessors, Contractors, RISE Inspectors, and CMC Inspectors. In addition to the market actors we describe the following program areas: digitizing the Multifamily programs' paperwork processes and missed health and safety issues found during the Multifamily programs' assessments, and marketing.

RISE Assessors

RISE assessors are responsible for conducting assessments within building common areas and individual customer units. When applicable, they are also responsible for creating the scopes of work for contractors to bid upon. Because of the varying size, age, and resident personalities from building to building, there is not a typical Multifamily program project, and as such, we describe different types of projects within the content of this report.

Typically, assessors visit a jobsite two or three days after it is scheduled through RISE, according to assessor interviews. To the extent possible, they cluster jobs based on geographic location to minimize travel time associated with the assessments. Assessors meet with the building contact at each participant facility, who is usually a property owner, manager or condo board member, to review the general layout of the building and plan where they will assess. Assessors also assess a selection of standard units within a multifamily building; they do not assess all building units.

The assessor is responsible for identifying health and safety barriers, such as knob and tube wiring, asbestos, and mold. After the assessment is complete, the assessor writes a report on their findings; assessors report that they speak to the building contact about what they found before creating the official report. The assessor sends the final report to the customer between two days and two weeks after the assessment. These reports are the roadmap for all program stakeholders – the contractors use them as a work order, the inspectors use them to ensure work is done correctly and that tasks are not missed, and the final inspection report is given to the customer for their records. According to Multifamily assessors and the Multifamily inspector, they complete all assessments and reports with pen and paper; the process has not yet been digitized like it has been for the EnergyWise Single Family program. This process is time consuming and inefficient to complete by hand and could be improved by digitizing. This is described in more detail in a subsequent section.

After the assessors complete the assessment and the multifamily customer (property manager or condo board representative/owners) decide to participate in the program, RISE sends out notification of a job opportunity to the list of approved the Multifamily programs' contractors.

Contractors

Contractors are responsible for installing the energy efficiency measures in building common areas and customer units. Processes differ slightly depending on the type of multi-family property (i.e., single structure multi-family building versus condo style single-family homes).

RISE management staff report that any job with more than 20 units in a building automatically goes out to bid to contractors. Program approved contractors receive an email with a bid document that describes the proposed work to be completed. At this point, contractors assess their labor and materials costs and submit a bid to RISE. Contractors must bid the products RISE specifies, though they are allowed to propose alternatives. Sometimes, during the bidding process, the RISE engineers responsible for designing the job will meet interested contractors at the customer site to review the project and answer any questions. RISE then reviews bids and calculates the cost-effectiveness of each proposal. They award

jobs to the bids with the highest benefit-cost ratios. RISE notifies contractors and contractors proceed to schedule the job directly with the building contact.

Contractors described the bidding process as "fair" and "straightforward". Contractors said that RISE provides a worksheet with the building specifications (collected by the assessors) that includes square footage, number of units, and the relevant measures. When contractors receive the spreadsheet, they calculate a quote with the cost of materials and labor and send it back to RISE. RISE notifies winning contractors within a few days of submission.

> *"We meet with facilities and go over what we were going to be doing. And you know how many apartments we thought we'd need to get into daily so they could schedule with the tenants."*
> *- Multifamily Contractor*

RISE managers reported buildings that have fewer units (around 5-20) do not go through a bidding process. Instead, RISE either completes the work with their in-house staff or awards them to a contractor. For these types of jobs, RISE uses standard pricing, which is already agreed upon with National Grid; contractors do not develop pricing or cost estimates.

The general process of a job starts when RISE awards contractors the work. Once they get a job, it takes two to three days for contractors to start on the work. During this time, contractors sign contracts and describe the project timeline and final materials choices. Depending on the job, crew chiefs and installation contractors will go to the site and meet with the property manager to coordinate work.

For jobs that have work in residents' space, contractors coordinate with building contacts to gain access into the units. RISE inspectors review a few[28] installations throughout the course of the job and complete a final inspection upon completion, described in more detail in the following section on RISE inspectors. When the job is complete, crew chiefs conduct a walk through with the property managers and owners or residents to explain the work that they have done and describe the equipment that was installed. Upon work completion, the contractor submits the invoice and paperwork to RISE by email and is typically paid between 10 and 30 days.

[28] The multifamily inspector did not specify how many units he typically looks at in a complex; only that they review a sample with the goal of representing all units within the MF property.

RISE Inspectors

RISE inspectors are responsible for ensuring contractors complete the work satisfactorily. They conduct inspections both during the job and after the job is complete. Throughout the course of the job, RISE inspectors are the liaison between RISE, the contractor crew, and the building contact. They ensure that contact information is shared, all parties are introduced to one another, that tasks are assigned correctly, that contractors have access to the site, and that concerns are communicated through the proper channels.

During the job, inspectors interact with the contractor and will place change orders if necessary. Change orders are required if there are energy saving measures that were missed during the assessment, adjustments to existing measures (e.g. differences in the vent sizes), or requests made by the customers during the installation process. When the change order is submitted, contractors can generally fix the issues. Depending on the scope of the job site, the Multifamily programs' inspectors visit the site a total of 6 – 12 times throughout the course of the project.

> *"I want to be informed of potential mishaps, needed repairs, any type of snags or install questions anything related to contractor scope, and what we know, as installers, to be the correct way so sites are the best they [contractors] can make them."*
> *- RISE Inspector*

Once the job is complete, the Multifamily programs' inspector completes a final inspection of the job site and submits paperwork to RISE. During the roll out of COVID-19 policies, the RISE inspector is currently responsible for ensuring the full team is certified according to the new health and safety protocols (which requires the completion of an online training), has the required personal protective equipment (PPE), and customers feel comfortable.

CMC Inspectors

CMC inspectors are third-party inspectors who review work throughout the process, from the assessment through job completion. There are three tiers of CMC inspections:

- **Tier 1:** In these jobs, the CMC inspector shadows the assessor and acts as a "silent observer." CMC inspectors do not interact with the customer at this point in the process.
- **Tier 2**: These inspections take place after the assessment and direct installation of measures, but prior to installation of recommended deeper retrofit measures. CMC inspectors speak to customers, ask about the assessment, and ensure direct install measures recorded in the data were installed. They also look for potential missed efficiency opportunities and/or overlooked health and safety barriers.
- **Tier 3**: These inspections happen after the completion of all work, including the assessment, direct install measures, and deeper retrofits. CMC inspectors review installation of measures and look for health and safety issues that may have been missed. For example, they may look for moisture issues in bathroom vents or damming around recessed lighting.

Digitizing Processes

CMC inspectors stated that their program processes have been digitized – including the reporting platform and historic paperwork. The Multifamily programs' assessors, inspectors, and contractors said that their program processes are still analog and that it would be more efficient if they could move to a digital platform.

For example, one multifamily stakeholder said that the reporting and paperwork process takes two to three times longer than the work onsite takes. He also said that it is onerous answering questions about older jobs because he must search for the past paperwork in a warehouse where they store records. Given that some property managers participate for multiple properties they manage, and that some buildings have the same floorplan, it is not uncommon for RISE staff to need these files for reference. A multifamily contractor, who works on both multifamily and single-family projects as part of the EnergyWise Single Family program offered by National Grid said that the multifamily paperwork is submitted manually rather than through the single-family portal.

The Multifamily programs' assessors, inspectors, and contractors said they would like the process to be digitized.

"Paperwork is manually submitted via email to RISE multifamily liaison as opposed to being uploaded to a portal [like with single-family]." - Multifamily Contractor

Recommendation 4:
Digitize processes for assessors and inspectors.

RISE assessors and inspectors report that the MF paperwork they complete is burdensome, in part because it is still done via paper and pen. By contrast, the EnergyWise Single Family digitized its paperwork approximately one year ago with the introduction of iPads. The MF programs should consider a similar transition to digitized paperwork.

Assessments: Missed Health & Safety Issues

The Multifamily programs' contractors gave mixed responses on how often health and safety barriers were missed in the assessments. Some contractors said that in up to a third of the jobs they go to, some type of health and safety issue was missed during the assessment, while others said it was less frequent.

Most commonly, contractors reported that missed health and safety barriers included knob and tube wiring and mold or asbestos. All contractors reported that if they find knob and tube wiring at a job site, they must stop immediately due to safety hazards to their employees. This costs the contractors money, which is a point of dissatisfaction for them.

Similarly, for cases in which contractors find mold on the job site, they cannot move forward on a project until the mold is remediated. Contractors reported that typically, this involves the building owner going to a mold specialist to have it removed.

Among property managers and owners whom we surveyed, six EWMF contacts reported that assessors identified health and safety barriers in their buildings; no IEMF contacts reported having health and safety barriers. Of those who reported health and safety barriers, three said they addressed all issues found in the assessment and one said they addressed some of the issues found. One building owner said that they would like a list of contractors who could help remediate knob and tube wiring. This building owner reported that they ended up addressing all health and safety issues found during the assessment. The person who said they addressed some of the issues noted that the energy savings did not outweigh the cost of remediation.

There may be an opportunity to serve customers more holistically for whom health and safety issues are identified, particularly as health is generally top of mind for many in the era of COVID-19.

"There's somethings that's missed where they didn't see a part of the attic, so we have to add a whole bunch of material or they didn't see that there was a certain type of material so we have to switch it to something else" - Multifamily Contractor

Recommendation 5:
Increase facilitation of health and safety remediation barriers

There are many strategies that National Grid could consider to further facilitate health and safety remediation, including direct referrals to remediation contractors or firms, developing partnerships with remediation firms, or offering various types of incentives through these partnerships to encourage properties to have this work conducted in a timely manner. As the MF programs continue to mature, it is likely that a greater percentage of multifamily properties will need to mitigate these barriers to unlock energy savings opportunities.

Marketing

National Grid is responsible for marketing the program. RISE is not paid as part of their contract to do marketing; however, they conduct direct outreach to building owners, managers, and condominium associations, described below.

In 2019, National Grid conducted a series of marketing activities. They sent out 3-4 emails targeted to building owners, property managers to update customers about the program and how they could participate. They also attended a handful of trade shows, such as the Rhode Island Home Show, where they had a booth and handed out program information to attendees. Program staff report that they do not know how effective the various marketing activities have been, though they perceive the direct outreach and word-of-mouth outreach completed by RISE to be most effective.

RISE staff also conduct outreach to multi-family properties. RISE staff report that they typically do this via phone calls and email to multifamily owners, property managers, and condominium associations and board members. RISE already has existing relationships with some of these contacts.

The outreach that RISE conducts to the condominium market within the EWMF program is unique. RISE uses the Condominium Boards as an outreach mechanism. After talking with a Condo Board, RISE

conducts direct outreach to residents, often facilitated by the Condominium Board. Residents at these facilities receive an offer of measures for which they are eligible. RISE provides the facility contact the text that they can use to email residents, with a link to any offers being made to residents. Residents can then go online, input the code provided in the email, and review the measures available to them. Residents simply click "yes" or "no" on any of the measures; the website lists the co-payments for the measures. For any selected measures, RISE notifies residents that they will contact them soon for scheduling. The program installs those measures which residents select.

RISE staff report that a sign-up period (the time during which residents can sign up and select their measures) for a condominium property typically lasts approximately three weeks. RISE program staff also report that the biggest challenge with outreach for the condos is getting resident's attention since they don't usually have direct interactions with residents during the assessment phase. Unlike the EWSF program, where a home energy assessor goes into every unit and meets the owner, for the Multifamily programs, the offer they receive is typically via email, without interaction with an assessor.

Outreach and Scheduling

Outreach

At each level of the program (notification, assessments, job completion, and inspections) there is some type of customer outreach. The process and various steps of outreach from the start of the process to the finish is as follows:

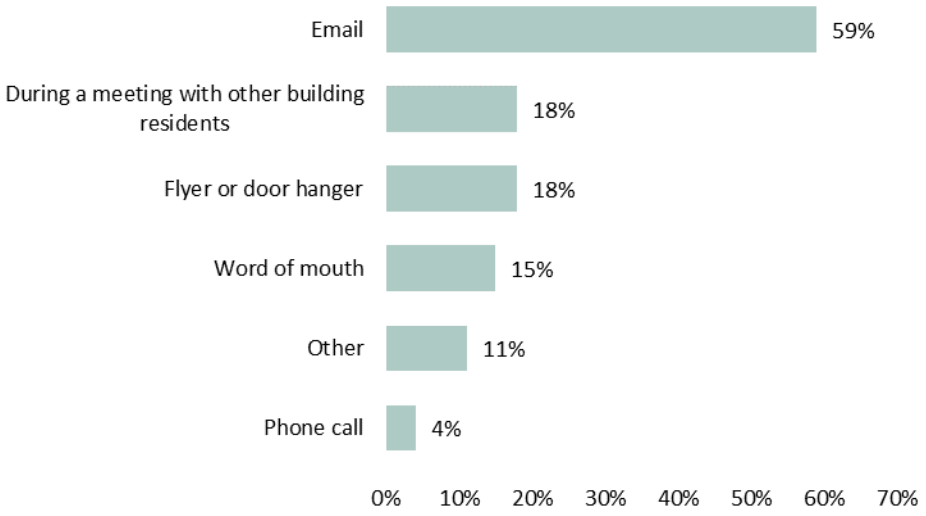
- Assessors reach out to property managers and customers to start the process
- Building contacts reach out to customers to schedule assessment and installation
- Contractors reach out to building and property managers to schedule installation and coordinate with residents
- Inspectors reach out to all stakeholders to coordinate scheduling.

As an example, MF assessors described relying on word of mouth for program promotion and information sharing. MF assessors do not assess all units, and as such, word of mouth information sharing may occur between assessed residents and their neighbors. A MF assessor reported that the outreach he does is most effective when he brings examples of program measures and photos of measures like attic insulation and describes measures using terms the owner understands. He also tries to get in front of the condo board to describe program benefits.

Of the 29 building contacts, the most frequent medium for resident outreach was flyer (n = 13), followed by email (n = 7), resident meeting (n = 6), and phone (n = 5).

Interestingly, most residents reported outreach via email (59%). The Multifamily programs' contractors and inspectors said that coordination with the property manager was key in accessing residents' homes.

Figure 9. Multifamily Resident Program Awareness Source (n=99)



Contractors do not conduct marketing or outreach for their work on the program. This is a point of satisfaction for them. Contractors appreciate that RISE does outreach or marketing to book jobs. In contrast to this sentiment, one contractor said he wants to take advantage of property management groups or managers who manage multiple properties. He said that he had a $100,000 job in a building managed by someone who manages multiple large-scale properties in the state. He wanted to leverage the relationship he built with the property manager to sell the program in all the buildings. In the building contact survey 12 respondents said they manage more than one property. The assessors also said they often interact with repeat property managers.

"So, I'm sitting there going why aren't we leveraging this one property to do the 50 other properties." - Multifamily Contractor

Scheduling

Generally, each program stakeholder handles their own scheduling. RISE assessors and inspectors have internal departments that schedule visits; the Multifamily programs' contractors work with the property manager to schedule installation. For the most part, stakeholders did not have complaints about the scheduling process. Contractors said they have good relationships with property managers and are easily connected to residents for scheduling. The majority of building contacts (n = 15) agreed with the statement that scheduling is a straightforward process.

Two issues came up related to scheduling. First, contractors said that it can be difficult to schedule condos because each unit has its own contact, and the condo board representative has less direct interaction or channels for communication than a traditional multifamily building manager. One contractor we spoke with said that he receives the list of condo owner phone numbers and must schedule appointments on his own. He said the process was difficult and took a long time. The second issue was that two building contacts said their residents sometimes did not sign up for the program due to incompatible scheduling. Building contacts suggested that more flexible scheduling options or night and weekend windows for customers to schedule their assessments could help the program access more units.

> *"Have a better window. Many of our residents are snowbirds and were away"*
> *- Condo Association Representative*
>
> *"Maybe allow weekend assessments or evening."*
> *- Multifamily Property Owner*

Program Satisfaction

In this section, we present findings on program satisfaction, including contractor satisfaction with key program processes, the work overall, and payments, and participant satisfaction for several program elements. We also note the few areas where dissatisfaction was expressed, either through the interviews or surveys.

Overall Satisfaction

Most of the program stakeholders and program participants were happy with program processes. Many of the contractors, assessors, inspectors, and CMC inspectors said they thought the program worked well and that they enjoyed their jobs. Among residents/tenants, 87% said they were at least moderately satisfied with the program overall (n=100). Most building owners/mangers said they were at least moderately satisfied with the program (n = 21). Stakeholders said they were eager to get back to work after COVID-19 restrictions had ended. Very few stakeholders had suggestions on how to improve the program. The lack of complaints about or suggestions for improvement implies that the program processes work well from their perspectives.

Contractor Satisfaction

Positive communications and experience with key program stakeholders and processes drives contractor satisfaction. To this end, contractors report being very satisfied with the program, consistently noting their positive interactions with other program stakeholders.

Relationships and, specifically, trust, are also important factors for and contributors to contractor satisfaction. One contractor specifically called out that they have a trusting relationship with RISE. He trusts that the prices are fair, and that RISE will work with them to get the job done if issues arise. Continual and long-term relationships also imply satisfaction with the program. Most contractors said they rely on RISE for most of their business and that contractors themselves have worked for RISE in the past.

Contractor Payment

A major point of satisfaction with the program for contractors is the payment structure and process. Contractors feel these jobs, when compared with others they do, are generally more profitable; however, they also noted that RISE only evaluates the costs on an annual basis, whereas manufacturers may increase multiple times in a single year. According to one contractor, "I don't think they review pricing enough. Coming from the sales side of things, you have two to three increases per year on materials, yet the program only reviews pricing once a year."

Contractors interviewed also mentioned how quickly they are paid for their work and the ease of the submission process. Contractors said they receive payments for work completed between two weeks and 30 days after the final inspection. Another contractor also said that he continues to work with RISE because the payment process is so easy for him.

> *"It's like you died and went to heaven to get paid within 30 days." - Multifamily Contractor*

Interactions with Inspectors

We found that communication channels between RISE inspectors and contractors were open and trusting. Inspectors described wanting to help, rather than "ding", contractors when they review jobs; contractors described liking inspections because it "only made them better at their jobs". We heard that program stakeholders are collaborative and work well together to provide a positive customer experience.

Decreasing Multifamily Jobs

Some contractors noted the volume of jobs has decreased. Two of the contractors noted that they used to see more opportunities for multifamily projects. They said that number of bids has decreased in the last two years. One contractor said that two years ago 40% of their work was on multifamily projects and now it is around 10%; another contractor said that the majority of his work was on multifamily and now it is about 25% of his work. Both contractors have been able to fortify their workload with single family jobs or larger scale multifamily jobs. These contractors described a few additional MF job opportunities. First, returning to buildings they'd previously visited that may still have remaining improvements; second, the condo market; and, finally, other properties managed by the same property manager they have worked with before. While only a couple of contractors talked about this as an issue, it may demonstrate an entry point into the single-family market for contractors, particularly if the program decides to pursue alternative program models in the future such as the residential coordinated delivery model. Further research could delve further into contractor perception of MF market saturations.

> *"From that point on, I don't know if it just they ran out of customers or clients, but it seemed like we got less and less work at that point. There were bids, but there were quite a few less bids. We bid on everything that came away, we got we got some of them. It's rare it's rare that we get multifamily work."*
> *- Multifamily Contractor*

Participant Satisfaction

In this section we discuss participant program satisfaction. We describe resident and building contact (i.e. property managers or building owners). Below we describe overall satisfaction and satisfaction with direct install measures, installers, and the general program process.

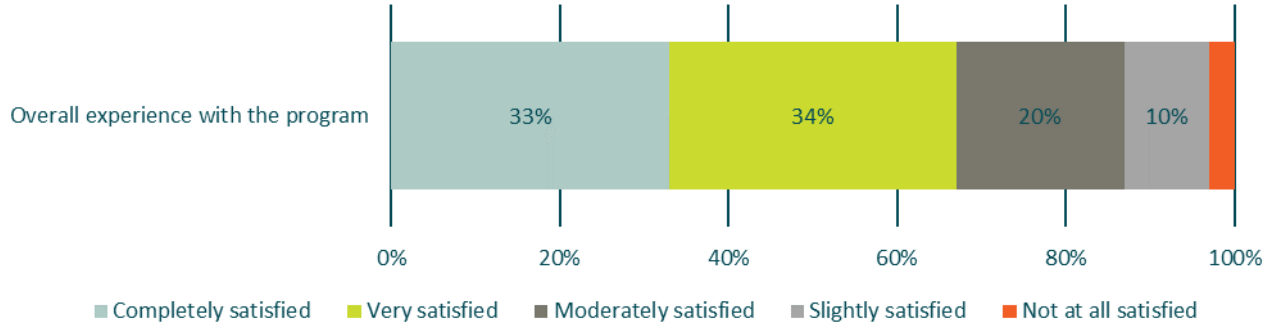
Overall Program Satisfaction

Multifamily residents expressed high levels of satisfaction with the program. Three-quarters of residents were "completely" or "very" satisfied with the program overall. There were no differences in satisfaction results between owners versus renters.[29]

> *"All aspects were handled professionally, from application form to installation process. I would highly recommend the program to everyone."*
> *Multifamily Resident - Owner*

Figure 10 details the residents' overall satisfaction ratings. Many of the resident survey respondents, in open-ended questions following their satisfaction ratings, said the program works well and they are appreciative of the measures they received through the program.

Figure 10. Multifamily Resident Overall Satisfaction with Program (n=100)



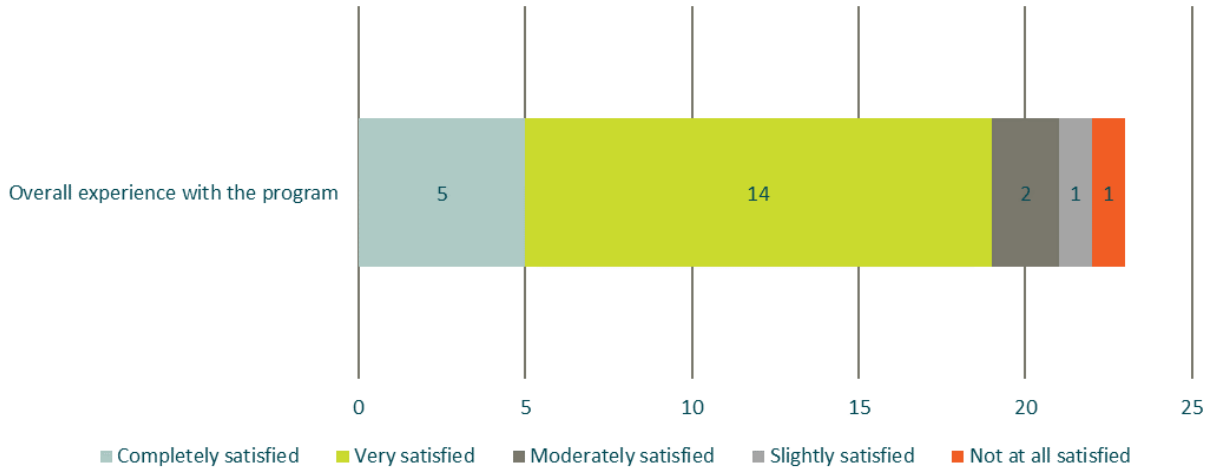
Building contacts also said they are satisfied with the program.[30] The majority of these respondents were completely or very satisfied with the program (n = 19). In fact, ten of the building contacts said they had participated in other buildings they manage. Eight building contacts said that their residents provided feedback about the program; six of these responses were positive and two were negative. Building contacts said their residents appreciated receiving free technology (n = 3) and they were generally grateful for the

[29] Results from Question 30 of the Resident Survey: [ASK ALL] Thinking about your overall experience with this program, how would you rate your satisfaction? Would you say you are… 1. Not at all satisfied; 2. Slightly satisfied; 3. Moderately satisfied; 4. Very satisfied; 5. Completely satisfied."

[30] Thirty building owners/property managers responded to the survey (22 EWMF and 6 IEMF and 2 blank). The responses between the two groups did not differ greatly. In order to increase the power of our analysis all results are combined unless specifically called out.

assistance (n = 3). The two negative comments were about the timing of the work and a mistake that was made in the units.

Figure 11. Building Contact Overall Satisfaction with Program (n = 23)



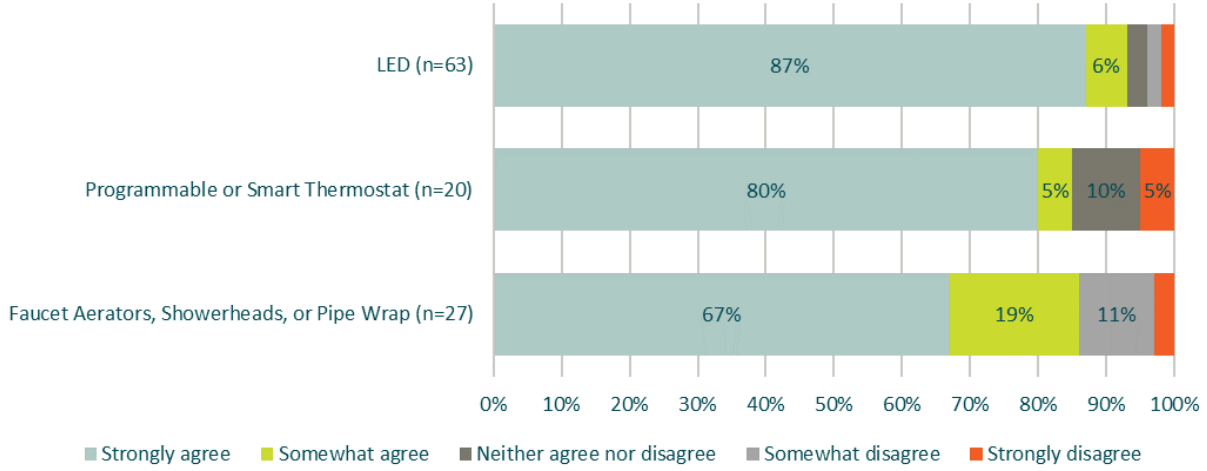
Satisfaction with Energy Specialist Communication

Communication between energy specialists and program participants is generally clear and well-received. Multifamily tenants and building contacts stated recommendations made by energy specialists were clear and that their questions were adequately answered. One clear example of positive communication is when inspectors go through the work orders line by line, photo by photo, with the owners. This ensures a level of transparency between RISE, the contractor, and the customer. The customer knows what is happening in their units at every stage. In addition, when asked about information clarity and communication with the assessor, building contacts agreed that they could easily understand information and their questions were answered. Most residents found that the assessor was able to answer their questions (87%).

Satisfaction with Direct Install Measures

Residents are very satisfied with the measures installed in their units, as well as the work completed by the installer in their home. Most residents *strongly* or *somewhat* agreed with the statements that they were satisfied with the direct install measures (Figure 12). However, compared to LEDs and thermostats, fewer residents strongly agreed that they were satisfied with the water saving devices.

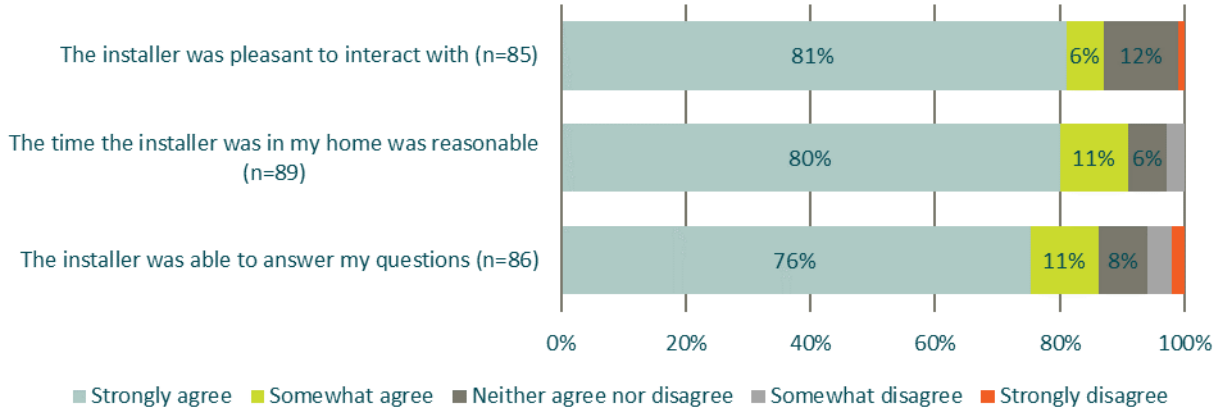
Figure 12. Multifamily Resident Satisfaction with Measures



Satisfaction with Installers

Residents were generally satisfied with installers. Specifically, most participants agreed that the installer was pleasant, spent a reasonable amount of time in their home, and was able to answer their questions. Figure 13 details the respondents' ratings of their installers.

Figure 13. Multifamily Resident Experience with Installer



The small number of residents and building owners/managers that expressed dissatisfaction with their installers and the installation process cited the following issues:

- The installer left a mess in their home (n=5)
- The installer was not thorough in the installation process (n=7)

- Quality of the installation and installer should be improved (in general) (n=16)

Recommendation 6:
Follow up with customers to triage those that had poor installation experiences.

National Grid should consider gathering customer feedback on contractor performance and including these assessments when rating, coaching, and assigning jobs to contractors receive jobs.

Satisfaction with Program Processes and the Energy Specialist

Building contacts were satisfied with the process components of the program and the Energy Specialist. Most respondents agreed that the scheduling process was straightforward, the timing of the assessment was reasonable, the energy specialist was pleasant and able to answer questions, and the recommendations were clear and helped them make decisions. Most building contacts also believed that the energy specialist was able to answer their questions and was pleasant to interact with. After the installations, RISE normally sends out customer satisfaction surveys to unit owners and follows up with any customers who have negative feedback regarding an installation contractor.

Table 15. Building Contact Program Experience

Response	Agree	Neither Agree nor Disagree	Disagree
The scheduling process was straightforward (n = 17)	16	0	1
The time it took to complete my building's energy assessment was reasonable (n = 16)	14	0	2
The recommendations helped me make decisions about how to improve the efficiency of my property (n = 22)	22	0	0
The recommendations provided clear information on my property's performance (n = 16)	14	1	1
The Energy Specialist who conducted the assessment was pleasant to interact with (n = 16)	14	0	2
The Energy Specialist was able to answer my questions (n = 16)	14	1	1
The information clearly described the rebates and incentives (n = 15)	14	0	1

Satisfaction with Program and Measure Expectations

A few of the survey responses implied that there may have been a misunderstanding by customers and building contacts about program offerings and potential savings. A handful of survey respondents (Building Contact: n=4; Resident: n=9), in both surveys, mentioned not receiving a measure they had expected like LED light bulbs, retrofitting lighting fixtures, insulation, thermostats, and mechanical upgrades. These were the common responses across measure types:

- Thermostats – existing thermostat was too "advanced" to be replaced (n = 8)
- LED bulbs – expected to receive more bulbs than installed or different types of LED bulbs, like outdoor lighting (n = 7)
- Lighting fixtures – expected fixtures to be upgraded so LEDs could be installed (n = 1)
- Insulation – expected to receive insulation but it was not installed (n = 1)
- Mechanical upgrades – expected larger mechanical updates made to things like, "Motors, boilers, fans, pumps, stuff that runs things" (n = 1).

Recommendation 7:
Set clearer expectations with participants.

While To set clearer expectations, we suggest that National Grid add language to assessment reports explicitly detailing the measures that customers did and did not qualify for, and, if possible, the rationale as to why they did not receive certain measures.

This mismatch in expectations could be a result of word of mouth marketing which, according to the stakeholder interviews, is a common tool for multifamily projects. Assessors said that they try to provide the property manager or condo board representative with as much information as possible. However, this means that the program information is spread through informal channels and may misrepresent program guidelines, savings, and equipment requirements. Regardless, it is important that participants have a deeper understanding of the program and measure qualifications and that savings expectations are more explicit. The magnitude of savings associated with each measure should be described for customers to truly understand the savings potential.

"That's why it's really important to spend some quality time with the person that I'm meeting with because they may be the only person to talk to a neighbor."
- Multifamily Assessor

Measure qualifications, like for thermostats, should be more explicit so customers are not disappointed when the contractors install measures.

Impact of COVID-19

In this section, we present findings on the impacts of COVID-19 on program stakeholders. We focus specifically on responses to the new processes implemented for program stakeholders to ensure their own and customer safety as well as general skepticism by program stakeholders and survey respondents about virtual assessments.

New Health & Safety Protocols

We conducted interviews with stakeholders between June 1 and July 10, 2020. During that time the program was offline and rolling out new COVID-19 protocols and procedures. The interviews we completed provided real-time feedback, which our team relayed to National Grid. Most of the concerns we heard came from contractors and focused on PPE and home access requirements that they were concerned presented health and safety issues for them. National Grid is continuously reviewing these requirements and has since changed many of the requirements that concerned interviewed contractors.

Virtual Assessments

National Grid and RISE are conducting trial virtual assessments in MF properties at the time of the writing of this report. When we interviewed program stakeholders, only one assessor had conducted a virtual assessment at that point. Program staff said that while these assessments were started virtually, RISE staff ultimately completed the assessment in person. No other aspects of the program have been moved to a virtual platform, though other steps such as the initial inspection or homeowner conversation that inspectors are responsible for could be conducted over the phone or virtually.

Assessors, inspectors, and contractors all expressed varying levels of skepticism about the effectiveness of virtual assessments. The reasons for this skepticism primarily revolve around concerns that assessments will not be adequate (i.e., produce sufficiently accurate and/or detailed scopes of work for contractors), and that contractors will end up having to order more changes on the job site, potentially costing them more money.

Assessors are concerned that they will not be able to execute an effective assessment virtually. As of our interviews in early June of 2020, only one interviewed MF assessor had completed a virtual assessment. This assessor completed the assessment for a building that he was already familiar with, so it was easier for him than one he had never seen before. He also reported that there are things that will be missed if he is not physically present in the building, and all assessors we spoke with agreed with this point. As evidenced by one assessor, "*There are certain things you're not going to pick up on. I go into a building and I can smell certain things, and I can tell certain things about the building by looking at it*."

Recommendation 8:
Identify the optimal long-term role for virtual assessments

National Grid should work on identifying the optimal role for virtual assessments within the Multifamily programs' offerings. For example, virtual work may be most useful for certain customer or building types, or specific inspection types. Identifying the optimal role for virtual work may result in greater efficiencies, free up time for assessors to access or assess more sites and do more customer follow-up.

Contractors are also concerned about virtual assessments and are concerned that more issues will be missed during a virtual compared to in-person assessment. Contractors report that if the assessors miss more issues during the assessments, then that will cause contractors to have to walk away from more jobs. In certain cases of missed mold or knob and tube wiring, the contractor cannot continue with the job and must walk away from the site. In other cases, the contract must be altered, and the contractor may not have the materials needed for the job adjustment, potentially costing them money. One contractor noted while talking about missed assessment issues generally, *"An auditor misses something and then we show up to the job and we can't get the job done. Or if there's mold, we have to walk away. So those types of things really kill us because we only get $200 or $250 reimbursement on a walk-off if we have to walk off for something that's not our fault."*

Despite this skepticism, some building contacts surveyed believe that virtual assessments are a safe and attractive choice.

Appendix A. Evaluation Scope of Work

Memorandum

To: Romilee Emerick and Adam Wirtshafter, National Grid
From: Cadeo and ILLUME
Date: May 1, 2020
Re: EnergyWise Single Family, EnergyWise Multifamily, and Income-Eligible Multifamily Evaluation Workplan

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This document details Cadeo and ILLUME's plan for completing impact and process evaluations of three National Grid residential retrofit programs in Rhode Island: **EnergyWise Single Family (EWSF), EnergyWise Multifamily (EWMF), and Income-Eligible Multifamily (IEMF)**. Our team was specifically tasked with evaluating program years 2017 to 2019, although National Grid will use the results of our impact and process efforts to prospectively inform program planning and delivery improvements.

This document, which will serve as the scope of work for evaluating all three retrofit programs, consists of the following sections.

- Introduction
- Tasks
- COVID-19 Impact and Contingencies
- Data Request
- Timeline

Introduction

The key objectives for each program's process and impact evaluation are similar and include:

- Verifying gross and net energy savings
- Assessing overall program effectiveness
- Providing actionable recommendations to prospectively increase cost-effectiveness, participation rates and, customer satisfaction

In addition to these overarching objectives, our team will pay particularly close attention to assessing program enhancements planned for the 2020 program year. These enhancements are designed to increase participation, weatherization project uptake and, ultimately, energy savings from completed projects.

For EWSF, the enhancements, include, but are not limited to:

- A 100% landlord incentive to encourage weatherization in rental properties
- An asset rating or energy performance score for homes
- An online assessment designed to provide additional information to energy auditors and convenience to residents

Our team will also explore the following enhancements planned for EWMF and IEMF:

- Any program design changes made in response to findings from potential study
- Shifting energy savings away from lighting and toward custom projects and air source heat pumps
- A tiered approach to incentives
- Providing greater customer choice to the condominium market, including working with their preferred HVAC contractor
- Increased marketing and community focus with an emphasis on smaller-scale properties
- Optimizing best practices stemming from studies in neighboring Massachusetts, including the recently completed multifamily census study

We have also included several measures in our impact evaluation scope that were not offered in 2017 or 2018 so that National Grid assess the potential role of these nascent measure in future programs.

In fewer words, our evaluation efforts will seek insights from the programs' past and current performance that National Grid can use to inform future program improvement.

Tasks

Since all three retrofit programs share a similar delivery approach (i.e., each provides an assessment, free direct installation measures, and incentives for completed projects), our team proposes to use a similar set of core impact and process evaluation tasks across programs. At the same time, we recognize these programs are different from each other: they serve separate target markets, have unique program design elements aimed at mitigating market-specific barriers, and are individually preparing for future challenges to delivery as recognized in National Grid's Annual Energy Efficiency Plan for 2020. As such, we note program-specific nuances, where appropriate, throughout this multi-program work plan.

The team will use the following five tasks, and related subtasks, to evaluate each retrofit program:

- Task 1. Data Review and Preparation
- Task 2. Impact Evaluation
    - Engineering Algorithm Analysis
    - Building Simulation
    - Billing Analysis
- Task 3. Net-to-Gross Estimation
- Task 4. Process Evaluation
    - Stakeholder Interviews
    - Materials Review

    - Participant Surveys & Building Representative Interviews
    - Cycle Time Analysis
- Task 5. Reporting

Task 1: Data Review and Preparation

Timing: April

Deliverables: Findings Memo (if necessary)

Data reviews are an integral part of the evaluation process as the outcome of the review determines what is—and what is not—possible as part of an evaluation. For this reason, we began the data request and review process at the very outset of this evaluation. Our team sent National Grid a data request covering all three retrofit programs on March 4th and, to date, we have already received most of the requested data.[1]

Completing the data review right away will enable our team to confirm that the available program data and materials will support the activities and analytical methods described in this work plan. If the data review determines that any element of this work plan is not possible—or requires significant modification—we will communicate that outcome, as well as the relevant evaluation implications, to National Grid and evaluation stakeholders via memo before the end of April.

Task 2. Impact Evaluation

Timing: April-July

Deliverables: Analysis Plan (May) Preliminary findings presentation, supporting workbooks, and model (July)

After our team has reviewed and prepared the required data for analysis, we will use one of the following three complementary approaches to estimate gross, per-unit energy savings for each measure in the EnergyWise Single Family, EnergyWise Multifamily, and Income-Eligible Multifamily programs:

1. Engineering Algorithms
2. Building Simulation
3. Billing Analysis

Based on our experience using these impact approaches for similar National Grid programs in Rhode Island and Massachusetts, as well as initial measure counts provided by National Grid, we anticipate using the identified approach shown in Table 1 (on the following page) for each measure. As evident in the table, our proposed approach can for the same measure depending on the fuel and/or program.

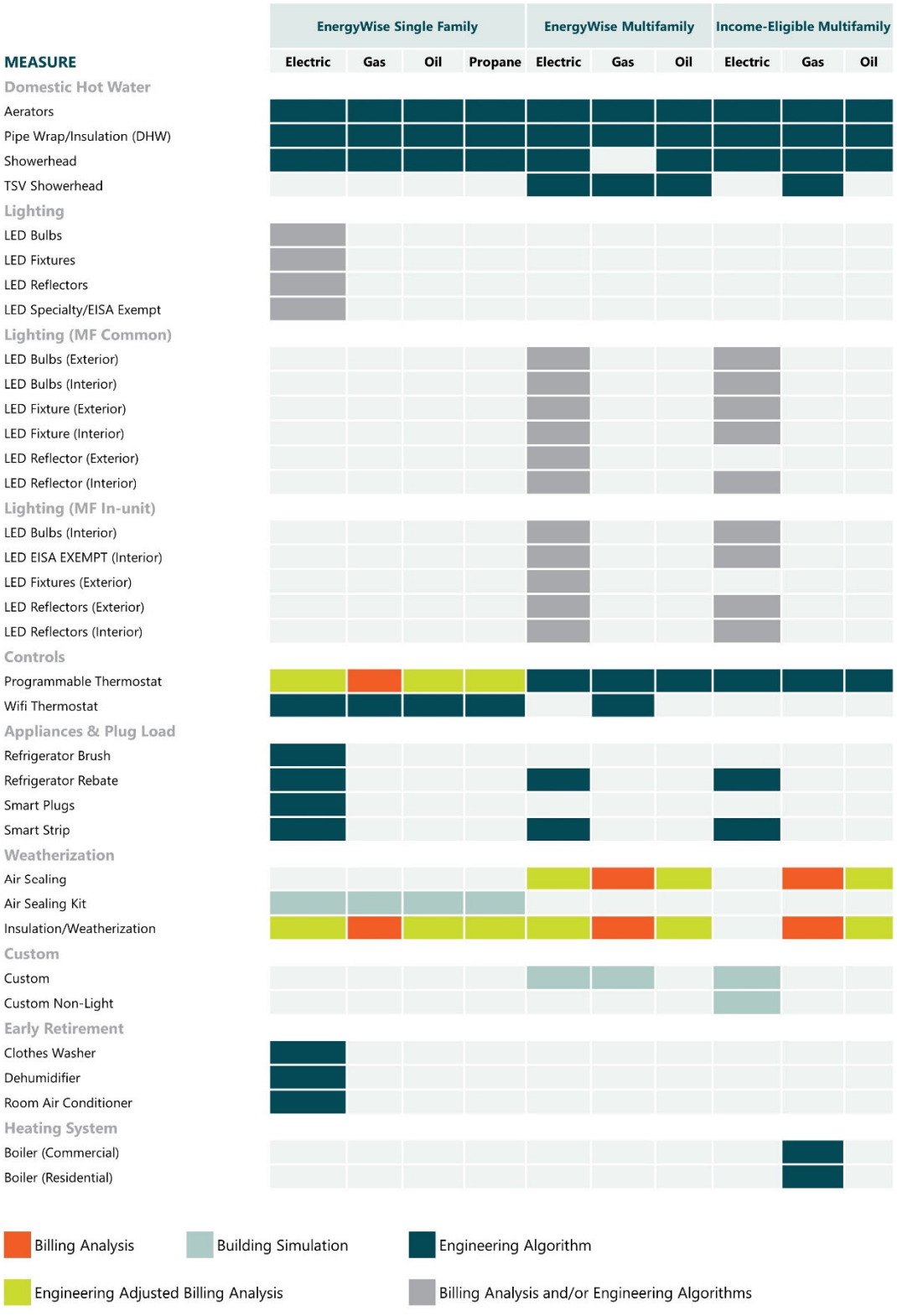
During initial evaluation discussions, National Grid requested that our team report gross savings at a measure level that is consistent with their internal program planning and benefit-cost screening procedures. As such, the measure names in Table 1 reflect this level of granularity and, collectively, represent a comprehensive list of the measures included in the impact evaluation scope.

[1] We have included a copy of the data request at the end of this work plan.

While the measures listed in Table 1 reflect the official scope of the impact evaluation, our team will also explore opportunities to estimate savings at other levels of measure specificity. For example, our team will attempt, through the billing analysis, to differentiate between the weatherization savings generated by air sealing and each type of insulation (attic, wall, and floor) installed through the retrofit programs. Although National Grid does not test the cost-effectiveness of these weatherization types individually, additional perspective regarding the savings associated with each element of weatherization may illuminate where the program is more (or less) successful when weatherizing participant's homes. However, it is important to note that reliable results for more granular measure types (i.e., air sealing and attic, wall, floor versus weatherization overall) are not always possible via billing analysis-largely due to overlap between measures (i.e. most air sealing participants also install some sort of insulation), smaller sample sizes, and a decreased signal (measure savings) to noise (total household consumption) ratio. Our team will buttress against this possibility by relying on building simulation to offer similar insights.

Conversely, our team will also aggregate the measures in Table 1 to gain additional perspectives on the program's impact on participant's energy usage. Specifically, our team will assess household-level lighting savings (via billing analysis) to complement—and potentially augment—the granular, lamp-specific savings that we will also estimate using engineering algorithms. Together, the top-down assessment of total household lighting savings provided by the billing analysis and the bottom-up, lamp-type-specific algorithmic approach will offer our team a well-rounded perspective on the program's lighting measures and a greater chance to observe the impetus behind the evaluated savings.

Table 1. Anticipated Impact Approach by Measure Type, Fuel and Program



Below, we describe each impact evaluation approach in greater detail.

Engineering Algorithms

We will primarily use the engineering algorithms to estimate energy savings for measures not impacted by interactive effects (i.e., the savings/usage of one program measure impacting another). As noted above, we will also use this approach for lighting measures (along with billing analysis), which do impact participant's post-participation heating and cooling usage. When appropriate, we will account for changes in heating and cooling loads (due to the decrease in lighting waste heat levels when participants shift to more efficient lighting) as part of our algorithmic approach.[2]

Using the program data reviewed and prepared as part of Task 1, as well as information from the Rhode Island TRM, our engineering algorithm analysis will produce a workbook with measure-specific worksheets that includes:

- The savings algorithm from the RI TRM
- High level summary explanation of the measure (i.e. what drives savings?)
- List of all inputs and input values, including sources
- A clear comparison of the TRM and evaluation inputs and savings
- 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 reported gross savings

In addition to these measure-specific worksheets, the workbook also includes a cross-cutting tab for inputs and assumptions that are common across measures. Maintaining these common values (and the relevant sources) in a centralized location ensures that an update to a common input impacts all affected measures. Such clear, transparent, documentation will enable National Grid Rhode Island to later leverage these evaluation deliverables as planning resources.

Building Simulation

For measures known to generate (or be subject to) interactive effects but for which billing analysis is not a good fit or feasible (e.g., air sealing kits and/or delivered fuel weatherization), we plan to estimate average, measure-specific energy savings through building simulation modeling. Specifically, our 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.

While we will determine the exact number of models necessary after completing the data review task, we anticipate developing (at least) four building type-specific models:

- Single-family detached structures (served through EWSF)
- 2-to-4 unit attached structures (served through EWSF)
- Small, low-rise multifamily structures (served through EWMF or IEMF)
- Large, high-rise multifamily structures (served through EWMF or IEMF)

[2] This adjustment is not necessary for the subset of participants that installed weatherization as the billing analysis for that measure will have already captured the waste heat related interactive effects of transitioning to LEDs.

Once we have created the relevant building type models, our team will populate them using each program's detailed participation data, run them reflecting the pre- and post-program conditions, and weight the various model's savings together (based on the prevalence of each building type in each program) to estimate overall savings. We will also leverage the billing analysis—discussed next—to calibrate our model's total consumption using actual participant consumption data (for the subset of customers living in each modeled home type).

Billing Analysis

In addition to engineering algorithms and building simulations, our team will undertake a billing analysis. As evident in Table 1, we anticipate primarily using billing analysis primary for insulation, air sealing, and, potentially, thermostats, but we will also explore lighting-related options.

Specifically, our team will use a monthly Post Program Regression (PPR) billing analysis model to estimate energy savings for a subset of measures for each of the three Retrofit program. The PPR model, which is the same model type our team will use as part of the concurrent Home Energy Reports program evaluation, uses the "post-program" period – that is, the period after the start of the program – energy usage only as the dependent variable in the model, as shown below:

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

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
- $NonProg_c$ = 1 if customer c received a non-program energy-efficiency or health and safety-related improvement
- e_{ct} is the error term from the regression model

In this model, we use billed, pre-program period energy consumption as an explanatory variable which helps to condition expected, billed energy consumption in the post-program period. We also include monthly fixed effects and use the model to interact these monthly fixed effects with the pre-program energy use variable, which allows pre-program usage to have a different effect on post-program usage in each calendar month.

Our approach uses a control group made up of "future" participants from the same program (i.e., those that received measures in 2019 after the 2017-2018 analysis period) 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 include economic effects, the movement of people in and out of dwelling units, and fluctuations in per-unit energy costs. To identify the most relevant customers for the control group, we will use the quasi-experimental matched control group (MCG) method. The MCG method goes beyond random sampling of treatment and comparison groups and instead uses a nearest-neighbor algorithm to match each participant (treatment group) customer with a specific best-match from a pool of future participants (control group) based on pre-program energy usage. This approach identifies the future participant whose energy consumption pattern over the most recent 12 pre-participation months was most like that of the participant.

ARE BILLING ANALYSIS RESULTS GROSS OR NET?

Billing analysis produces a result that lies on a spectrum between net and gross savings. The exact location on that spectrum depends on the customers in the control group and the measure in question. Since we are focusing the billing analysis on weatherization, as well as using future participants as our control group, the results of our billing analysis—per the guidance of the Uniform Methods Project—should be considered **gross**. However, if the team uses billing analysis for lighting measures, the lighting results should be interpreted as **net**.

About Multifamily Buildings

We recognize that multifamily programs pose a challenge for billing analyses because of the variability in which utilities record their billing data and the level at which program services are tracked. Our team's early discussions with National Grid indicate program data is tracked at three, interrelated levels (units, buildings, and facilities) and that it will be possible for our team to tie each level to the relevant participant billing data. We anticipate that we will need to aggregate in-unit and common area billing records to the building or facility level for most participants, but we are optimistic about the viability of billing analysis for the identified subset of multifamily measures. (This aggregation process would also include accounting for any measures installed using C&I incentives.) However, if these challenges prove too great and reliable billing analysis results are not possible, our team will evaluate these measures using the existing multifamily BeOpt building simulation models.

Controlling for Cross-Participation

We also recognize the necessity of identifying, and controlling for, measures installed outside of EWSF, EWMF, or IEMF; not doing so would conflate the programs and overstate the billing analysis results. For

example, some EWSF participants also installed a high-efficiency heating system through a different National Grid program.[3] To avoid conflating savings across programs in instances such as this, our team requested (and National Grid provided) data for other residential programs. We will use these data to control for cross-program participation, specifically by including a program- or measure-specific dummy variable reflecting cross-participation in our model specification.

Task 3. Net-to-Gross Evaluation

Determining net savings requires estimating both **freeridership** (i.e., action likely without program support) and **spillover** (i.e., subsequent reductions in energy consumption due to program influences that accrue outside of direct participation).

Timing: April-June

Deliverables: Methodology memo with batteries and supporting algorithms

Specifically, our team will estimate net savings for the EWSF and EWMF programs at the measure group-level (i.e., the gray end-uses listed in Table 1). We will not collect NTG-related data for IEMF, which we will deem as 100% (standard practice for income eligible programs).

For efficiency reasons, we will include our NTG battery (i.e., the set of freeridership and spillover questions) in the participant process evaluation surveys described in more detail later in the work plan). The exact questions we will pose in NTG battery will vary by program and measure.

Best practices have generally shifted towards approaches that are simpler for respondents and avoid consuming an excessive amount of survey real estate. In particular, our team appreciates the relatively straightforward, yet rigorous approach used in Illinois and, in the absence of a standard algorithm for RI or MA, proposes to use it for this evaluation.[4]

We will share the details of how we will apply the Illinois approach to EWSF and EWMF in an NTG analysis plan memo in mid-April. However, it is important to note here that the approach accounts for the key elements of free-ridership (program influence on timing, efficiency level, and quantity), as well as participant "like" (i.e., more of the same measures installed through the program) and "unlike" (i.e., different measures than installed by the program) spillover.

WHAT ABOUT NONPARTICIPANT SPILLOVER?

Nonparticipant spillover captures the savings incurred at the nonparticipating market-level in response to program efforts. A rigorous and defensible nonparticipant spillover study can be expensive, time consuming, and, depending on methodology, face defensibility concerns. While we recognize nonparticipant spillover exists, we do not include it as part of this NTG research for these reasons.

[3] It is worth noting that National Grid confirmed that no non-National Grid funded measures were installed at participating IEMF facilities so that is not a potential source for billing analysis bias.
[4] 2020 IL TRMv8.0 Vol4_October 17, 209_FINAL

Task 4. Process Evaluation

Process evaluation activities provide insight into the customer journey, identify barriers to project completion, and inform opportunities to increase the energy savings obtained from each home. We are committed to ensuring that process evaluation activities result in recommendations that are actionable and forward-looking—focused on building upon program strengths while providing practical insight for program evolution where relevant for future success.

As noted at the beginning of this work plan, all three Residential Retrofit programs contain the same basic elements: a no-cost in-home energy assessment with direct installed measures, generating a set of participant-specific efficiency recommendations, and (ideally) customer adoption of those recommendations. These basic similarities will allow our team to create an initial set of process evaluation materials (stakeholder interview guide, participant survey, etc.) that is generally applicable to all three programs. We will then add tailored modules to each research instruments to address program-specific research needs.

This approach yields multiple benefits. First, it is economical. Creating a single standardized research instruments and then adjusting it for each program is less expensive than independently creating three individual documents. Second, it is faster for our team to create and for National Grid, and its evaluation stakeholders, to review. Third, the approach fosters consistency. By virtue of starting each program-specific document from the same place, it is easier to keep questions relevant for multiple programs (e.g., basic awareness and satisfaction questions) consistent across evaluation.

The following sections detail our four proposed process evaluation activities, which as mentioned, we will coordinate across programs.

- Stakeholder Interviews
- Materials Review
- Participant Surveys & Building Representative Interviews
- Cycle Time Analysis

Stakeholder Interviews

> *Timing:* April-May
>
> *Deliverables:* Interview guide

A first and foundational process evaluation task is to have in-depth discussions with the people involved in the daily execution of a program, specifically the program staff at National Grid and the primary implementation company. These initial discussions will provide our team with critical context, as well as the program-specific language we need to effectively converse with each program's participants.

Collectively, the stakeholders identified in Table 2 will offer broad insight into National Grid's design, marketing, and delivery of all three programs. Beginning with the utility implementation manager and lead vendor provides our team the most comprehensive introduction to a program. Informed by the information obtained in these interviews we, will shift our focus to those that are working directly with customers and are integral to program operations.

Table 2. Stakeholder Interviews*

Stakeholder	Stakeholder Group	EnergyWise Single Family	EnergyWise Multifamily	Income-Eligible Multifamily
National Grid Implementation Managers & Customer Energy Management Strategic Planners	Implementation/ Program Staff	1	1	1
Lead Vendor/Implementation Manager		1	1	1
Lead Vendor In-Home Assessors	Assessors	6	3	3
Installation Contractors	Contractors	6	4	4
Lead Vendor Internal QA/QC Auditors	QA/QC	2	2	2
Third-Party QA/QC Manager and Auditors		4	4	4
Total		**20**	**15**	**15**

*The totals in the table represent the number of interviews with each type of stakeholder. We anticipate that, in some cases, several stakeholders will participate in an interview. At the end of any group interviews, we will notify all interviewees that they are welcome to follow-up with our team individually (via phone or e-mail) if they have additional thoughts that they would like to share but either did not have time during the interview or felt uncomfortable doing so in a group setting.

We organized the six stakeholders into four stakeholder groups (assuming stakeholders within these groups will require similar types of questions). As described above, the interview guide will include program-specific modules as appropriate. As with all our deliverables, we will share draft interview guides with evaluation stakeholders prior to deploying them.

Materials Review

Our team also requested key program documents (including both printed materials and digital distributions) for review. This review will provide multiple benefits:

> *Timing:* April-May
>
> *Deliverables:* Summary of materials in final report

- Helps our team become **more familiar with program nuances**. This, in turn, allows us to ask appropriate questions of each set of participants.
- Serves as a resource to **directly investigate statements** made in the interviews. For example, if interviewed field assessors mention the program's materials confuse participants, having and reviewing a copy of the materials allows our team to offer more specific recommendations for improving them.
- Allows us to **identify opportunities to clarify the program information for participants**. Reviewing outward-facing materials with a fresh eye and participants' perspectives can glean valuable insights related to program communication.

Participant Surveys and Interviews

A critical input to every process evaluation is direct input from participants. To provide consistency and facilitate comparison across programs, we will draft a single core survey assessing participant awareness,

> *Timing:* May - June
>
> *Deliverables:* Survey instruments, fielded survey, analysis in final report

satisfaction, demographics, and barriers to implementing program-recommended action. The core questions will also include verification and influence-related questions to feed into impact and net-to-gross evaluation activities. We will build the core survey first and then add modules to investigate the program- and participant specific nuances.

We plan to use web and, to a lesser extent, telephone surveys to reach participants. Web surveys are increasingly popular as the bias continues to decrease and costs far less to administer than a telephone survey. However, this approach is subject to e-mail availability as determined through the data review. In addition, certain customer types, such as older customers and multifamily property owners, may be more likely to respond to a telephone survey. We will therefore follow-up with unresponsive sampled customers via phone.

Sampling

In recent years, National Grid's three programs have annually served over 20,000 housing units across more than 10,000 single family homes and 233 multifamily buildings. To effectively evaluate the process experience for each type of participant (and to support the net-to-gross survey research), we have employed a stratified random sampling approach based on program and participant types.

It is important to recognize that the survey (and subsequent sampling strategy) needs to meet process and impact evaluation needs. Specifically, the survey needs to include questions to verify measure-level installation, retention, and program influence on actions (for net-to-gross), as well as yield insight into improving future programs. These types of questions require measure-level stratification considerations. The sampling strategy also needs to account for population size and number of target respondents. As an example, while the multi-family program served thousands of units, there are considerably fewer building decision-makers (e.g., property managers / owners).

Our proposed approach, summarized in Table 3, will focus on 2019 participants and, at minimum, yield results of at least 10% precision at the 90% confidence level for each program and participant type. Survey 2019 participants will minimize recall bias and ensure our process findings capture any recent changes to the programs' delivery. We have also proposed an additional stratum for the EWSF and EWMF programs, which will allow us to dig deeply into differences between "assessment only" and "major measure" participants and identify opportunities for higher conversion rates.

Table 3. Survey and Interview Sampling

	Homes/Units (Annually)	**Survey/Interview Sample°**
EnergyWise Single Family		
- Assessment only	~6,300	150
- Major measure	~3,700	150
EnergyWise Multifamily		
- Tenant	~4,000	100
- Building Decision-Maker (Assessment only)*	~200	30
- Building Decision-Maker (Major measure)*		30

	Homes/Units (Annually)	Survey/Interview Sample°
Income-Eligible Multifamily**		
- Tenant	~7,000	100
- Building Decision-Maker*	~100	30
Total		**590**

*Interview, not survey

**Our team assumes that all buildings assessed through the Income-Eligible Multifamily program install a major measure.

°Pending completion of data review

Strategies to Maximize Response

Our team will employ three strategies to maximize response rates:

- **Advanced Notification.** We will send sampled customers an advanced email (where available) and a postcard describing the study and requesting their participation. Our efforts for National Grid in Massachusetts have shown that providing customer with advanced notification is an effective means for improving response rates and mitigating non-response bias.
- **Incentives.** In appreciation of their time, and to encourage survey completion, we will offer participants a $10 gift card. Multifamily building contacts, phone interviewed, will get a $50 gift card.
- **Survey design.** We will encourage completion of the full survey by limiting the length to no more than an average of 15 minutes. Further, we offer to complete telephone surveys in Spanish to further mitigate any non-response from Spanish speakers.[5,6,7]

Cycle Time and Attrition Analysis

Using the provided program data, we will calculate the typical time required for a customer to move through the key stages of participation, as well as the overall program timeframe (i.e., from signing up for an assessment to completing the QA/QC process). We will then juxtapose the results of the cycle time analysis with the findings of the participant survey to identify any key points of attrition, or places where participants tend to "fall out" of the current participation process. We will also keep an eye for timeline or dropout rate differences for specific participant sub-segments (geography, income, demographics, home vintage or similar).

As part of this task we also will create a graphical representation of the typical customer participation process for each program. The graphic will include the average time associated with each step and, when relevant, note instances where participants drop out or delays can occur.

Our team will also use this task to assess and report key participation trends over time (total assessments, the percent of participants that installed at least one major measure, etc.) The exact set of historical trends that our team can report will be a function of the program data provided by National Grid and its implementor.

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[5] https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

[6] All other non-English languages combined are 3.4%.

[7] A Cadeo team member is a fluent Spanish speaker and capable of translating and administering the English version of the survey in Spanish in real time. This approach minimizes the cost relative to formally translated and offering a Spanish version online, thereby making it possible to offer a Spanish survey option within the constraints of the evaluation budget. The Cadeo team member has previously successfully provided similar translation services on customer energy efficiency surveys.

Task 5. Reporting

We have found that discussing our preliminary findings—in detail—in advance of submitting the official draft report expedites our writing process, reduces stakeholder review iterations, and, most importantly, yields more robust and actionable reports. As such, we plan to present preliminary findings to National Grid and evaluation stakeholders in mid-July (focused on gross and net savings from the impact evaluation) and again in early August (process evaluation.

> *Timing:* Mid-July through mid-September
>
> *Deliverables:* Preliminary findings presentations, draft and final reports (including designed one-page summaries)

Following these presentations, our team will create two retrofit reports—one of EWSF and another that combines EWMF and IEMF—oriented around the key themes and findings identified across evaluation tasks.

The final program report will include a concise, high-level, graphical executive summary of all pertinent information within a few pages, followed by a more detailed narrative. As some information is best presented visually, we will include graphical elements to provide clarity on findings, as well as references and citations for applicable data, phone conversations, non-confidential sources, publications, and other media. To ensure high quality reporting, we will employ the services of our technical editor and graphic designer. Their specialized assistance will ensure that our report is properly and carefully edited and formatted before delivery.

COVID-19 Impact and Contingencies

As a result of COVID-19, the landscape of National Grid's retrofit programs has changed dramatically in recent weeks. At this time, none of the three programs are completing in-person home energy assessments and a significant portion of the programs' implementation team have been furloughed.

It is still possible to evaluate all three programs and provide National Grid with the insight it seeks to inform future delivery of the programs after COVID-19 restrictions lessen. However, the change to status of the programs impacts some of our proposed evaluation activities.

Table 4 outlines, task by task, whether each evaluation activity is impacted, or has the potential to be affected, by the COVID-19 restrictions. In these instances, we note how our team will adjust our plans to meet, to the best of our ability given the circumstances, National Grid's evaluation needs.

Beyond the specific contingencies noted in the table, it is important to note that our team will adhere to National COVID-19 communication and outreach policies and adapt as necessary. We will include National Grid-approved language in all customer and stakeholder outreach and, more in generally, demonstrate sensitivity to the current situation in all our communications.

Table 4. COVID-19 Contingencies

Task	Impacted?	Contingency/Context
Task 1. Data Review and Preparation	No	Relies entirely on previously gathered data
Task 2. Impact Evaluation – All Tasks	No	Relies entirely on previously gathered data; team will exclude any 2020 billing data from billing analysis
Task 3. Net-to-Gross	Potentially	National Grid has approved the team to contact participants for the process survey, which will also inform our net-to-gross analysis (see below for more details related to data collection). If outreach policies change and primary data collection is no longer possible, our team will rely on previous research for similar programs in neighboring states and National Grid territories.
Task 4. Process Evaluation – Stakeholder Interviews	Yes	Since most of assessors and QA/QC staff have been furloughed, the team will limit our initial stakeholder interviews to core National Grid and RISE program managers, who are actively managing the programs. We will our interview with the RISE program managers to, in part, understand their assessor's work situation. If beneficial for their company and team, we may proceed with the assessor interviews. Otherwise, we will revisit completing all remaining stakeholder interviews later in the evaluation timeline.
Task 4. Process Evaluation – Materials Review	No	Relies entirely on previously gathered information
Task 4. Process Evaluation – Participant Surveys & Interviews	Yes	As noted above, our team has permission from National Grid to complete the evaluation's proposed surveys and interviews and plans to proceed as outlined in this plan. To be less intrusive and allow respondents more flexibility, our team will rely more heavily on online surveys. This includes transitioning the MF building owner/manager interviews to online surveys with telephone interview follow-up as needed.
Task 4. Process Evaluation – Cycle Time & Attrition Analysis	No	Relies entirely on previously gathered data
Task 5. Reporting	No	While reporting will happen as planned, the team will document the limitations and implications of COV-19 on evaluation activities and results.

Data Request

The evaluation team submitted a data request for data and program materials to support the evaluation of the three retrofit programs program on March 4th, 2020. To date, National Grid has supplied nearly all of these items.

The data request includes four components:

1. Program data
2. Billing data
3. Program materials
4. Stakeholder contact information

Below, we provide the text of the data request.

Program Data

Please provide the following program data for participants in EnergyWise Single Family, EnergyWise Multifamily, and Income-Eligible Multifamily programs during **2017, 2018, or 2019**. (We will use 2019 participants from each program as the control group in our billing analysis.)

- National Grid Account Number
- National Grid Premise Number
- Information regarding all **measures** installed using **National Grid funding**[8], 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(s)
  - Measure-specific estimated (also known as ex ante) savings
- Information about the **home**, including:
  - All relevant information regarding the existing conditions in the home prior to participation (e.g., existing attic insulation R-value prior weatherization)
  - Space Heating Fuel Type (e.g., natural gas, electricity, heating oil, propane, other), including efficiency (if available)
  - HVAC Distribution Type
  - Water Heater Type, including efficiency (if available)
  - Air Conditioning Type (central, room AC, none), including efficiency (if available)
  - Size (square footage)
  - Size (number of units in building/premise)
  - Number of Stories (single or multi-story)
- Information about all **participants**[9], including:
  - Name
  - Address, including ZIP Code

[8] Please also provide similar information—as part of the same dataset or separately—for any energy efficiency measures installed in using non-National Grid funding. This is most likely occurring as part of the Income-Eligible Multifamily program. If provided separately, include the participant's account number so our team can combine this information with National Grid funded measure installations.

[9] For the EnergyWise and Income-Eligible Multifamily programs, please provide this information for the primary program contact at each property (i.e., the owner or manager) as well as the tenants in the individual units that received measures through the program

- Phone
- E-mail
- Owner/Renter Indicator (if available)
- Total occupants (if available)
- Demographic/Income information (if available)
- Information about **program** milestones, including:
- Sign-up/Enrollment Date
- Assessment Date
- Measure-specific Installation Date(s)
- Quality Control Visit Date(s)

Billing Data

Please provide the following fields for all customers that participated in EnergyWise Single Family, EnergyWise Multifamily, and Income-Eligible Multifamily program in **2017, 2018 or 2019**. (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 minimum of one year's worth of pre- and post-participation energy consumption records, please provide the billing data for the customer's identified above **from September 1st, 2015 through the present.**

At a minimum, we need the following fields:

- National Grid Account Number
- National Grid Premise Number
- National Grid Rate Schedule
- Master Meter Flag/Identifier
- 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.

Program Materials

At a minimum, we need the following documents:

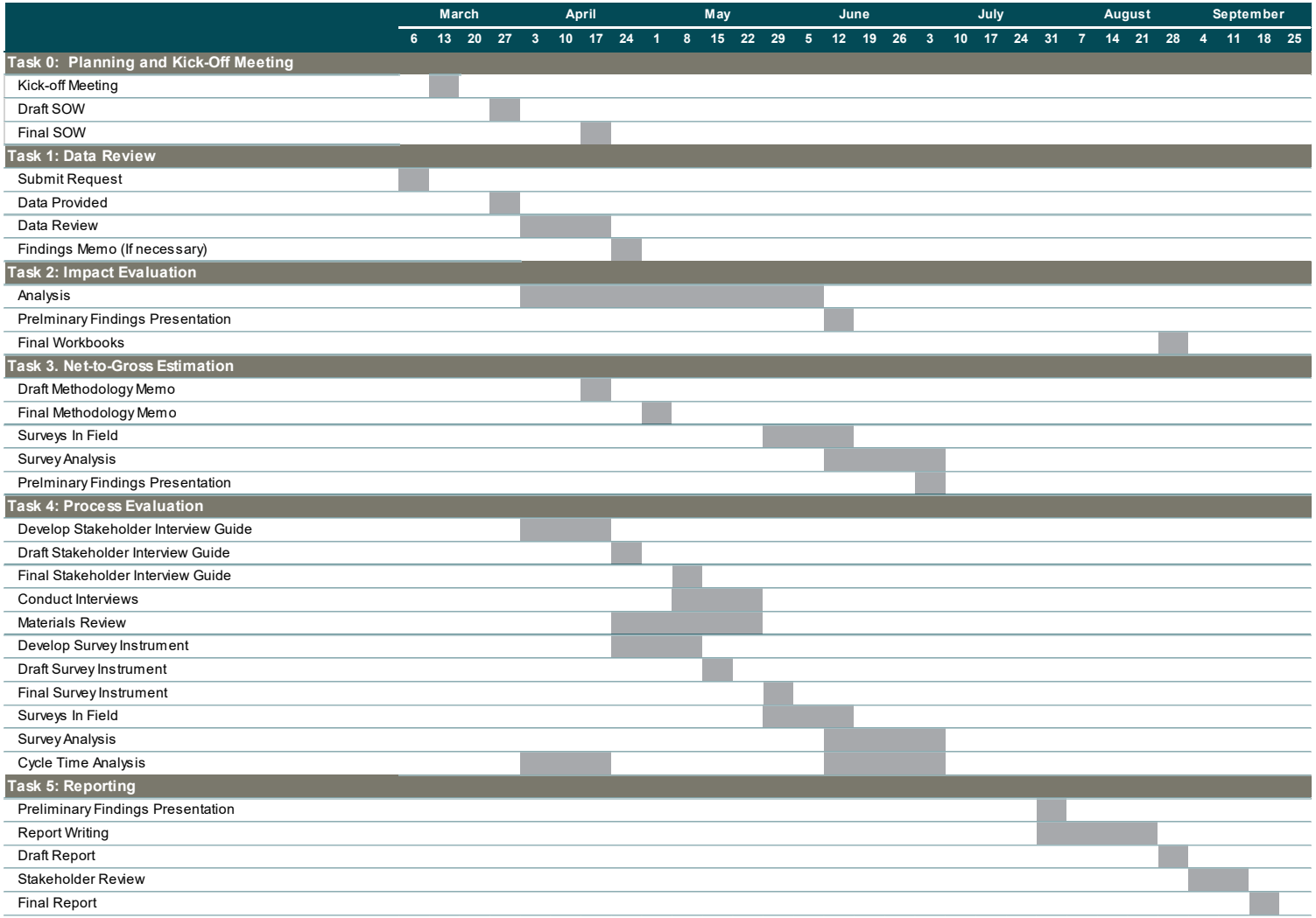
- All marketing and outreach documentation (printed and digital)
- Program documentation, including applications, audit protocols and QA/QC procedures if available

Stakeholder Contact Information

To facilitate interviews, we request contact information (name, role, phone number, and e-mail) for the stakeholders listed for potential process evaluation interviews

Timeline

We will follow the approximate schedule shown below.



Appendix B. Impact Analysis Plan

Memorandum

To: Romilee Emerick and Adam Wirtshafter, National Grid
From: Cadeo and ILLUME
Date: May 22, 2020
Re: EWSF, EWMF, and IES MF Impact Evaluation Analysis Plan

This memo details Cadeo's analysis plan for the impact evaluations of three National Grid residential retrofit programs in Rhode Island: **EnergyWise Single Family (EWSF), EnergyWise Multifamily (EWMF), and Income-Eligible Multifamily (IEMF)**. The scope of our impact evaluation will be program years 2017 and 2018.[1] This analysis plan adds detail to the impact evaluation tasks outlined in our team's overall evaluation work plan for all three programs and leans upon our team's ongoing review of program data recently provided by National Grid.

The analysis plan consists of the following sections:

- Data Sources
- Overarching Approach
- Billing Analysis Details
- Engineering Algorithms Details
- Building Simulation Modeling Details

Data Sources

National Grid has provided the following datasets, which our team will use to inform our impact evaluation activities.[2]

- **Program Data.** These data include basic customer (account number, address, ZIP code) and measure (type, quantity, savings) information for 2017, 2018, and 2019 participants. These data also include some information about pre-existing conditions for each participant. As described in more detail later in the plan, our team will use data regarding 2017 and 2018 participants for all three impact evaluation tasks and data for 2019 participants as a control group for our billing analysis.
- **Supplemental Participant Data.** These data provide additional information regarding the physical structures of participating buildings, as well as mechanical systems. This information includes, but is not limited to: HVAC system types (heating and cooling), heating fuel, water heating fuel and type, building size, building vintage, rent/own status (EWSF only), and building-level ownership type, i.e., condominium or apartment (EWMF and IEMF only).

[1] The concurrent process evaluation will focus on 2019 participants for all three programs.
[2] We also requested and have received other related information – e.g., a do-not-contact list, contact information for market actor interviews, and program materials – that do not relate to impact evaluation activities.

- **Cross-Program Participation Data.** As assessment programs, EWSF and EWMF can serve as a gateway to participating in other, complementary National Grid residential programs.[3] Since it is critical to account for participation in other programs when estimating savings for EWSF and EWMF, we will flag cross-program participants so that we can control for the energy savings from other programs as part of our billing analysis. To enable this, National Grid provided participation data for three of its other residential programs: Natural Gas Heating and Water Heating, Central AC, ENERGY STAR products, and the Home Energy Reports behavioral program.[4]
- **Billing Data.** National Grid provided monthly energy consumption data ranging from January 1, 2012 to December 31, 2019.[5] These data include billed, gas and electric energy consumption for all National Grid Rhode Island's residential customers – including both program participants and program future participants. However, these residential billing data do not fully capture multifamily buildings, which often have common areas or master meters. Thus, we received commercial and industrial rate-class billing data to supplement the residential billing data for multifamily buildings and will aggregate these billing data to a facility level for our analysis.

In addition to the data that National Grid provided, our team acquired contemporaneous, hourly weather data from the National Oceanic and Atmospheric Administration (NOAA) for all NOAA weather stations in Rhode Island. These data will allow the heating and cooling degree days in our billing analysis to be specific to each customer's locale and billing cycles.

Impact Evaluation Approach

Our impact evaluation approach will use one or more of the complementary methods below to determine gross, per-unit energy savings for each measure in the EWSF, EWMF, and IEMF programs.

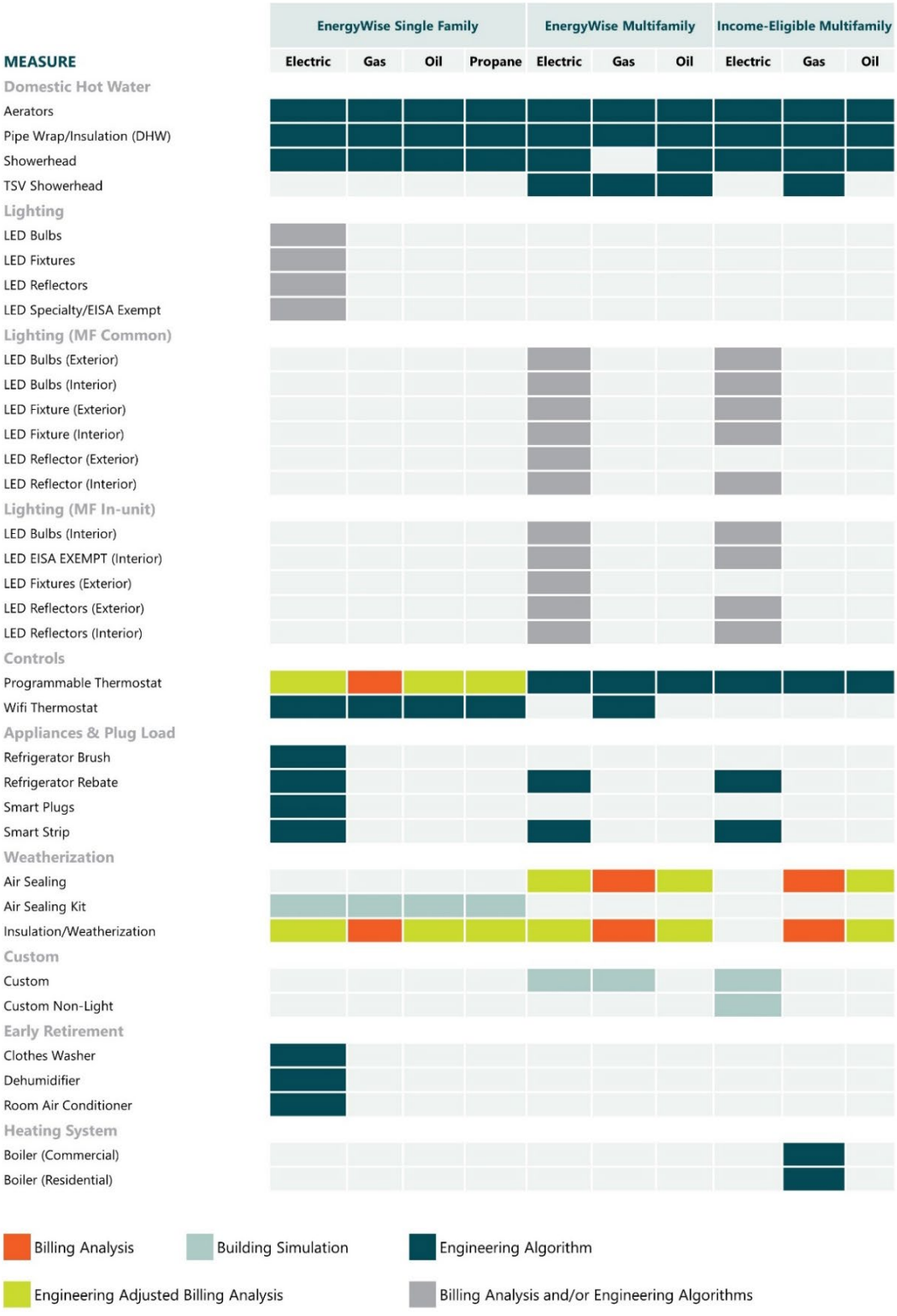
- **Billing Analysis** compares energy consumption from participant billing records, both before and after their participation date, to determine energy savings. Billing analysis is our preferred approach when possible because it, when employed with a well-matched control group, best reflects the actual change in energy usage within participating homes.
- **Building Simulation** uses engineering-drive modeling software to estimate energy savings from program energy efficiency measures, and is best used for the measures that have interactive effects across end-uses (e.g., heat pump water heaters) when billing analysis is not viable (e.g., delivered fuel weatherization).
- **Engineering Algorithms** use calculations specified in Rhode Island Technical Reference Manual (TRM)[6] or other regional studies to calculate bottom-up energy savings. We use National Grid Rhode Island's program data and other appropriate regional studies as inputs for this approach, which is best employed for measures that do not have interactive effects (e.g., faucet aerators)

[3] Our team anticipates that IEMF participants are comprehensively served through that program and, with the likely exception of the Home Energy Reports program, do not cross-participate in other residential programs. However, we will confirm this assumption when combining program databases before proceeding with the billing analysis.
[4] Excludes upstream lighting.
[5] The billing data provided by National Grid will also support our team's concurrent Home Energy Reports (HER) impact evaluation. The HER analysis spans a much longer participation period, which is why National Grid provided consumption data as far back as 2012.
[6] http://rieermc.ri.gov/wp-content/uploads/2019/11/ngrid-ri-2020-trm.pdf

and, again, are not viable for billing analysis (often because the per-unit savings are too small).

The approach that we propose for each measure in our evaluation scope is shown in Figure 1.

Figure 1. Primary Impact Approach by Measure Type, Fuel and Program



Note: Engineering Adjusted Billing Analysis estimates savings by applying an algorithm to billing analysis result

In some cases, we will also explore blending more than one of these approaches to determine energy savings. For example, our team will estimate energy savings from weatherization using the billing analysis, and in doing so, attempt to differentiate between the savings generated by air sealing and each type of insulation (attic, wall, and floor) installed through the retrofit programs.[7] However, it is important to note that reliable results for more granular measure types (i.e., air sealing and attic, wall, floor insulation versus weatherization overall) are not always possible via billing analysis. This is due to several reasons: multicollinearity (i.e. most air sealing participants also install insulation), smaller sample sizes for each insulation type, and a decreased "signal" (measure savings) to "noise" (total household consumption) ratio. Our team will buttress against this possibility by relying on building simulation to offer similar insights into the savings generated by specific types of insulation.

Lighting is another example where our team will consider blending more than one approach to gain additional perspectives on the program's impact. Specifically, our team will assess household-level[8] lighting savings (via billing analysis) to complement—and potentially augment—the granular, lamp-type-specific savings that we will estimate using engineering algorithms. Together, the top-down assessment of total household lighting savings provided by the billing analysis and the bottom-up, lamp-type-specific algorithmic approach will offer our team a well-rounded perspective on the program's lighting measures and a greater chance to observe the impetus behind the evaluated savings.

The remainder of this document describes the three approaches in further detail.

Billing Analysis Details

This section describes our billing analysis in detail. In each subsection, we note where our approach for the single-family participants in EWSF differs from multifamily participants in EWMF and IEMF.

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

Applicable Measures

As described above, our team will use billing analysis to estimate savings for several EWSF, EWMF, and IEMF electric and gas measures.

- **Electric**. Lighting (at the household-level), weatherization (air sealing, wall insulation, floor insulation, attic insulation), and programmable thermostats.
- **Natural Gas**. Weatherization (air sealing, wall insulation, floor insulation, attic insulation), and programmable thermostats.

[7] National Grid does not test the cost-effectiveness of these weatherization types individually, however, additional savings perspective for weatherization types may illuminate where the program is more (or less) successful when weatherizing participant's homes.

[8] Our experience will similar analysis suggests that it is unlikely that the billing analysis will produce statistically significant savings for each of the specific LED lighting measures (i.e., general service, EISA EXEMPT, and reflectors)

We anticipate the billing analysis will have adequate sample size to produce statistically significant results for these measures.[9] Regardless, our team will also use engineering algorithms and/or building simulation to assess savings for each of the billing analysis measures described above. We will use these related results to validate the reliability of our billing analysis findings.

Also, as we describe above, we will aggregate each participant's individual lighting measures and use billing analysis to estimate energy savings for lighting measures as a single group at the household level. Then, the team will use algorithmic approach described later in this document to disaggregate savings to an individual measure level.

Treatment Group Selection

For our electric and natural gas billing analyses, we define treatment groups for the ESWF, EWMF, and IEMF programs as those participants who satisfy the criteria shown in Table 1.

Table 1. Billing Analysis Treatment Group Details

Savings Fuel	Measures	Installation Period	Number of Eligible Participants*
Electric	Lighting (All Types) Weatherization Programmable Thermostats	January 1, 2017 through December 31, 2018	16,402
Natural Gas	Weatherization Programmable Thermostats	January 1, 2017 through December 31, 2018	4,606

* Unique projects that received at least one program measure in 2017 or 2018. Note: the actual billing analysis will use fewer participants due to the billing data screening steps described later in this document.

9 As a rule-of-thumb, we look for +/- 25% precision at 90% confidence when reporting billing analysis results.

For the remainder of this analysis plan, we refer (for each of the three retrofit programs) to the aggregated group of 2017 and 2018 participants as the "treatment group".

Control Group Selection

We also use a control group to account for the impact of macroeconomic factors and other non-programmatic influences on pre- and post-program energy consumption. 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.

ARE BILLING ANALYSIS RESULTS GROSS OR NET?

Billing analysis produces a result that lies on a spectrum between net and gross savings. The exact location on that spectrum depends on the customers in the control group and the measure in question. Since we are focusing the billing analysis on weatherization, as well as using future participants as our control group, the results of our billing analysis—per the guidance of the Uniform Methods Project—should be considered **gross**. However, if the team uses billing analysis to report savings for lighting measures, the results should be interpreted as **net**.

For this analysis, we will use future participants as a control group for our analysis (i.e., a group of customers that participated in the same programs after the treatment period). As "future" participants, it is unlikely that these customers made many of the energy efficiency improvements offered through the program prior to participating, and thus we assume that our billing analysis results represent gross, rather than net, savings for all non-lighting measures.[10] Because these future participants self-selected into the same program, we assume that they are generally similar (in terms of housing stock, income eligibility, and consumption habits) and offer a reasonable counterfactual for the treatment group. We will validate this assumption as part of our analysis.

For the single family analysis, we define the control group as 2019 EWSF participants (Table 2) who also did not receive EWSF measures in 2017 and 2018. It is critical to note that although these participants later received measures through EWSF, we will only make use of their energy consumption data prior to participation.

Table 2. Billing Analysis Control Group Details, EWSF

Savings Fuel	Measures	Installation Period	Number of Eligible, Future Participants*
Electric	Any Measure	January 1, 2019 through December 31, 2019	11,651
Natural Gas	Any Measure	January 1, 2019 through December 31, 2019	4,749

*The matching and screening processes we describe below will determine exact number of future participants that we can use in the control group.

We will attempt to develop a control group for each of the multifamily programs using a similar approach.

[10] See Chapter 8 (Whole-Building Retrofit with Consumption Data Analysis Evaluation Protocol) of The Uniform Methods Project (UMP) for further detail. Available at https://www.nrel.gov/docs/fy17osti/68564.pdf.

However, these programs contain fewer participants, and facility-level participation adds layer of complexity to matching the treatment group to the control group. Should we determine that a control group is not feasible for multifamily program participants, we will use the appropriate billing analysis model specification (described later in this document). Similar to the matched control approach we describe above, this model specification produces gross savings.

Creation of Pre- and Post-Periods

As mentioned above, the treatment group are participants who installed at least one billing analysis relevant measure in 2017 or 2018. However, since treatment participation period is two years long and participants installed program measures at various times during that period, we will create customized pre- and post-periods for each participant.

For each participant, the day before the earliest program installation date (usually the date of their home energy assessment when they had measures such as lighting and aerators directly installed) is the last day of pre-period. Conversely, the day after each participant's last installation date marks the first day of the post-period.

However, billing cycles do not perfectly align with these specific pre- and post-period demarcations so we will define a "blackout" period that ensures clearly defined pre and post periods. The blackout period will include the billing cycle that includes the last day of the pre-period, the first day of the post-period, and every billing cycle in-between. Using the blackout period ensures we will not consider a participant's energy consumption during those billing cycles as part of our analysis. Table 3 below tables provides an example of pre- and post- periods for a specific customer.

Table 3. Example of Pre-Post Period Determination

First Installation	12-month Pre-Period	Latest Installation	12-month Post-Period
February 8, 2017	January 2016 – December 2016	May 28, 2017	July 2017 – June 2018

Data Preparation

Before specifying the billing analysis models, we will conduct the following sequence of data preparation steps:

- Weather Normalization
- Screening Billing Data
- Matching Treatment & Control Groups
- Controlling for Cross-Program Measures
- Multifamily Data Preparation

Weather Normalization

To weather normalize, we use weather data from the weather station closest to each customer's ZIP code. Once we determine the closest weather station, we use daily temperature data from that station to calculate the average daily heating and cooling degree days (HDD and CDD) between the read dates of

each customer billing record.[11] Next, we create a regression model for each treatment and control group customer that estimates their observed average daily consumption as a function of weather at the time (i.e., HDD and CDD during each billing cycle). Lastly, we apply each model's customer-specific coefficients, which describe how that customer's usage responds to different weather, to a "normal" weather year (or typical meteorological year - TMY3). This process yields an estimate of each customer's energy usage during an average weather year.

Screening Billing Data

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 any the following criteria:

- Unable to link billing and program participation data
- Insufficient pre- or post-billing data (i.e., less than ten months of pre- or post-installation billing data[12])
- Billed consumption does not meet reasonable monthly values (outlier removal - 1st and 99th percentile)
- Large changes in pre- to post- installation period energy consumption; beyond what is potentially attributable to the program (i.e., change of +/- 80% of pre-period consumption).[13]

Matching Treatment & Control Group

After conducting the data screening process described above, we will match each treatment group customer to a future (2019) participant with a similar pre-program energy consumption profile.

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 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. Our MCG approach allows for many-to-one selections, that is, a customer in the control group can potentially be the "best match" for more than one customer in the treatment group.

Controlling for Cross-Program Measures

Our team's initial assessment found that 2,062 (6%) of the EWSF participants in the treatment group also participated in one or more of National Grid's other residential programs: Natural Gas Heating and Water Heating, Central AC, and ENERGY STAR products.[14] In addition, we found that 4% and 3% of units that participated in IEMF and EWMF, respectively, cross-participated in one of these same programs. For all

[11] Using 60°F as the base temperature for HDD and 70°F as the base temperature for CDD, which is consistent with UMP's guidance.
[12] This step includes screening for vacancies.
[13] The purpose of this screening step is to eliminate unexplained changes in energy consumption – either increases or decreases - that are inconsistent with program participation. Typically, we expect to drop less than 5% of customers through this step.
[14] IEMF stakeholders notified our team that no measures are installed at participating IEMF facilities using funding from other, non-National Grid efficiency sources (e.g., WAP or LIHEAP).

programs, the team will include cross-participation variables in the billing analysis model to control to ensure the savings from these programs are not conflated with EWSF, EWMF, or IEMF measures.

Aggregate Multifamily Data

We recognize that multifamily programs pose a particular challenge for billing analyses because of the variability in which National Grid records their billing data (dwelling unit, building, or master meter) and the level at which program services are tracked. Our team's early analysis of National Grid's program data indicates that it is tracked at three, interrelated levels (units, buildings, and facilities) and that it will be possible for our team to tie each level to the relevant participant billing data.

We anticipate that we will need to aggregate in-unit and common area billing records to the building or facility level for most participants, but we are optimistic about the viability of billing analysis for the identified subset of multifamily measures. This aggregation process would also include accounting for any measures installed using C&I incentives. However, if these challenges could prove too great and we cannot obtain reliable billing analysis results our team will evaluate these measures using the multifamily BeOpt building simulation models described later in this plan.

Model Specification

Our preferred billing analysis approach is to use a monthly Post Program Regression (PPR) model to estimate average measure-specific savings for the measure and fuels shown in Figure 1. However, the PPR approach requires a control group, which could prove problematic for EWMF and IEMF. Thus, we have also included a pooled fixed effect regression model as an alternative specification for those programs.

Post-Program Regression

Our team will use a PPR model specification for EWSF. We will also use this specification for EWMF and IEMF if we are able to construct a control group.

The general form of our PPR model follows:[15]

$$ADC_{ct} = b_1 Treatment_c + b_2 LagADC_{ct} + \sum_{month\ i} b_{3i} Month_{it} + \sum_{month\ i} b_{4i} Month_{it} * LagADC_{ci} + \sum_{prog\ j} b_{5j} CrossProg_{cj} + e_{ct}$$

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.

[15] 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.

- $CrossProg_{cj}$ = 1 if customer c received an energy-efficiency measure from non-EWSF program j.[16]
- e_{ct} is a cluster-robust error term for customer k during billing cycle t. Cluster-robust errors account for heteroscedasticity and autocorrelation at the customer level.

In the PPR 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 or detached, size) and characterize other EWSF measures that impact same-fuel consumption to augment the general model described above if those terms sufficiently improve how the model fits.

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.

Pooled Fixed Effects Regression

If we are unable to create a control group for the multifamily programs, we will use an appropriate, alternative model specification for our billing analysis, such as a pooled, fixed effects regression.

Again, the general form of such a model would follow:

$$ADC_{kt} = b_{0k}Part_k + b_{1t}Time_t + \sum_{meas\ i} b_{2i}Measure_{ik}Post_{tk} + \sum_{prog\ j} b_{3j}CrossProg_{jk} + e_{ct}$$

Where

- ADC_{kt} = The average daily usage in kWh for customer k during billing cycle t. This is the dependent variable in the model;
- $Part_k$ is a participant level-fixed effect
- $Time_t$ is a time-period (monthly) level-fixed effect
- $Post_{tk}$= 1 if month t is in customer k's post-program period, 0 otherwise
- $Measure_{ik}$= 1 if customer k is installed measure *i*, 0 otherwise
- $CrossProg_{jk}$ = 1 if customer k received an energy-efficiency measure from cross-program j, 0 otherwise
- ek_t = The cluster-robust error term for customer k during billing cycle t. Cluster-robust errors account for heteroscedasticity and autocorrelation at the customer level.

In the model above, we derive annual, measure level savings from the b_2 coefficients, which represent the average daily savings (kWh for electric, therms for natural gas) attributed due to the program. We will adapt this model to add weather-sensitive terms, as needed, for weatherization measures.

Engineering Algorithms Details

[16] We will also explore using program-specific cross-program participation variables.

Concurrent with the billing analysis, our team will estimate savings for a subset of EWSF, EWMF, and IEMF measures using the engineering algorithms from the 2020 Rhode Island TRM. To begin, our team identified each measure slated for evaluation using an engineering algorithm to the relevant measure summary within the TRM (Figure 2). This critical first step ensure our team will rely on the appropriate listing in the TRM, which includes many program- and customer-specific measure variations.

Figure 2: TRM Measure/Page Mapping

	EnergyWise Single Family				EnergyWise Multifamily			Income-Eligible Multifamily		
MEASURE	**Electric**	**Gas**	**Oil**	**Propane**	**Electric**	**Gas**	**Oil**	**Electric**	**Gas**	**Oil**
Domestic Hot Water										
Aerators	165	860	175	177	201	883	211	460	927	456
Pipe Wrap/Insulation (DHW)	167	864	191	193	250	893	272	466	939	468
Showerhead	171	862	195	197	254		256	462	935	458
TSV Showerhead					266/268	885/887	264		932/933	
Lighting										
LED Bulbs	155									
LED Fixtures	153									
LED Reflectors	159									
LED Specialty/EISA Exempt	157									
Lighting (MF Common)										
LED Bulbs (Exterior)					213			430		
LED Bulbs (Interior)					229			446		
LED Fixture (Exterior)					215			444		
LED Fixture (Interior)					231			442		
LED Reflector (Exterior)					225					
LED Reflector (Interior)					233			438		
Lighting (MF In-unit)										
LED Bulbs (Interior)					243			448		
LED EISA EXEMPT (Interior)					241			432		
LED Fixtures (Exterior)					237					
LED Reflectors (Exterior)					239			424		
LED Reflectors (Interior)					247			436		
Controls										
Programmable Thermostat	145	856	149	189	260/262	874	217	410/412/414	913	416
Wifi Thermostat	147/183	858	185	187		876				
Appliances & Plug Load										
Refrigerator Brush	163									
Refrigerator Rebate	137				252			398		
Smart Plugs	*									
Smart Strip	161				258			452		
Weatherization										
Air Sealing					205	868	203		907	400
Air Sealing Kit	179	854	139	181						
Insulation/Weatherization	143	866	141	*	209	870	207		909	404
Custom										
Custom					235	872		408		
Custom Non-Light								**		
Early Retirement										
Clothes Washer	*									
Dehumidifier	*									
Room Air Conditioner	*									
Heating System										
Boiler (Commercial)									923	
Boiler (Residential)									919	

**Denotes new measure*
*** Team is awaiting final clarification from National Grid*

Billing Analysis
Building Simulation
Engineering Algorithm
Engineering Adjusted Billing Analysis
Billing Analysis and/or Engineering Algorithms

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

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

For some measures, the TRM also includes a secondary algorithm for calculating *deltakWh*.[17] However, in many cases, the TRM does not and instead references a previously completed evaluation. For example, one showerhead measure (M-254) references the 2012 Massachusetts Low-Income Multifamily Initiative Impact Evaluation completed by The Cadmus Group as the source of the savings value. In instances such as this, our team will locate the referenced evaluation and identified the relevant information to estimate the *deltakWh* term in Rhode Island's TRM.[18] In this case, the aforementioned evaluation used the following algorithms to estimate savings for showerheads:

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 did not rely on an algorithmic approach, instead using billing analysis or building simulation to estimate savings. When this happens, our team will rely on the Massachusetts TRM[19] or another well-established industry engineering algorithm.

After identifying the appropriate algorithm – as stated in the Rhode Island TRM, a previous evaluation report, or elsewhere – our team will search out relevant algorithm inputs in the program data provided by National Grid. Again, using showerheads as an example, the program included some, but not all of the algorithm inputs (e.g., number of showerheads installed, but not baseline flow rate or hot water setpoint temperature). Our team will rely on a combination of program documentation (which provides guidance to assessors on which showerheads are eligible for replacement) and other well-established, regionally appropriate secondary sources when program data is unavailable.

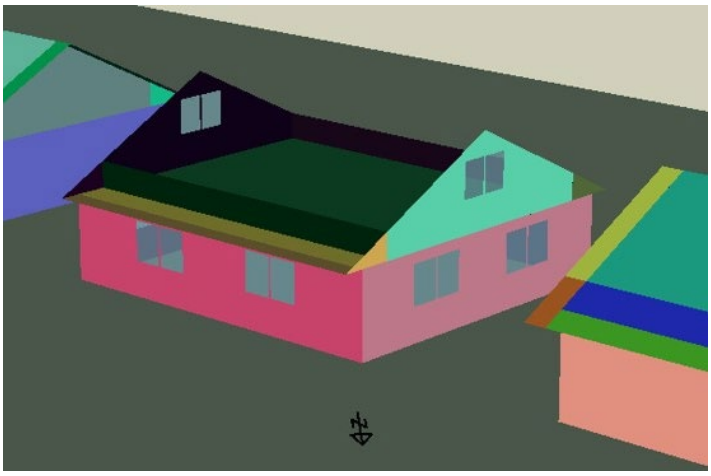
Building Simulation Details

Our team will use building simulation for a small subset of measures that generate (or are subject to) interactive effects and that do not readily lend themselves to billing analysis.

[17] Or *deltaMMBtu* for gas and oil measures
[18] Our team reserves the right to use a different algorithm if we determine the algorithm previously employed is insufficient.
[19] https://www.masssavedata.com/Public/TechnicalReferenceLibrary

For this evaluation, we will use the BEopt building simulation software, which was created by the National Renewable Energy Laboratory and utilizes the Department of Energy's EnergyPlus as its simulation engine. Similar to the engineering algorithm approach described above, our team will utilize as much program-specific participant, household, and measure data as possible as BEopt inputs.

Figure 3: BeOpt Building Shell Rendering of Single Family Prototype Home



We will construct multiple simulation prototypes for each program to account for differences in building configuration, heating systems, heating fuels, and other building characteristics. The following subsections offer more detail for EWSF and EWMF/IEMF.

Modeling EWSF

To model homes that participated in EWSF, we propose to construct at least six models: one building configuration, two heating fuel types (electric and gas[20]), and at least four heating/AC system combinations.[21] We will finalize the exact set of heating and AC system configurations we will model based on the prevalence of each system within the program data. This analysis is ongoing, but we anticipate including baseboard, furnace, boiler, and heat pumps.

We propose to use one building configuration protype to model EWSF program participants: a detached 1.5 story model as can be seen in Figure 3. In this prototype, the home has a finished main floor with a half-finished upstairs/attic area containing kneewalls. We want to prioritize including kneewalls in our model because knee wall insulation is a common EWSF measure, even in homes listed as one story in the program data.[22] The team's decision to model this building prototype as a representative of EWSF homes is further detailed in the following paragraphs.

We looked at three key home characteristics in the EWSF data to inform our building simulation prototypes for the program: number of stories, square footage, and home types. As detailed in Figure 4, we found that 93% of EWSF participants live in one or two-story homes. While stack effect[23] is a critical factor when modeling high-rise buildings, the difference in stack effect in one and two-story homes is

[20] We will also calculate savings for oil and propane heated homes by scaling the results of the natural gas prototype building by the relative heating system efficiencies.

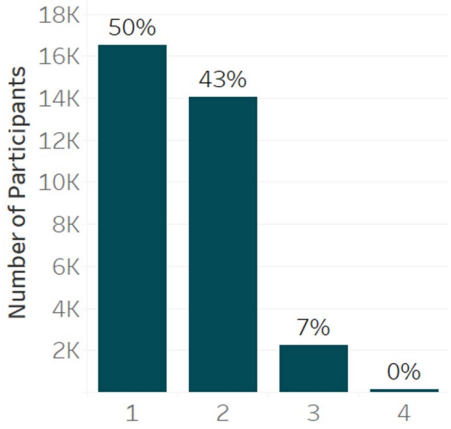
21 The team will address additional combinations of heating/AC systems based on their prevalence in program data. At a minimum, the team expects to model two gas heating systems and two electric heating systems.

[22] 45% of EWSF participants that received kneewall insulation are listed as living in 1 story homes.

[23] Stack effect is when warm air moves upward in a building, resulting in differences in temperature and pressure at different heights within the structure.

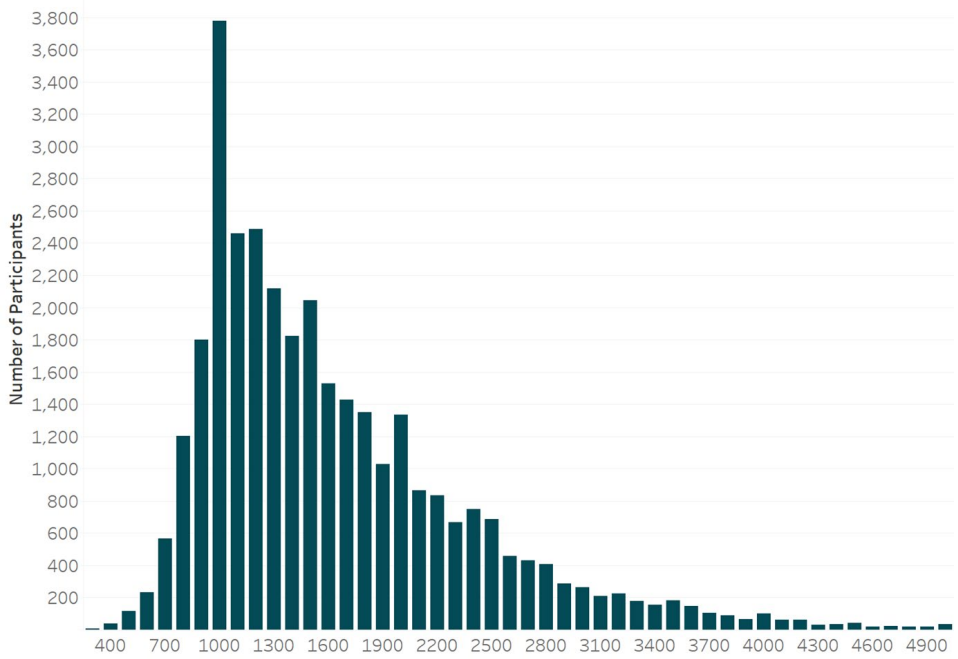
minor. Consequently, our team plans to model a hybrid detached, 1.5 story building with knee walls that reflects the vast majority of EWSF homes.

Figure 4. EWSF Building Number of Stories Characteristics



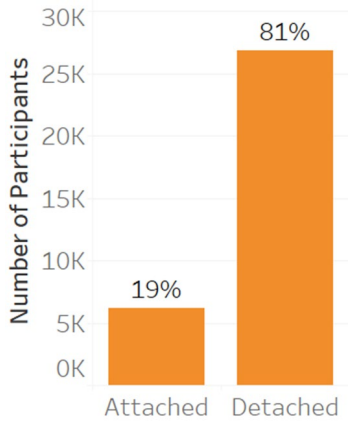
Next, we looked at the square footage of conditioned space to determine if the EWSF participant square footage distributions were uni-modal (which suggests using an overall program average) or multimodal distribution (which would warrant multiple prototype models). As evident in Figure 5, the distribution is unimodal, with an average of 1,684 square feet. In fact, 60% of participating EWSF homes were between 800 and 1,800 square feet.

Figure 5. Square footage of EWSF homes



Finally, we looked at the prevalence of attached vs detached homes. As evident in Figure 6 below, 81% of participants live in detached homes, consistent with our model.

Figure 6. EWSF Building Types Characteristics



Modeling EWMF and IEMF

The team analyzed a number of factors to identify which building characteristics most accurately represent the EWMF and IEMF sample data. Like EWSF, these key characteristics include the number of stories, number of units, square footage and heating system type. The team assessed each of these characteristics for both multifamily programs to determine if our team needed to create program-specific models or if, for some prototypes, an overall multifamily model was appropriate.

We have come to the preliminary conclusion to model at least four prototype buildings to evaluate the EWMF and IEMF programs. One building configuration, at least two fuel types (again, electric and gas), at least 2 heating system types, and potentially different IEMF and EWSF model variations based on other building characteristics (e.g., differing pre-program insulation levels). The team proposes to use one 3 story "low rise" building, which represents the most common multifamily program participant building configurations. Our path to that decision is detailed below.

First, we analyzed the average number of stories in multifamily participant's buildings. As seen in Figure 7 91% and 83% of the buildings that participated in EWMF and IEMF, respectively, were between 2 and 4 stories. Therefore, modelling a 3-story multifamily building will provide accurate estimate savings for the majority of participants in both programs. We also considered modeling a high-rise building configuration to account for taller participating buildings. However, the number of such buildings (even when accounting for total participating units, not buildings) represent a small portion of the total program's participation and is not the highest use of evaluation resources.

Our team is still investigating the appropriate building prototype square footage and number of units for both MF programs. Our data review identified some uncertainties in the EWMF/IEMF building characteristic data (i.e., does the value in the program data reflect entire facilities, individual buildings at those facilities, or tenant spaces). Our team is currently working with National Grid to clarify these values so that we can apply them appropriately.

The team will also continue to explore potential differences between EWSF and IEMF buildings that would suggest creating separate models for each program. While our initial review of the MF data did not find any significant differences, we continue to dig deeper in the program data to identify potential

discrepancies that would warrant either additional models or, at a minimum, using different baseline assumptions within a model (i.e., different pre-program wall insulation levels). Specifically, the team is looking into the hypothesis that IEMF buildings may be different from EWSF buildings in terms of the quality and/or condition of their pre-program building shell or air sealing characteristics. Such differences would not necessarily require a separate building prototype but may warrant program-specific models with separate pre-program/existing conditions assumptions.

Figure 7: EWMF and IEMF Building Characteristics by # of Buildings

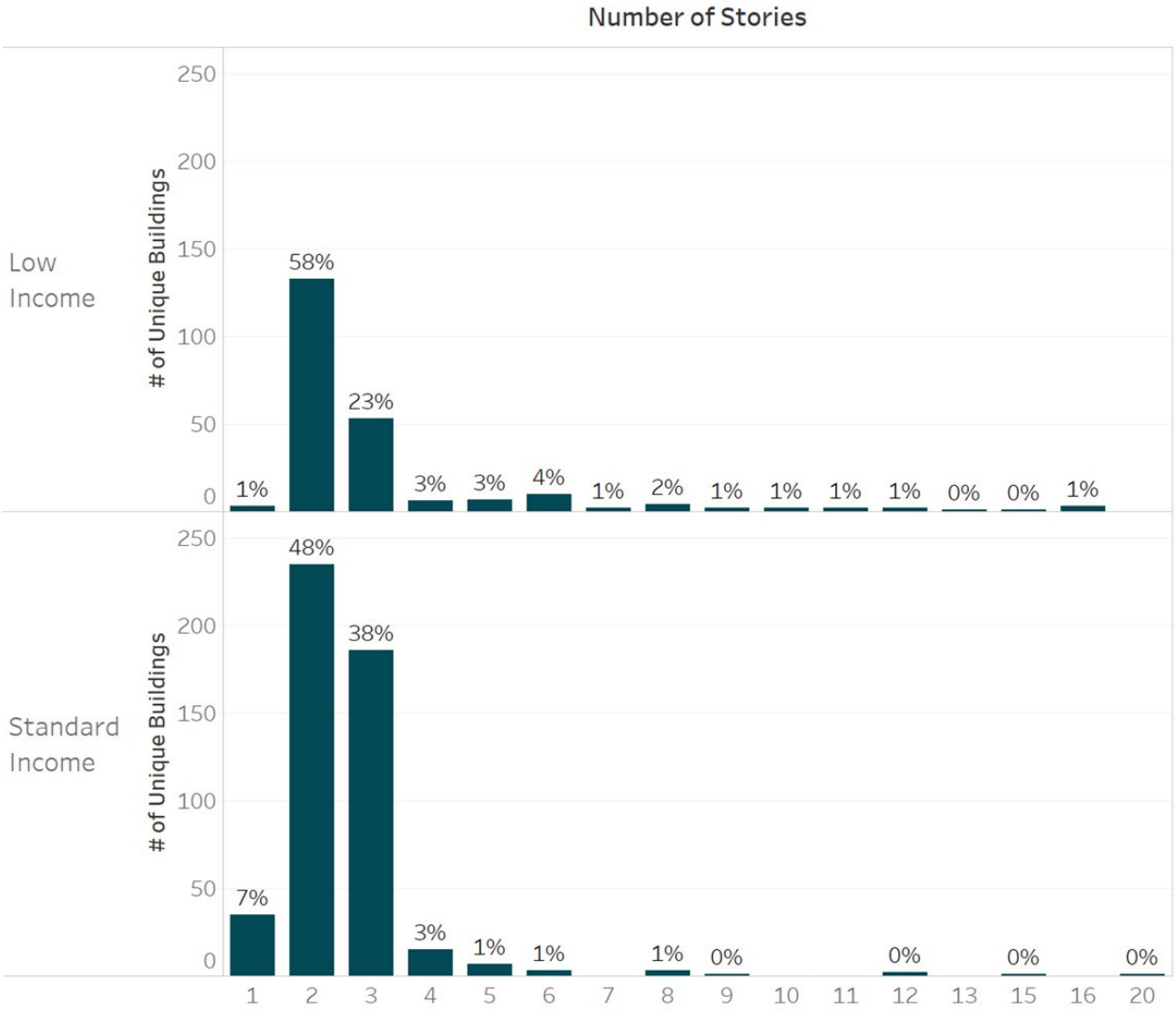
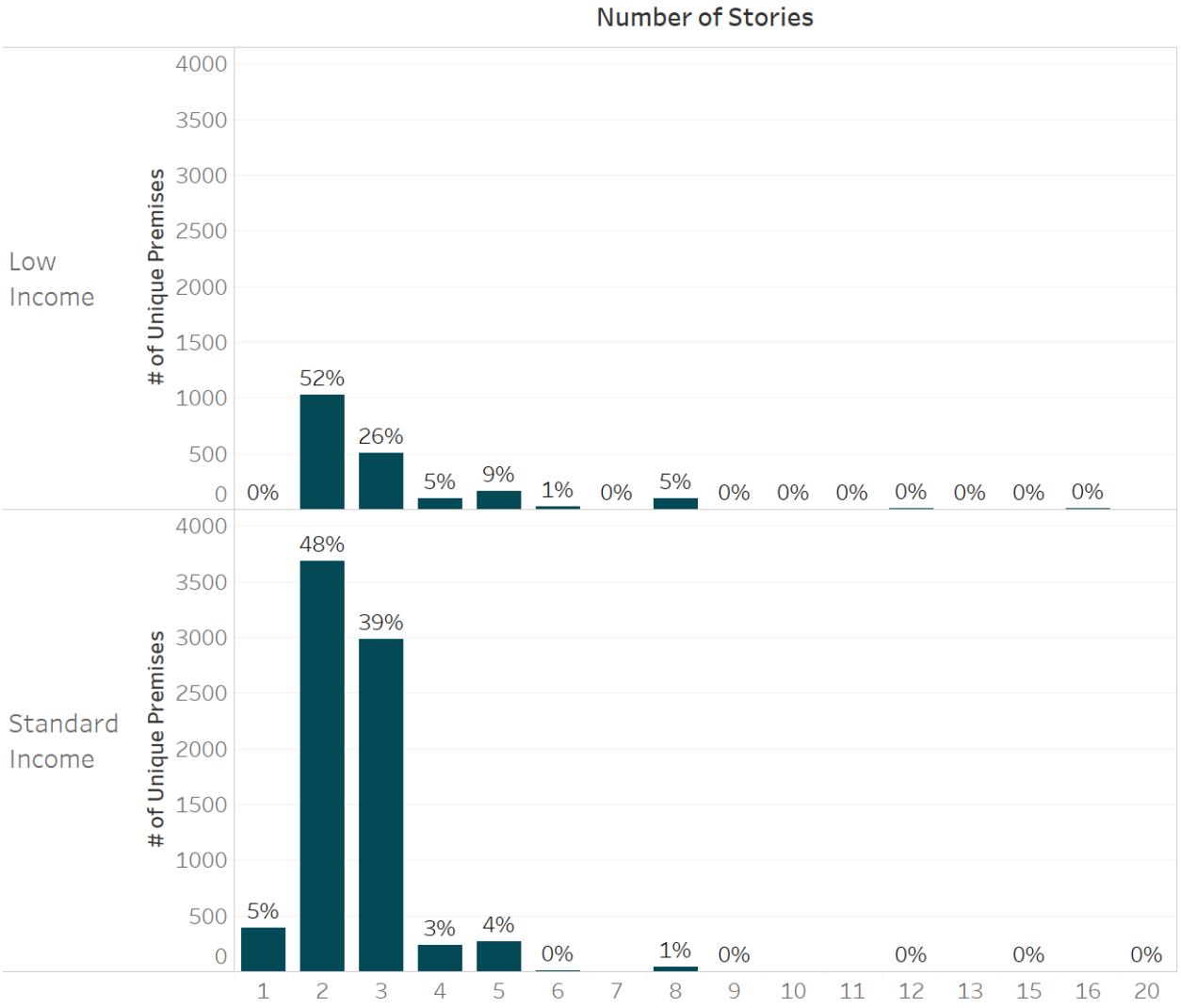


Figure 8: EWMF and IEMF Building Characteristics by # of Units (Premises)



Appendix C.
Net-to-Gross Methodology Memo

Memorandum

To: Romilee Emerick and Adam Wirtshafter, National Grid
From: Cadeo and ILLUME
Date: May 1, 2020
Re: Net-to-Gross Methodology for EWSF and EWMF in Rhode Island

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National Grid contracted with Cadeo and ILLUME (the evaluation team) to evaluate their EnergyWise Single Family and Multifamily programs in Rhode Island. The evaluation includes measuring net-to-gross (NTG) for the programs. This document contains the evaluation team's proposed approach.[1]

As detailed below, the team applied the NTG method published in the 2020 Illinois Statewide Technical Reference Manual (TRM) for Energy Efficiency, Version 8.1 (available here). In the absence of a Rhode Island-specific NTG approach, our team identified the Illinois approach as the most appropriate alternative; it's a comprehensive NTG framework that follows industry standards for measuring free-ridership and spillover, while striking a reasonable balance between analytical rigor and survey length.[2]

The result of this research will be measure category level (e.g., in-unit lighting) NTG ratios that our team will apply to the evaluated gross savings for all measures (e.g., in-unit LED lamps, reflectors, and fixtures) within that category.

In this memo, we discuss, in detail, each element shown in the basic NTG formula shown below:

NTG = 1 – (Free-ridership + Participant Spillover)

Program Information

National Grid Rhode Island's EnergyWise Single Family (EWSF) program offers no-cost energy assessments for single-family homes (defined as one-to-four-unit buildings). During the assessment, an energy specialist directly installs certain energy-saving products free of charge and visually inspects the home for further energy saving equipment recommendations. The energy specialist produces a report documenting the findings of the assessment and recommendations, which the energy specialist discusses with the customer at the end of the assessment. Customers may be eligible for up to $4,000 in rebates toward the cost of insulation, air sealing, and appliances.

National Grid Rhode Island's EnergyWise Multifamily (EWMF) program operates similarly, providing multifamily buildings (defined as five-or-more-unit buildings) includes home energy assessments, direct-install measures and rebates on in-unit and common area energy efficiency measures, typically 75% of cost, up to a threshold of $2,000 depending on the measure. Multifamily properties that receive National Grid electric, gas, or dual-fuel are eligible to participate, although direct install and rebated measures differ depending on the fuel type. Direct install measures include in-unit lighting common area lighting,

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[1] The evaluation team will not be conducting NTG for the Income Eligible Multifamily program, assuming a NTG ratio of 100% (as is common practice for income eligible programs.)

[2] The team explored the possibility of using the standardized approach currently being developed in Massachusetts but determined the approach would not be finalized soon enough to meet the timeline for these evaluations.

smart strips, thermostats, air sealing, showerheads and aerators and refrigerators. Rebated measures include common area lighting, insulation, demand controllers, and outdoor reset controllers.

Proposed Net-to-Gross Method

The evaluation team will provide net savings, reflecting both free-ridership and participant spillover at the measure category level (e.g., in-unit lighting). All measures within that category (i.e., in-unit LED lamps, reflectors, and fixtures) will share the same NTG value. The study will use a self-report survey, administered in conjunction with the process evaluation, to collect NTG-related data from recent EWSF and EWMF participants.

The evaluation team proposes using the NTG approach detailed in the state of Illinois' TRM in sections 4.5 (Single Family Home Energy Audit) and 4.6 (Multi-Family Protocol). This methodology gives credit for all the influential components of the program, including the information and education provided through the energy assessment and the rebates.

In order to measure the impact of the separate components of both EWSF and EWMF, including the energy assessment, no-cost direct install measures, and rebated measures, the evaluation team will include sections of the survey battery tailored to match the customer's specific experience. The Illinois TRM recommends two approaches, one for the direct installation of free low-cost measures (i.e., direct install measures installed during the assessment) and a second approach for rebate measures, such as air sealing and insulation.

It is essential that the individuals we survey are familiar with the decisions for participation, installations, and any program-related follow-up actions. The target respondent is most apparent and easily identified for EWSF, as it tends to be the person of record in the tracking data. For EWMF, there may be multiple participants that the team will need to contact. For common area and building shell components, the appropriate "participant" for the survey is the property manager and/or building owner; for in-unit measures, such as efficient lighting, surveys could include residents (tenants or owners) as well as property managers/building owners. The evaluation team will identify the correct respondents based on program staff interviews and review of the tracking data. The team will also verify the contact person was the primary decisionmaker through the survey screening process.

Free-ridership

As noted above, the free ridership battery will have separate modules for direct install and rebated measures and includes a separate NTG algorithm for each. These batteries and algorithms reflect the fact that rebated measures require a more complex decision-making process, and therefore need a more rigorous process than direct install measures. We have noted these measure type differences, where relevant, in the text below.

There are three basic components to the free-ridership question series**: Program Influence Score, No Program Score,** and **Consistency Checks**.

1. Program Influence Score

The Program Influence (PI) score, which is only relevant for rebated measures (not direct install measures), assesses the participant's perception of the influence of various program elements—including the assessment and rebate—on their decision to install the recommended rebated measure. The algorithm provides the program credit by using the maximum rating provided by the respondent to any one area of program influence. This approach acknowledges that a variety of program components can influence customer decision-making in different ways.

The team will ask surveyed participants questions related to program influence score such as:[3]

> *Please rate the importance of each factor that may have influenced your decision to have energy efficient product(s[4]) installed at this property through the program. Use a scale from 0 to 10 where 0 means "not at all important" and 10 means "extremely important".*
>
> - *The [REBATE/DISCOUNT] received for [PROGRAM MEASURE].*
> - *Recommendations from the assessor/contractor/National Grid representative*
> - *Information from the National Grid Multifamily program or other marketing materials*
> - *The no-cost project management and installation*
> - *Recommendation from someone else [follow-up: did they participate in the past?]*

The team will calculate the PI score as:

Program Influence Score (PI) *= Max (program-related influence ratings)*

2. No Program Score

The No Program (NP) score, calculated for both direct installation and rebated measures, captures the program counterfactual, i.e., the participants' likely decisions absent the program. As is standard practice in NTG studies and documented within the Uniform Methods Project protocols on common practices for estimating net savings[5], this score considers the following three components: **timing, efficiency,** and **quantity.**

Exactly how the team will ask NP questions will vary depending on specific measure the participant installed, but the questions will look like the examples below and focus on measuring timing, efficiency, and quantity, all on a 0-10 scale (where 0 is not at all likely and 10 is extremely likely):

Timing (T)

- *What is the likelihood that you would have installed an item of any efficiency within 6-12 months, had you not received it through the program?[6]*

Efficiency (E)

- *Without the program, what is the likelihood that you would have installed equipment of the same level of high efficiency as the unit installed had you not received them for free through the audit? (For direct install measures)*
- *Without the program, what is the likelihood you would have installed equipment of the same level of efficiency? (For rebated measures)*
- *Without the program, what is the likelihood you would have installed [measure]?*

(Q)uantity

- *What is the likelihood that you would have installed fewer measures / performed less weatherization without the program?*

---

[3]The program influence rating for the rebate is adjusted if the participant said they decided to purchase the equipment before learning about the rebate.

[4] Note that the survey will be programmed to ask about the specific, appropriate measure for a given participant

[5] https://www.nrel.gov/docs/fy17osti/68578.pdf

[6] The team will use 6 months for less expensive items, such as direct install measures, and 12 months for more expensive or rebated item

The team will calculate the NP score as follows. The elements address free-ridership, with the lower values representing lower free-ridership. The algorithm therefore takes the minimum value, providing credit in the area most influential. The algorithm then divides the value by 10 to calculate a ratio, or percentage, which will be used to calculate the free-ridership ratio

$$\textbf{No Program Score (NP}FR\textbf{)} = Min\,(T, E, Q)/10$$

3. Consistency Check

It is possible that some surveyed participants will provide responses that are inconsistent (i.e., the PI score does not indicate free-ridership, while the NP score does). While these batteries have been implemented in many jurisdictions, it is possible that participants can misinterpret the closed-ended questions and/or that the questions posed do not capture the full range of program influences.

To account for these issues, the evaluation team will include open-ended questions about program influences, which will serve as consistency checks for the PI and NP responses. The evaluation team has found that the consistency check questions rarely change the free-ridership results, but can be invaluable for providing additional context for the results.

All participants

- *Finally, in your own words, can you tell me how influential the program was in your decision to install this / these measures at the time you did? Consider all the areas discussed in this survey.*

For direct install recipients with inconsistent results

- *Prior to the audit, had you purchased any [measure]? Y/N*
- *IF YES AND NP <7: Before receiving the audit, why didn't you purchase additional on your own without the program? [OPEN END]*
- *IF NO AND NP >6: Given that you have not purchased before, why were you likely to purchase on your own without the program? [OPEN END]*

The evaluation team will assess all responses to open-ended questions and exclude respondents with responses that cannot be resolved through review of individual questions. The evaluation team will document the number of and reason for any exclusions in the report.

Consolidating Results to Calculate Free-Ridership

For participants that pass the consistency screening check, the team will calculate free-ridership for rebated measures by averaging the No Program and Program Influence scores and use the No Program score for direct install measures.

The following figures illustrate how the various scores are operationalized to calculate NTG for single family and multifamily programs evaluated in Illinois. These figures are excerpted directly from the Illinois TRM.

Figure 1: Free-ridership Summary: Direct Install/No Cost Measures

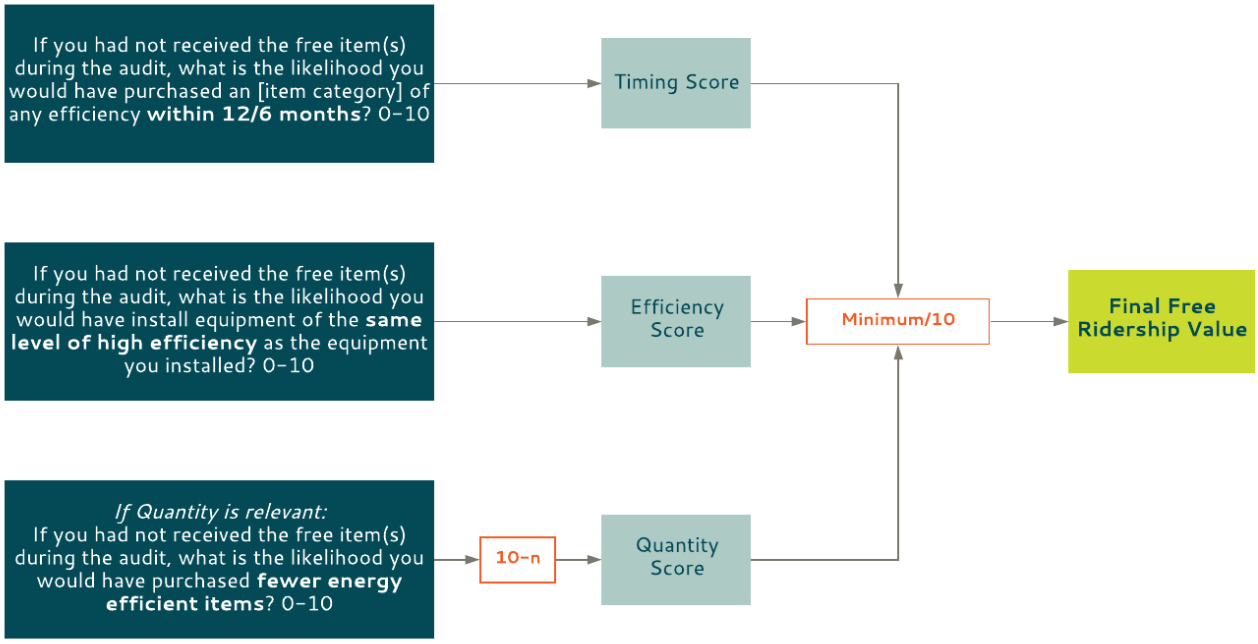
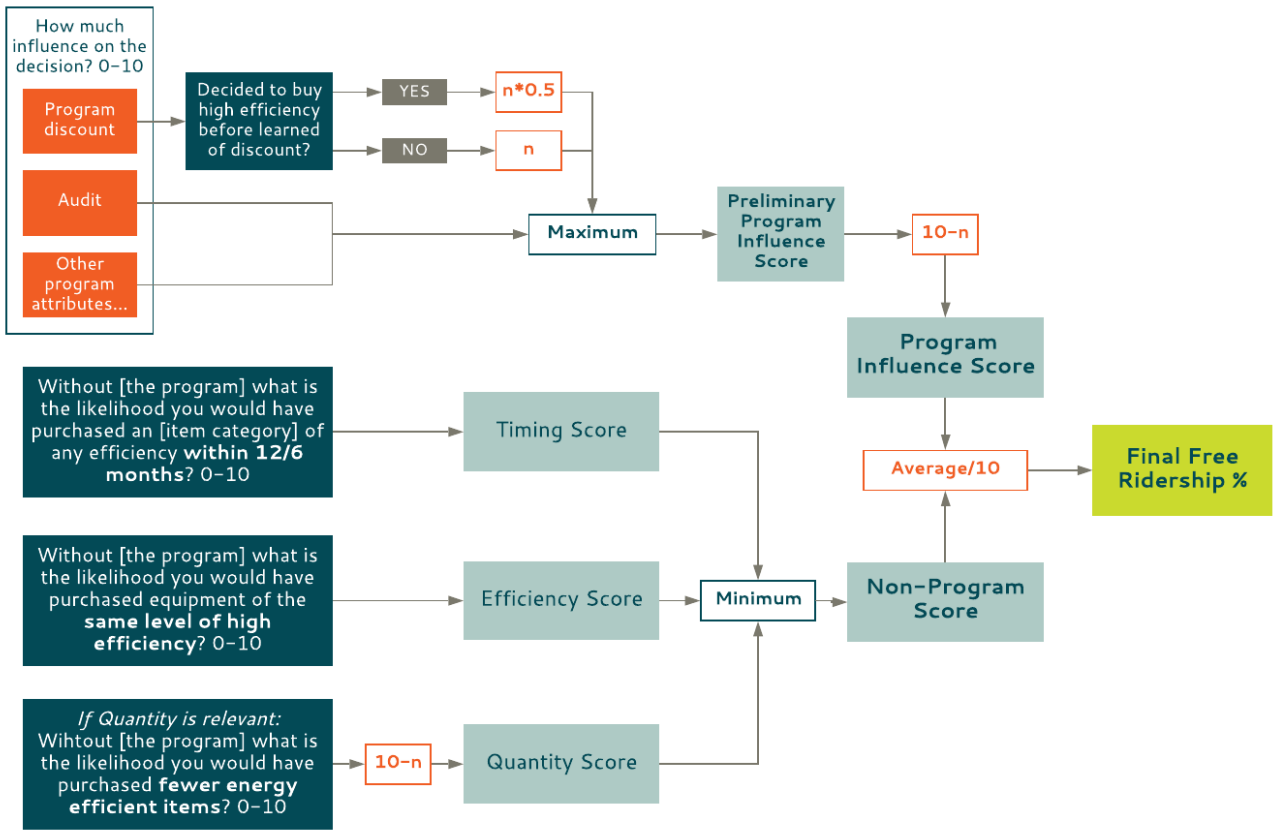


Figure 2: Free-ridership Summary: Rebated/Major Measures



Spillover

The evaluation team will also use the participant survey to calculate participant spillover, i.e., additional energy efficiency actions taken by the participant as a result of their participation. The approach detailed within this section aligns with the approaches used and outlined in both the Illinois TRM and the most recent Massachusetts Multifamily Impact and NTG evaluation[7].

The survey first asks questions to assess what was installed and could potentially qualify for spillover savings. As examples (note question wording will be programed to match participant experience as appropriate):

- *What did you install since your participation in the program?*
- *Did you receive a rebate for that installation?*
    a. *If did not receive a rebate, but they say the program is high-efficiency, and falls within specific areas that National Grid offers rebates, the survey could also ask why the respondent did not receive a rebate for that measure. This type of consistency check question can reveal if they tried but it did not qualify (thereby disqualifying the measure) and/or reveal process-related information that can be valuable to know).*

Any measures where the respondent indicates they received a rebate are disqualified, and subsequent questions are not asked for these measures.

From there, the battery uses a simplistic approach to assess program influence on spillover, basing the analysis on two questions for each measure mentioned in the prior question. Aligning with the free-ridership approach, the battery accounts for importance (or, influence) and the counterfactual intention, as shown below.

Measure Attribution Score 1

- *How important was your experience with the [PROGRAM] on your decision to install these efficient products on your own? [Scale from 0-10 where 0 is "not at all important" and 10 is "extremely important"].*

Measure Attribution Score 2

- *If the [PROGRAM] did not exist, how likely is it that you would still have installed these energy efficient products on your own? (Scale from 0 to 10, where 0 means WOULD NOT have installed the equipment and 10 means definitely WOULD have installed the equipment)*

This approach then combines the responses from these two attribution scores to create a spillover score which accounts for both importance and intention, providing equal weight to each.

Spillover Score = (Measure Attribution Score 1 + (10 – Measure Attribution Score 2))/2

This approach takes a threshold approach to assigning savings. A spillover score of at least 5 indicates program influence and attributes spillover savings when that threshold is met. In other words, if the spillover score is greater than 5.0, the energy impacts associated with that higher efficiency measure are attributable to the program. If the spillover score is less than 5.0, then the energy impacts are not attributable to the program.

[7] http://ma-eeac.org/wordpress/wp-content/uploads/RES-44_Multi-family-Program-Impact-Evaluation_FINAL_SO-Rates-Updated.pdf

$$\textbf{Total Spillover Savings} = \sum \quad savings\ for\ measures\ with\ attribution \geq 5$$

Finally, the evaluation team will calculate a program-level spillover rate in two steps. First, the team will calculate a participant-level spillover rate using the participant-specific data, calculated as:

$$\textbf{Participant Spillover Rate} = \textbf{Total Spillover Savings} / \textbf{Total Savings}$$

The analysis will then calculate a final, savings weighted spillover weight to represent the population-level spillover.

The evaluation team recommends only assigning spillover savings for measures that are included in National Grid's Technical Reference Manual (TRM) and/or where evaluated savings are reported as part of this study. Doing so will provide the most defensible results and ensure the relative savings values align with what is claimed in these Rhode Island programs.

Finally, the evaluation team recognizes that before qualifying a measure for savings it is important to validate efficiency levels as best as possible. Participants may say a measure is efficient, but in fact it is not. As noted earlier, the survey will assess whether they attempted to apply for a rebate for the measure; applying and not receiving the rebate is an indicator that the measure may not have qualified for efficiency reasons. The survey will also include confirmation questions to assess efficiency qualification. The Massachusetts Program Administrators used the question below, which we plan to include for this evaluation. We will refine this question and categories during the survey design process.

How did you know that the product(s) you installed were energy efficient?"

Response option	***Indicates efficiency***
Efficiency rating or label of equipment, such as ENERGY STAR logo	*Yes*
Equipment dealer/retailer said it was efficient	*Yes*
Personal experience	*No*
Met utility rebate requirements	*Yes*
Did not rely on any specific type of information	*No*
Don't know	*No*
Other (record)	*Evaluated individually*

Appendix D. Additional Spillover Details

Appendix D. Additional Spillover Details

This section provides more information on the spillover analysis.

Table 1 displays the number of actions respondents reported taking after their assessment, the number of actions that were removed from spillover because they did not receive a rebate, did not qualify for a rebate or could not verify the item's efficiency, or did not attribute their actions to the program. Overall, six actions (five by multifamily residents and one by a property owner) were included in the spillover savings.

Table 1. Spillover Action Screening

Measure	Total Actions Reported (n)	Removed: Received Rebate (n)	Removed: Did not Qualify for Rebate (n)	Removed: Influence Threshold Check (n)	Removed: Unverified Efficiency (n)	Total Actions Included in Analysis (n)
Air Source Heat Pump	1	0	0	0	0	1
Boiler	3	-1	0	-2	0	0
Central AC	3	0	-1	-2	0	0
Clothes Washer	2	-1	0	-1	0	0
Dehumidifier	3	-1	0	0	0	2
Dishwasher	1	-1	0	0	0	0
Electric Clothes Dryer	1	-1	0	0	0	0
Electric Water Heater	2	0	-1	-1	0	0
Freezer	1	0	-1	0	0	0
Furnace	1	0	0	-1	0	0
Gas Water Heater	2	0	-1	-1	0	0
Insulation	6	-2	-1	-3	0	0
LED Lighting	11	-3	0	-6	0	2
Low-e Storm Windows	2	0	0	-2	0	0
Low Flow Faucet Aerator	4	-1	-1	-1	-1	0
Low Flow Showerhead	5	-1	-1	-1	-2	0
Programmable Thermostat	5	-1	-1	-1	-1	1
Refrigerator	4	-2	0	-1	-1	0
Smart or Wifi Thermostat	6	-1	0	-5	0	0

Smart Strip Plug Outlet	4	-3	0	-1	0	0
TOTALS	**67**	**-19**	**-8**	**-29**	**-5**	**6**

Table 2 displays the savings estimates and source the evaluation team used for each measure identified as spillover through the survey. The team only included measures available in the 2020 Rhode Island TRM in the analysis.

Table 2. Spillover Savings Estimates

Measure	kWh	MMBtu	Savings units	Source
Air Source Heat Pump	5,891.2	0	Per unit	Pg. 105, Energy Star HVAC
Dehumidifier	167.6	0	Per unit	Pg. M-300, EnergyStar Products
LED Lighting	33.3	0	Per bulb	Pg. M-243 Energy Wise Multi Family
Programmable Thermostat (Electric Heat)	214.6	0	Per thermostat	Pg. M-145, Energy Wise Single Family

Table 3 displays the savings for the number of items qualifying as spillover survey respondents reported installing.

Table 3. Spillover Energy Savings Reported by Participants

Measure	Unique Participants (n)	Participant Savings (kWh)	Participant Savings (MMBtu)	Total Participant Savings (MMBtu)
Air Source Heat Pump	1	5,891.20	-	20.10
Dehumidifier	2	335.20	-	1.14
LED Lighting	2	732.60	-	2.50
Programmable Thermostat (Electric Heat)	1	858.40	-	2.93
TOTALS	**5**	**7,817.4**	**0**	**26.67**

*Sum of participant kWh savings converted to MMBtu and participant MMBtu savings.

Appendix E: Program Manager Interview Guide

National Grid Rhode Island
Residential Retrofit—Process Evaluation
Program Manager & Lead Vendor Interview Guide

Introduction

Thank you for taking the time to talk with us today. Our work requires having a solid understanding of the programs we are evaluating. There are no right or wrong answers, this is simply to help us gain a better understanding of the program.

We have four goals for this interview:

- To understand how the program works overall
- To gather information about your experience with the program, including successes and challenges you have had
- To find out about changes you are considering, or intend to make, to the program
- To learn what you would like to learn from this evaluation that will help you go forward with this program.

We expect this interview to take about 90 minutes. We'd like to record this interview to refer to our notes later. Is that okay with you? Do you have any questions for us before we begin?

Roles and Responsibilities

Let's begin by talking about your roles and responsibilities.

1. Can you briefly describe your role in implementing the **[ENERGY WISE SF, ENERGY WISE MF, INCOME-ELIGIBLE MF]** program?

2. Please describe the broader set of stakeholders that help deliver the program, as well as their roles. Probe/listen for:
   - Lead vendor and in-home assessors
   - Installation contractors
   - QA/QC
   - Other residential efficiency programs
   - [**INCOME-ELIGIBLE MF**: CAPs or RI DHS – marketing/income verification]

3. How do team members communicate? Probe/listen for:
   - Is there an expected method or frequency in communication?
   - How is this working overall? Do you have the right information at the right time?
   - Any opportunities for improvement?

4. Are there any other important program stakeholders you rely on to market or deliver the program?

5. Do you have enough help? In what areas could you use more support?

Program Planning and Goals

6. We know there are energy savings goals for these programs. Are there other primary goals for the **[ENERGY WISE SF, ENERGY WISE MF, INCOME-ELIGIBLE MF]** program we should be aware of?

7. How do you track progress towards these goals?

8. Are there any other objectives, maybe softer or internal targets?

9. How did the program do relative to its participation and savings goals, as well as any of these softer/internal targets, in 2017, 2018, and 2019?

10. What's happening with the program right now due to COVID-19?

11. Has participation tended to differ for certain customer or building types (for example, by ethnicity, primary language, renter vs. owner, home type, geography)? Why do you think that is?

12. Prior to the changes caused by COVID-19, what, in general, was going particularly well with the program?

13. Again, prior to the changes caused by COVID-19, what program aspects were you struggling with and/or working to improve?

14. In the process of planning for this evaluation we reviewed filing documents and noted some specific enhancements that were planned. I was hoping we could talk through them and you could let me know the status of each. (Probe as relevant)

    EnergyWise (both SF and MF)
    - A substantial participation goal increase
    - An enhanced landlord incentive (up to 100%)
    - Efforts to launch a residential energy score/asset rating
    - An online assessment, which customers could access directly

    MF (EWMF and IEMF)
    - An overall review of multifamily marketing
    - A shift in goals towards custom projects and air source heat pumps as lighting savings continue to decline
    - A consideration of a tiered incentive approach designed to get more units to participate
    - An effort to provide greater choice to the condominium market

    IEMF
    - Increased outreach to CDCs

15. Have you made any changes to program processes in the last year or so?

16. Looking ahead, can you tell me about any changes underway for 2020? Probe/listen for:
    - Any changes in marketing approach?
    - What about measures?
        - What measures are you considering for 2020? What measures are you not considering for 2020? What is the rationale behind these considerations?
        - How do you anticipate the program changing in another year, two years? (specifically on the program in a post-lighting future).
    - Any expansion or reduction in eligibility?
    - Any changes specific to multifamily buildings? Rental properties?
    - What about the income eligibility process?
        - Can you walk me through how this typically works?
        - How are/aren't income qualification procedures working? (Probe to understand if these are a barrier to program participation and if so, what is being done to address this.)
        - How, if at all, could these procedures be improved?
        - Can you please describe any differences in income qualification procedures between homeowners versus renters?

17. How do you track and manage program data? Probe/listen for:
    - Who is involved in this process?
    - How well do you think the current data collection process is working?
    - Have you had any issues with data accuracy or completeness?
    - How is the data tracking system working (for all parties involved)?

Customer Participation & Experience

Now I'd like to talk through some details of the program.

18. Let's start with recruitment and sign up. I understand that customers can sign up for a home energy assessment in a variety of ways, such as online, by phone, or through a local CAP agency (for income-eligible customers).

    Can you talk me through how participants get started in the program? Probe/listen for:
    - Are there any other ways customers sign up?
    - How do most participants enter the program?
    - Do you offer sign-up in multiple languages?
    - One of the scheduling scripts we've reviewed indicates that customers are asked how they heard about the program. What is the most common source of program awareness?
    - What happens after a customer enrolls (i.e., confirmation email; reminder email; phone calls; day of assessment communications)
    - How far out are assessments scheduled?
    - What kind of cancellation rate have you seen?

19. Next, can you briefly walk me through a typical home assessment? Probe/listen for:
    - What does the typical assessment look like?
    - Do you use one assessor or two?

- How long do assessments typically last? How often do they exceed that?
- In your opinion, do assessors have enough time in each participant's home?
- How many assessments does each assessor typically complete in a day?
- How is the assessment report provided? Is it produced right away and reviewed with the customer, or is it sent as a follow up?

20. I have a few questions about the measures installed on-site or left with customers. I understand that the directly installed items include ENERGY STAR®-certified LED bulbs, faucet aerators, low-flow showerheads, smart strips, and programmable thermostat.
    Probe/listen for:
    - Are there any other direct install measures?
    - Are there program limits on number of direct install measures that a customer can receive?
    - Does the program replace CFLs with LEDs?
    - What measures, if any, are left behind for the customer to install?
    - Are any of the direct install measures particularly popular or unpopular? Why do you think that is?
    - Are there specific challenges related to any of the measures?

21. Next, let's talk about deeper retrofit measures, like insulation and air and duct sealing, replacing old appliances, and upgrading heating, cooling and water heating systems.
    Probe/listen for:
    - What percent of participants typically receive recommendations for these measures?
    - What are the most common retrofit measures recommended? Why is that?
    - About what percent act on the recommendation?
    - Why do you think that is?
    - Can you describe how coordination works with WAP, LIHEAP, and any other state or federal programs and funding?
    - Which programs do you coordinate with?
    - How does this process look – for you and for the customer?

22. My next question is about health and safety issues, as well as pre-weatherization barriers. Are there any recurring health or safety barriers that prevent customers from taking action?
    Probe/listen for:
    - What do you consider to be a health and safety issue? (indoor air quality, pests, asbestos, radon, etc.)
    - What specific tests are completed to identify these health and safety issues in the home? Can you describe the process for this? (how do customers pass or fail the indoor air quality test? Is this different from the combustion safety test?)
    - Do all customers receive a health and safety screening? (do all customers receive an initial assessment and then the health and safety screening if there appears to be an opportunity for weatherization; do these occur simultaneously?)
    - How frequently do health and safety issues arise?
    - When these issues are identified, how are they addressed?

- From the materials we have, it looks like health and safety barriers are tracked (i.e., knob and tube wiring, asbestos, unvented gas heater, etc.). Can you describe how the process for tracking these issues in the home?

23. Beyond these barriers, what do you think is preventing more participants from installing these deeper retrofit measures?
    - What is the program's process for follow-up with participants that do not take action right after their assessment?
    - **[Multifamily Only]** How does this process work for multifamily buildings? How are your interactions different between tenants (in-unit opportunities) and building owners/managers (common area opportunities)?

24. I was hoping you could talk about the HEAT loans' impact on participation. Probe/listen for:
    - About percent of participants get a HEAT loan?
    - Do you think the HEAT loan is driving greater/deeper participation?
    - Do participating lenders market the program (i.e., encourage their customers to get an assessment)?

25. I understand that customers may have the option to select a participating contractor or be assigned one by the program. Can you tell me a little bit about the participating contractors, what type of expertise do they have?
    - What portion of customers are assigned a contractor by the program (versus selecting their own)?
    - What's the process for a contractor to become eligible?

Marketing

26. Please describe the marketing and outreach activities deployed for this program. Probe/listen for:
    - What aspects is National Grid responsible for?
    - What marketing activities is RISE responsible for?
    - What are the most common marketing activities?
    - Are there different efforts to reach different audiences?
    - If so, how does that work? Do you have different campaigns or strategies marketing to, for example, landlords versus tenants?

27. How effective do you think current marketing is? Probe/listen for:
    - Why do you say that?
    - [If necessary] How do you assess marketing effectiveness?
    - Which strategies have been most effective? Least effective?
    - Who is not being reached? What strategies have you used to try to reach these folks?
    - Do you market in multiple languages?

QA/QC, Program Data and Tracking

28. Can you describe the program's QA/QC procedures? Probe/listen for:
    - What does RISE do? (How many, training, certifications?)
    - What does CMC (the third-party QA/QC vendor) do? (How many, training, certifications?)
    - What portion of projects receive a QA/QC inspection (by each and overall)?
    - How do you track and report QA/QC related results and data?
    - How do you handle QA/QC issues when they arise? (Probe to understand if issues arise repeatedly).
    - How does the QA/QC process factor into contractor assignments?

29. From your perspective, how well is the current QA/QC processes—and related data capture and reporting—working? Probe/listen for:
    - What is working particularly well?
    - What could be improved?
    - What persistent issues, if any, have arisen from your QA/QC work?
    - How are these resolved?

Wrap-up

30. Given your experience, what do you think prevents eligible customers from participating in the program?

31. What information are you most hoping to get out of this process and impact evaluation?

32. In the past, have you received evaluation results? How have you used those results (i.e., in program planning)?

Thank you very much for taking the time to talk with us today. Your contribution is a very important part of the process. Do you mind if we follow-up with you if any additional questions arise?

Appendix F: Stakeholder Interview Guide

National Grid Rhode Island
Residential Retrofit—Process Evaluation
Program Stakeholder Interview Guide

Context

This interview guide is designed to facilitate telephone interviews with four key populations of program stakeholders critical to the effective delivery of the EnergyWise Single Family, EnergyWise Multifamily, and Income-Eligible Multifamily retrofit programs:

- **In-home Assessors**. RISE employees responsible for conducting thorough assessments of participant homes, installing no-cost measures, completing combustion safety tests, and preparing assessment reports.
- **Installation Contractors**. Independent construction professionals responsible for completing weatherization upgrades and other improvements as identified by the assessment reports.
- **Internal QA/QC Inspectors**. RISE employees who accompany installation contractors, providing oversight and real-time quality assurance.
- **Third-party QA/QC Auditors**. CMC auditors responsible for assessing project quality post-installation.

This interview guide assumes the data collected will be qualitative and that interviewers will probe fully to understand responses to questions. The guide includes a few initial questions that will be asked of everyone as well as modules for each group that focus more on their specific role delivery National Grid's retrofit programs. [Note that the research team will create a table mapping interview questions to key research topics when we finalize the question numbering and prepare a final draft.]

Introduction

National Grid contracted with my company [Cadeo/Illume] to evaluate its residential retrofit programs. We are primarily focused on how the programs operated in 2019.

Thank you for taking the time to talk with us today. Our work depends on the input and insights from those engaged to deliver this program to Rhode Island residents. There are no right or wrong answers, this conversation is designed to help us gain a better understanding of the program. Also, everything you share is confidential. We will report the findings of our interviews in aggregate and anonymously.

We have two goals for this interview:

- To better understand how the program is delivered
- To gather information about your experience with the program, including successes and challenges you have had

We expect this interview to take 30-45 minutes. We'd like to record this interview to refer to our notes later. Is that okay with you? Do you have any questions for us before we begin?

Your Role [Ask All]

Let's begin by talking about your roles and responsibilities.

A1. Our work includes the single family and multifamily EnergyWise programs, as well as the Income Eligible Multifamily program. Which of these programs do you work on?

INTERVIEWER NOTE: If the interviewee works across multiple programs, ask them to primarily focus on the program that they work on the most. However, also encourage them to mention when their response would be meaningfully different for another program. To encourage this, periodically prompt them to note key differences across programs by asking, for example, "Is this any different for IEMF?"

A2. And, can you briefly describe your primary responsibilities for **[EWSF, EWMF, INCOME-ELIGIBLE MF]**?

On-Site Assessors

Let's start at the beginning of the process.

B1. How are assessments assigned and communicated to you?
B2. How far out are assessments typically scheduled?
B3. When do you first communicate directly with a customer?
B4. What kind of cancellation rate have you experienced? Any common reasons?
B5. Please briefly walk me through a typical assessment, what does it look like? [**FOR MULTIFAMILY**, probe to understand how the process works for both the common area and in-unit assessments.]
B6. [**FOR MULTIFAMILY**] What is the process, including timeline, for planning and scheduling out assessments and direct installations? (If not covered, probe to understand how units are sampled for assessment, and tenant notification and interactions.)
B7. About how many assessments do you complete in a typical week? And about how much time does each assessment take? [**FOR MULTIFAMILY**, if not covered, differentiate between building level assessments vs. unit level]
B8. When and how is the assessment report provided? (Probe for: Is it produced right away and reviewed with the customer, or is it sent as a follow up?) [**FOR MULTIFAMILY,** differentiate between building level report vs. unit level.]
B9. What takes the most time during an assessment?
B10. Are there aspects of the assessment where you wish you could spend more time?

We know that COVID-19 has greatly affected the program, and that many elements are in flux. We are interested in hearing about COVID-19 related changes a little later in our discussion. For now, let's start by discussing how the program was designed to run - and how you delivered it in 2019 and the first few months of 2020.

To start, I have a few questions about the measures that RISE directly installs during the assessment.

B11. What kind of screening is required to install a programmable or Wi-Fi thermostat, showerhead or faucet aerator?
B12. In what situations would measure(s) be left behind for a customer to install or use later?
B13. Thinking about these Instant Savings Measures—which are most popular? Which are more challenging to get installed? Are any of the direct install measures particularly popular? Why is that?
B14. How important are free LEDs in encouraging customers to sign up for an assessment? What do you think happens if lighting is eventually removed or plays a lesser role in the program?

What about retrofit measures…

B15. How do you determine if additional insulation is needed? What about whether air or duct sealing is necessary, or determining if an appliance or heating/cooling system is inefficient? What is the assessment process and threshold for recommending upgrades?

B16. In about what portion of assessments do you find opportunities to add insulation? Is there a specific type/location that is most common? What about air and duct sealing? Appliance replacement? Heating or cooling system replacement? [**FOR MULTIFAMILY:** Does this differ by program?]

B17. What are the challenges to convincing participants to install the measures you recommend? What approaches do you use to convince them?

B18. **[FOR MULTIFAMILY]** What additional complexities do you face with condominiums? Can you talk about how your process differs when interacting with condo association representative and/or boards/homeowner associations?

B19. In your opinion, what is the most important component of the program in encouraging customers to move forward (information from the assessment, cost sharing, financing, contractor scope and recommendations)?

B20. How would you describe interest in the HEAT Loan?

- What information do you typically provide?
- What questions do they tend to have?

B21. **[FOR MULTIFAMILY]** Can you also talk about your process for identifying and recommending custom measures?

B22. Do you typically prepare an assessment report on site or send it afterwards?

B23. We know that the recommendations are documented in the assessment provided to customers, how do you track or follow up on them?

B24. In about what portion of your assessments do you feel customers are already aware of and planning to install recommended measures?

B25. Which measures are most commonly mentioned by customers as already planned for?

B26. What recommendations would you say tend to be new information for participants—something they did not know about or consider prior to the assessment?

B27. Why do you think participants decide not to follow through on recommendations for these measures?

B28. Do you have ideas for ways to get more participants to act on these recommendations?

We have a few questions about health, safety, and pre-weatherization barriers.

B29. In what scenarios would an assessment exclude combustion safety or other health and safety screening? (For example, would screenings be done in a home without weatherization opportunity?)

B30. How frequently do health and safety issues arise? Which are the most prevalent? And how frequently do they keep you from completing the work [deferring work]? **[If work in both EWMF and IEMF]** Please describe the differences you see between income eligible and non-income-eligible buildings.

B31. When these issues are identified, how are they documented and communicated to customers?

B32. How do customers typically react? Do they understand the issues? What questions do they typically ask?

B33. What is the program's process for following-up with participants that do not take action – either to resolve a pre-weatherization barrier or simply to act on a recommended upgrade?

B34. How well do you think that process works? Do you see any opportunities for improvement?

I understand that the program made some changes recently.

B35. **[EWSF ONLY]** Did you provide home energy scores to any residents in 2019? If yes:

- How did that work?
- What type of response did you receive from the home energy score?
- Do you think something encouraged customers to move forward?

B36. Did any of your assessments include access to the 100% landlord incentives? If yes:

- How did that work?
- What type of response did you receive to this opportunity?
- Do you think the higher landlord incentive encouraged customers to move forward?

Two overarching questions before we talk about recent COVID-related changes.

B37. Again, prior to COVID-19, what do you think is working best about the assessment process overall?

B38. And, are there any changes you'd like to see in any part of the assessment process once the program is back in the field?

Let's wrap up with a few questions about adjustments to the program as a result of COVID-19.

B39. How has COVID-19 affected your work with the program?

B40. Have you completed any remote or virtual audits? If yes:

- What works well about these virtual audits? What components do not work as well?
- Have you received any feedback from customers about the experience?
- Do you see a place for virtual assessments, long-term, as one pathway to deliver the program?

Thank you so much for your time today, those are all my questions.

Installation Contractors

C1. How long have you been involved with National Grid's energy efficiency programs in Rhode Island?
C2. How did you learn about the program(s)?
C3. What was your experience becoming an approved contractor for the program?
C4. What percent of your total business do program jobs represent?
C5. What portion of program-associated projects are assigned to you versus those where the customer selected you as their contractor? [**FOR MULTIFAMILY**, How typical is it to competitively bid on multifamily projects?]

We know that COVID-19 has greatly affected the program and likely your business, and that many elements are in flux. We are interested in hearing about COVID-19 related changes a little later in our discussion. For now, let's start by discussing program jobs you worked on in 2019 and the first few months of 2020.

C6. Can you walk me through a typical job?
C7. What types of unexpected issues do you run in to?
C8. What is the simplest type of project? The most complicated?
C9. **[IF WX CONTRACTOR]** How/when do you test air leakage? How do you handle jobs near minimum ventilation guidelines? Do you do both air and duct sealing?
C10. Are you also engaged in projects where you are mitigating health and safety barriers?
C11. What types of health and safety barriers do you most frequently work on (for example, knob & tube wiring, mold and mildew, mechanical ventilation, or adjustments to combustion equipment)?
C12. How could the program better address H&S barriers??
C13. What is it like to work with a RISE inspector present for program-associated projects? Tell me about how you coordinate your work on projects.
C14. Have you had any interaction with the program's independent QC contractors? (In what scenarios?)
C15. Has your involvement with the program changed how you sell or install weatherization for customers outside the program? If so, what has changed and why?

Two, final overarching process questions before we talk about recent COVID-related changes.

C16. What is working best about the program from your perspective?
C17. What would you like to see changed?

Let's wrap up with a few questions about adjustments to the program as a result of COVID-19.

C18. How specifically has COVID-19 affected your work with the program?

C19. Are there any long-term implications on your involvement in the program because of COVID-19?

Thank you so much for your time today, those are all my questions.

Before we go – let's work out the best way to get you your $50 incentive.

RISE Inspectors

D1. Please describe your role at the customer's project site, what are you typically responsible for?
D2. About how many projects do you attend in a typical week?
D3. Do you visit every job? If not, how do you determine which project sites to inspect?
D4. What is the process for adding - or removing - contractors for the qualified contractor list?

We know that COVID-19 has greatly affected the program and likely your business, and that many elements are in flux. We are interested in hearing about COVID-19 related changes a little later in our discussion. For now, let's start by discussing program jobs you worked on in 2019 and the first few months of 2020.

D5. How do you interact with contractors at the project site?
D6. How do you communicate any issues identified during the process, and with whom?
D7. Are there particular issues that consistently arise?
D8. How do you, or the program more generally, remediate these persistent issues?
D9. Do you systematically track issues, and if so how?
D10. From your perspective, how well is the inspection processes working?
D11. What could be improved?

Let's wrap up with a few questions about adjustments to the program as a result of COVID-19.

D12. How has COVID-19 affected your work with the program?
D13. Are there any long-term implications of COVID-19 on how you think the program should be delivered?

Thank you so much for your time today, those are all my questions. Your contribution is a very important part of the process.

Would it be okay to follow up again if any additional questions arise?

CMC QA/QC Auditors

We know that COVID-19 has greatly affected the program and likely your business, and that many elements are in flux. We are interested in hearing about COVID-19 related changes a little later in our discussion. For now, let's start by discussing program jobs you worked on in 2019 and the first few months of 2020.

E1. At what stage(s) is a project eligible to be selected for QA/QC? (Does it vary?)
E2. How are projects selected for QA/QC?
E3. Are there particular types of projects or contractors that are prioritized for QA/QC? If so, why?
E4. How long does an inspection usually take?
E5. How many QA/QC visits do you complete in a typical week?

E6. Please walk me through your process, what are the typical components of a QA/QC inspection?
E7. What type of information do you collect on-site through inspection?
E8. Does this include post-participation air infiltration rates? If not, do any of the other program stakeholders (RISE or the contractor) "test out" after weatherizing?
E9. Can you tell me about your interactions with the customers? Do you schedule directly with them?
E10. What type of information do you collect from the customer?

E11. How do you typically interact with RISE assessors and/or program staff?
E12. What about installation contractors, in what scenarios would you interact with them?
E13. Are there any recurring issues that you identify during your inspections? If so, what are they and why do you think that is?
E14. What happens when QA/QC issues arise? How are they resolved?
E15. How do you think National Grid and those that deliver the program (RISE and contractors) can better mitigate the more prevalent QA/QC issues (either through design, delivery, or support).
E16. How do you track and report your QA/QC results?
E17. From your perspective, how well is the current QA/QC processes—and related data capture and reporting—working?
E18. What is working particularly well?
E19. What could be improved?

Let's wrap up with a few questions about adjustments to the program as a result of COVID-19.

E20. How has COVID-19 affected your work with the program?

E21. Are there any long-term implications of COVID-19 on how you think the program should be delivered?

Thank you so much for your time today, those are all my questions. Your contribution is a very important part of the process. Would it be okay to follow up again if any additional questions arise?

Appendix G: Participating Building Contact Survey

National Grid Rhode Island: Residential Retrofit

EnergyWise and Income-Eligible Multifamily - Property Manager & Owner Survey

E-mail

SENDER: National Grid Research

EMAIL SUBJECT: Share your experience with National Grid – Get $50!

Hello <**Customer Name**>,

Our records indicate that your multifamily property received an Energy Assessment in 2018 or 2019 as part of National Grid's Multifamily program.

We are interested in hearing about your experience with the energy assessment, any no-cost energy efficiency services you received, as well as any other upgrades that may have been completed on your property.

Please take a short 15-minute survey using the link provided below. Please respond by {Date].

We understand that this is a difficult and strenuous time. Your input is valuable to us. As a thank you for completing the survey, you'll be able to choose a $50 Amazon e-gift card or a $50 Visa gift card. Gift cards are limited and offered only while supplies last.

<Survey Link>

Si prefiere tomar esta encuesta en español, por favor llamenos al numero: (202) 506-4487.

National Grid is here for you in during the COVID-19 outbreak. Learn more about how we are supporting the health and safety of customers and employees here.

Thank you for helping us improve our program especially during this unprecedented time!

Sincerely,
Multifamily Services Team
National Grid

EMAIL FOOTER

If you would like to verify the legitimacy of this research, please contact Romilee Emerick at National Grid by calling (781) 907-3709.

If you prefer not to receive National Grid survey invitations by email, you can unsubscribe here: <insert link>.

Cadeo, an independent research firm, is conducting this research on behalf of National Grid and using Qualtrics to gather feedback from program participants. This message was sent by Cadeo, 1660 L St NW, Suite 216, Washington, DC 20036.

Introduction

Thank you for completing this survey on behalf of National Grid. Your responses will help improve energy efficiency programs for residential customers like you.

Our questions are primarily about your experience with the National Grid [ENERGY WISE OR INCOME-ELIGIBLE] Multifamily program, which provides energy assessments, directly installs LED lights, power strips, showerheads, and other low-cost energy saving equipment into building units, and identifies opportunities for additional energy saving recommendations.

To thank you for your time, we will e-mail you a $50 Amazon e-gift card or mail a $50 Visa gift card within one week of completing the survey. You can choose which option you prefer at the end of the survey.

As we navigate through the challenges of the COVID-19 pandemic, we'd also like to take this opportunity to thank you for being a valued customer.

Let's get started…

Awareness and Participation

1. How would you best describe yourself? Are you a…
    1. Property owner
    2. Property manager
    3. Facilities/maintenance manager
    4. Condo Association Representative
    97. Other **(Fillable field)**

2. According to our records, your multifamily property located at **[ADDRESS]** participated in National Grid Rhode Island's [ENERGY WISE MULTIFAMILY OR INCOME-ELIGIBLE MULTIFAMILY] program in **[MONTH/YEAR].** Please focus your responses for this survey on this property. Do you recall receiving an energy assessment for your multifamily property?
    1. Yes
    2. No **[Thank and terminate]**
    98. Don't know **[Thank and terminate]**

3. Were you responsible for deciding which item(s) were installed in individual units of your multifamily property?

1. Yes
2. No
98. Don't know

4. **[IF Q3=2 or 98]** Can you refer us to someone else we can speak to about decisions related to which items were installed in individual units? Please provide a name and contact information if possible. **[Fillable Field]**

5. Below is a list of reasons you may have had for participating in the Multifamily program. For each reason, please indicate if it was very important, somewhat important, or not at all important in your decision to get an assessment... **[RANDOMIZE OPTIONS.]**

Item	**Very Important [3]**	**Somewhat important [2]**	**Not at all important [1]**	**Not Applicable [99]**
1. To learn more about how my building uses energy				
2. To learn how to reduce energy costs in my building/save energy				
3. To get free energy saving items, such as LEDs, for my residents				
4. To access incentives for energy improvements for my building				
5. To improve resident comfort				
6. To improve the air quality in my building				
7. Because my condo/co-op association requested it				
8. Because my tenants/residents requested it				
97. Another reason? **[Fillable field]**				

6. Did you inform your residents about the program?
    1. Yes
    2. No

98. Don't know

[IF Q6=1]

7. How did you inform your residents about the program? **[SELECT ALL THAT APPLY]**
    1. Email
    2. Phone call
    3. Flyer or door hanger
    4. During a meeting with residents
    98. Other **[Fillable field]**

8. Approximately what percent of your residents allowed access into their units for the installation of energy-saving items?
    1. 0%-25%
    2. 26%-50%
    3. 51%-75%
    4. 76%-99%
    5. All of them **[skip to Q11]**
    98. Not sure

9. For your residents who did not get energy-saving items installed in their units, please select the main reason why:
    1. Scheduling challenges with residents
    2. Privacy concerns
    3. Security concerns
    98. Other **[Fillable field]**

10. In your opinion, what could the program could do to increase the percentage of residents who allow access into their units for the installation of energy-saving items? **[Fillable field]**

11. Did you receive any feedback from your residents about participating in the program?
    1. Yes
    2. No

12. **[If Q11=1]** What was the feedback? **[Fillable field]**

13. Were you present during the energy assessment?
    1. Yes **[SKIP TO Q15]**
    2. No **[PROCEED TO Q14]**
    98. Don't know **[SKIP TO Q18]**

[ASK If Q13=2]

14. Who was present during the assessment? **[Add conditional programming to display only the options that are not selected in Q1]** Select all that apply.
    1. Property Manager
    2. Property owner
    3. Facilities/maintenance manager
    4. Condo Association Representative
    97. Other **[Fillable field]**

[ASK If Q13=1]

15. How long did the energy assessment of your property take?
    1. 2-3 hours
    2. 4-5 hours
    3. More than 5 hours
    98. Don't know

[ASK If Q13=1]

16. We want to understand your experience getting the energy assessment for your building. Please rate your agreement or disagreement with the following statements.

	Strongly Agree [5]	**Somewhat Agree [4]**	**Neither Agree nor Disagree [3]**	**Somewhat Disagree [2]**	**Strongly Disagree [1]**	**Not Applicable [99]**
The scheduling process was straightforward.						
The time it took to complete my building's energy assessment was reasonable.						
The Energy Specialist who conducted the assessment was pleasant to work with.						
The Energy Specialist was able to answer my questions.						

17. **[IF ANY RESPONSES TO Q16 = Somewhat disagree or Strongly Disagree]** Please tell us more about why you disagree. **[Fillable Field]**

18. Did you receive customized recommendations for your facility on how to save energy?
    1. Yes
    2. No **[Skip to Q21]**
    98. Don't know **[Skip to Q21]**

[If Q18=1]

19. Please indicate the extent to which you agree or disagree with the statements below:

	Strongly Agree [5]	Somewhat Agree [4]	Neither Agree nor Disagree [3]	Somewhat Disagree [2]	Strongly Disagree [1]	Not Applicable [99]
The recommendations provided clear information on my property's performance						
The recommendations helped me make decisions about how to improve the efficiency of my property						

20. **[IF ANY RESPONSES to Q19= Somewhat disagree or Strongly Disagree]** Please tell us more about why you disagree. **[Fillable Field]**

21. **[ASK ALL]** As part of the assessment of your building, did you receive information about National Grid energy efficiency programs and available incentives and rebates?
    1. Yes
    2. No **[Skip to Q25]**
    98. Don't know **[Skip to Q25]**

[If Q21=1]

22. Please indicate the extent to which you agree or disagree with the statements below:

	Strongly Agree [5]	Somewhat Agree [4]	Neither Agree nor Disagree [3]	Somewhat Disagree [2]	Strongly Disagree [1]	Not Applicable [99]

The information clearly described the rebates and incentives						
I learned about additional National Grid program opportunities from the Energy Specialist						

23. Were there any additional energy saving upgrades that you hoped would be part of the recommendations you received?
    1. Yes
    2. No
    98. Don't know

24. **[ASK IF Q23=1]** What were the additional energy saving upgrades you hoped would be part of the recommendations you received?

25. Did the assessment identify any health and safety issues or repairs that needed to be resolved before you could act on the program's recommended efficiency improvements?
    1. Yes
    2. No **[Skip to Q30]**
    98. Don't know **[Skip to Q30]**

[If Q25=1]

26. What health and safety or home repair requirements were identified? **[RANDOMIZE OPTIONS]**

	Yes [1]	**No [2]**	**Not Sure [98]**
Combustion safety, combustion gases, or gas leak			
Heating system, water heater, or oven carbon monoxide			
Knob and tube wiring			
Moisture, mold, or draft issues			
Mechanical ventilation			

Something else:			

27. **[ASK IF ANY Q25=1].** Did you address the issues identified?
    1. Yes, I addressed them all **[Skip to Q30]**
    2. I addressed some of them
    3. No, I didn't address any of them
    98. Not sure **[Skip to Q30]**

[IF Q27=2 or 3]

28. What prevented you from addressing **all** the health and safety or repair requirements? **[SELECT ALL THAT APPLY] [RANDOMIZE OPTIONS]**
    1. Upfront/out of pocket cost too large
    2. The energy savings were too small given the estimated project cost
    3. There were too many recommendations to consider
    4. Work was invasive or inconvenient
    5. Didn't have time
    6. Didn't need the work done
    7. Complications related to COVID19 outbreak
    97. Other **[Fillable field]**

29. **[If ANY Q26=1]** What, if anything, could the program have done to help you address these health and safety barriers? **[Fillable Field].**

30. According to our records, the assessors installed the following free or low-cost energy saving equipment in your residents' units as part of your energy assessment. Is that correct?

	Yes [1]	**No [2]**	**Not Sure [98]**
[IF Lighting=YES] LED bulbs or fixtures in tenant living spaces			
[IF Common Area Lighting=YES] LED bulbs or fixtures in common areas			
[IF Domestic Hot Water=YES] Faucet Aerators, Showerheads, or Pipe Wrap			
[IF Appliances & Plug Load=YES] Smart Power Strips			

[IF Controls=YES] Programmable or Smart (Wifi) thermostat			
Something else:			

31. Have you received any complaints from residents about the energy saving items?
    1. Yes
    2. No
    98. Not sure

[IF Q31=1]

32. What were the complaints you received? **[Fillable field]**

33. Please rate your agreement or disagreement with the following statement.

	Strongly Agree [5]	**Somewhat Agree [4]**	**Neither Agree nor Disagree [3]**	**Somewhat Disagree [2]**	**Strongly Disagree [1]**	**Not Applicable [99]**
Overall, I am satisfied with how the energy assessment went.						

34. **[IF ANY RESPONSE TO Q33 = Somewhat OR Strongly Disagree]** Please tell us more about why you were dissatisfied with the assessment. **[Fillable Field]**

35. National Grid is considering conducting energy assessments virtually. In virtual assessments, a live Energy Specialist would assess units at your property via video conferencing technology. Please rate your agreement or disagreement with the following statements.

	Strongly Agree [5]	**Somewhat Agree [4]**	**Neither Agree nor Disagree [3]**	**Somewhat Disagree [2]**	**Strongly Disagree [1]**	**Not Applicable [99]**
In my opinion, a virtual assessment is an attractive option.						
Virtual assessments seem safer right now than in-building assessments.						

36. **[IF ANY RESPONSES to Q35 = Somewhat disagree or Strongly Disagree]** Please tell us more about why you disagree. **[Fillable Field]**

F. Free Ridership

[NTG ASKED ONLY IF EWMF = YES AND RESPONDENT IS DECISION MAKER (Q3=1)]

[FR SET PROGRAMMED FOR UP TO TWO SAMPLED MEASURES]

[DIRECT INSTALL MEASURE COUNTERFACTUAL]

We have some questions about items installed at your building during the assessment.

F1. **[IF SAMPLED MEASURE=LED]** In the year prior to the assessment, had you installed any LED bulbs in any of your buildings?

1. Yes
2. No

F2. **[ALL SAMPLED MEASURES]** If you had **NOT** received the free **[measures]** as part of your assessment, what is the likelihood you would have purchased **[measures]** **within 6 months** of your assessment? Please use a scale of 0 to 10, where 0 is "not at all likely" and 10 is "extremely likely."

[Show 0-10 scale, with end-point labels]

[ASK IF SAMPLED MEASURE INSTALLED QUANTITY>1]

F3. If you had **NOT** received the item(s) during the assessment, what is the likelihood you would have installed **FEWER** **[measures]**? Please use a scale of 0 to 10, where 0 is "not at all likely" and 10 is "extremely likely."

[Show 0-10 scale, with end-point labels]

[ASK IF SAMPLED MEASURE=LED, F1=1 AND F2< 7)]

F4. Given that you had purchased LED bulbs before receiving the assessment, why is it **unlikely** that you would purchase additional **LED bulbs** on your own without the program? **[OPEN END]**

[ASK IF SAMPLED MEASURE=LED, F1=2 AND F2>6)]

F5. Given that you have not purchased LED bulbs before receiving the assessment, why is it **likely** that you would purchase **LED bulbs** on your own without the program? **[OPEN END]**

[IF BOTH SAMPLED MEASURES ARE DIRECT INSTALL]

F2b. **[ALL SAMPLED MEASURES]** If you had **NOT** received the free **[measures]** as part of the assessment, what is the likelihood you would have purchased **[measures]** **within 6 months** of your assessment?

[Show 0-10 scale, with end-point labels]

[ASK IF SAMPLED MEASURE INSTALLED QUANTITY>1]

F3b. If you had **NOT** received the item(s) during the assessment, what is the likelihood you would have installed **FEWER** **[measures]**?

[Show 0-10 scale, with end-point labels]

[If Weatherization=0]

F10a. In your own words, please explain how the program influenced you to install the energy efficient item(s) at the time you did. **[Fillable Field]**.

[WEATHERIZATION BARRIERS]

[IF WEATHERIZATION = 0]

37. Did your Energy Specialist recommend insulation or other weatherization work for your building?
    1. Yes
    2. No
    98. Don't Know

[If Q37=1]

38. Did you complete the recommended work on your building?
    1. Yes
    2. No
    98. Don't Know

39. **[If Q38=2]** What prevented you from making recommended changes]? **[Select all that apply, RANDOMIZE OPTIONS]**
    1. Upfront/out of pocket cost too large
    2. Cash flow criteria did not support recommended changes
    3. Return on investment was inadequate
    4. Building or condo association did not approve recommended changes
    5. The energy savings were too small given the estimated project cost
    6. There were too many recommendations to consider
    7. Work was invasive or inconvenient
    8. Didn't have time
    9. Didn't need the work done
    10. Complications related to COVID19 outbreak

97. Other **[Fillable Field]**
98. Not sure

[IF Q39 = 10]

40. Can you tell us more about how COVID19 prevented you from making energy efficiency changes to your building? **[Fillable Field]**.

41. **[If Q39 <97]**What could the program have done to help you overcome these barriers to making recommended changes? **[Fillable Field]**.

[MAJOR MEASURE FR SET ASKED IF EWSF=YES AND WEATHERIZATION=YES]

[MAJOR MEASURE/WX COUNTERFACTUAL]

Our records indicate that you installed **[SAMPLED MAJOR MEASURE]** in your building following building's energy assessment.

[IF MAJOR MEASURE = YES]

42. We want to understand your experience with the energy upgrades made to your building. Please rate your agreement or disagreement with the following statements.

	Strongly Agree [5]	Somewhat Agree [4]	Neither Agree nor Disagree [3]	Somewhat Disagree [2]	Strongly Disagree [1]	Not Applicable [99]
The time that passed between the assessment and when work on my building started was reasonable.						
The contractor/crew that worked on my property was professional.						
I am satisfied with the quality of work completed on my property.						
I noticed a decrease in my energy bill.						

43. **[IF ANY RESPONSES TO Q42= Strongly disagree OR Somewhat disagree]** Please tell us more about why you disagreed with the previous statement(s). **[Fillable Field]**

[ASK IF SAMPLED MEASURE=MAJOR MEASURE]

F6. Without the program, what is the likelihood you would have installed **[SAMPLED MAJOR MEASURE]** within **12 months** of your assessment? Please use a scale of 0 to 10, where 0 is "not at all likely" and 10 is "extremely likely."

[Show 0-10 scale, with end-point labels]

[Show 0-10 scale, with end-point labels]

F7. **[ASK IF MAJOR MEASURE = TRUE and QUANTITY>1]** Without the program, what is the likelihood you would have installed **LESS** insulation? Please use a scale of 0 to 10, where 0 is "not at all likely" and 10 is "extremely likely."

[Show 0-10 scale, with end-point labels]

PROGRAM INFLUENCE [ONLY MAJOR MEASURE]

F8. **[ASK IF MAJOR MEASURE=TRUE]** Please rate the importance of each factor that may have influenced your decision to install the **[MEASURE NAME].** Please use a scale of 0 to 10, where 0 is "not at all influential" and 10 is "extremely influential." [Programming note: Not sure = 98, Not applicable = 99.

1. The rebate or discount I received for **[MEASURE NAME]**
2. Recommendation from the Energy Specialist
3. Information provided during the assessment
4. Program materials or website
5. Project management and installation support
6. Recommendation from someone else
7. Experience with the same or similar equipment in other buildings that participated in the program

F9. **[ASK IF F8=6]** Did the person who gave you a recommendation participate in National Grid's EnergyWise program in the past?

1. Yes
2. No
98. Not sure

[IF WEATHERIZATION=1]

F10. In your own words, please explain how the program influenced you to install the energy efficient item(s) at the time you did. **[Fillable field]**

S. Spillover

[NTG ASKED ONLY IF EWMF = YES)]

S1. Since your participation in the EnergyWise Multifamily program, have you installed any ADDITIONAL energy efficient products in this or other buildings you own or manage in **Rhode Island**?

Note: This does not include actions that your tenants may have taken through the program.

1. Yes
2. No **[SKIP TO OVERALL SATISFACTION/DEMOGRAPHICS]**

98. [Not Sure]

S2. **[ASK IF S1=1]** What additional energy efficient products did you install?

*Note: If you're a property owner or manager, this does **not** include actions that your tenants may have taken through the program. Please answer only for properties in Rhode Island.*

1. LED Lighting
2. Clothes Washer
3. Electric Clothes Dryer
4. Gas Clothes Dryer
5. Low Flow Faucet Aerator
6. Low Flow Showerhead
7. Programmable Thermostat
8. Smart Thermostat
9. Smart Strip Plug Outlet
10. Refrigerator
11. Freezer
12. Dishwasher
13. Dehumidifier
14. Central A/C
15. Furnace
16. Boiler
17. Air Source Heat Pump
18. Ductless Heat Pump
19. Electric Water Heater
20. Gas Water Heater
21. Solar Water Heater
22. Heat Pump Water Heater
23. Insulation
24. Low-e Storm Windows

25. Doors
26. Energy Management or Control Systems
27. Chiller
28. Package Terminal Air Conditioner (PTAC)/Package Terminal Heat Pump (PTHP)
97. [Other][Specify]
98. [Not Sure]

S3. **[IF S2< 98]** You indicated that you installed the following energy efficient products after your EnergyWise assessment. Please indicate if you received a rebate from National Grid to help offset the cost.

	Received a rebate?		
	1. Yes	2. No	98.Not sure
[List each item selected in S2]			

[PROGRAMMING NOTE: For any measures where S3=1 (they received a rebate) remove from selected items in S2 **and do not display in subsequent questions]**

S4. **[IF ANY S3=2 ASK]** Why didn't you receive a rebate for the item(s) you installed?

1. Did not know rebate was available
2. Applied for rebate but item did not qualify
3. Did not think rebate amount was worth the effort
4. Did not apply because item did not qualify for a rebate
97. [Other][Specify]
98. [Not Sure]

S5. **[IF S2< 98]** How influential, if at all, was your experience with the EnergyWise Multifamily program in your decision to install these efficient product(s)?

[PROGRAMMING NOTE: Display 0 to 10 rating scale for each of the items selected in S2]

1. **[IF S2=1]** LED Lighting
2. **[IF S2=2]** Clothes Washer
3. **[IF S2=3]** Electric Clothes Dryer
4. **[IF S2=4]** Gas Clothes Dryer
5. **[IF S2=5]** Low Flow Faucet Aerator
6. **[IF S2=6]** Low Flow Showerhead
7. **[IF S2=7]** Programmable Thermostat

8. **[IF S2=8]** Smart Thermostat
9. **[IF S2=9]** Smart Strip Plug Outlet
10. **[IF S2=10]** Refrigerator
11. **[IF S2=11]** Freezer
12. **[IF S2=12]** Dishwasher
13. **[IF S2=13]** Dehumidifier
14. **[IF S2=14]** Central A/C
15. **[IF S2=15]** Furnace
16. **[IF S2=16]** Boiler
17. **[IF S2=17]** Air Source Heat Pump
18. **[IF S2=18]** Ductless Heat Pump
19. **[IF S2=19]** Electric Water Heater
20. **[IF S2=20]** Gas Water Heater
21. **[IF S2=21]** Solar Water Heater
22. **[IF S2=22]** Heat Pump Water Heater
23. **[IF S2=23]** Insulation
24. **[IF S2=24]** Low-e Storm Windows
25. **[IF S2=25]** Doors
26. **[IF S2=26]** Energy Management or Control Systems
27. **[IF S2=27]** Chiller

1[IF S2=28] Package Terminal Air Conditioner (PTAC)/Package Terminal Heat Pump (PTHP)

28. **[IF S2=97] Display B2"Other" response text**

9

S6. **[IF S2<98]** How likely is it that you still would have installed the efficient product(s) on your own if the EnergyWise Multifamily program did not exist? **[RECORD 0-10; 98=Don't Know for each]**

[PROGRAMMING NOTE: Display 0 to 10 rating scale for each of the items selected in S2]

1. **[IF S2=1]** LED Lighting
2. **[IF S2=2]** Clothes Washer
3. **[IF S2=3]** Electric Clothes Dryer
4. **[IF S2=4]** Gas Clothes Dryer
5. **[IF S2=5]** Low Flow Faucet Aerator
6. **[IF S2=6]** Low Flow Showerhead
7. **[IF S2=7]** Programmable Thermostat
8. **[IF S2=8]** Smart Thermostat
9. **[IF S2=9]** Smart Strip Plug Outlet
10. **[IF S2=10]** Refrigerator

11. **[IF S2=11]** Freezer
12. **[IF S2=12]** Dishwasher
13. **[IF S2=13]** Dehumidifier
14. **[IF S2=14]** Central A/C
15. **[IF S2=15]** Furnace
16. **[IF S2=16]** Boiler
17. **[IF S2=17]** Air Source Heat Pump
18. **[IF S2=18]** Ductless Heat Pump
19. **[IF S2=19]** Electric Water Heater
20. **[IF S2=20]** Gas Water Heater
21. **[IF S2=21]** Solar Water Heater
22. **[IF S2=22]** Heat Pump Water Heater
23. **[IF S2=23]** Insulation
24. **[IF S2=24]** Low-e Storm Windows
25. **[IF S2=25]** Doors
26. **[IF S2=26]** Energy Management or Control Systems
27. **[IF S2=27]** Chiller
28. **[IF S2=28]** Package Terminal Air Conditioner (PTAC)/Package Terminal Heat Pump (PTHP)
29. **[IF S2=97] Display B2"Other" response text**

S7. **[IF S2<98]** For each item installed, please specify how you knew that the product(s) you installed were energy efficient? Select all that apply. **[PROGRAMMING NOTE: Randomize list and allow respondents to select all that apply (1-98) for each of the measures displayed]**

1. Efficiency rating or label of equipment, such as an "ENERGY STAR®" logo
2. Equipment dealer/retailer said it was energy efficient
3. Prior corporate experience with product(s)
4. Met utility rebate requirements
5. Third party report, such as Consumer Reports
6. Recommendations from the contractor/installer
7. Did not rely on any specific type of information
8. Internet/website

97. [Other][Specify]
98. [Not Sure]

1. **[IF S2=1]** LED Lighting
2. **[IF S2=2]** Clothes Washer
3. **[IF S2=3]** Electric Clothes Dryer
4. **[IF S2=4]** Gas Clothes Dryer

5. **[IF S2=5]** Low Flow Faucet Aerator
6. **[IF S2=6]** Low Flow Showerhead
7. **[IF S2=7]** Programmable Thermostat
8. **[IF S2=8]** Smart Thermostat
9. **[IF S2=9]** Smart Strip Plug Outlet
10. **[IF S2=10]** Refrigerator
11. **[IF S2=11]** Freezer
12. **[IF S2=12]** Dishwasher
13. **[IF S2=13]** Dehumidifier
14. **[IF S2=14]** Central A/C
15. **[IF S2=15]** Furnace
16. **[IF S2=16]** Boiler
17. **[IF S2=17]** Air Source Heat Pump
18. **[IF S2=18]** Ductless Heat Pump
19. **[IF S2=19]** Electric Water Heater
20. **[IF S2=20]** Gas Water Heater
21. **[IF S2=21]** Solar Water Heater
22. **[IF S2=22]** Heat Pump Water Heater
23. **[IF S2=23]** Insulation
24. **[IF S2=24]** Low-e Storm Windows
25. **[IF S2=25]** Doors
26. **[IF S2=26]** Energy Management or Control Systems
27. **[IF S2=27]** Chiller
28. **[IF S2=28]** Package Terminal Air Conditioner (PTAC)/Package Terminal Heat Pump (PTHP)
29. **[IF S2=97]** Display B2"Other" response text

S8. Please describe any other details regarding the installation of these additional energy efficient items. How many did you install of each item? Where did you install them (e.g., common areas, in tenant's homes)? **[Fillable Field]**

OVERALL SATISFACTION

44. Thinking about your overall experience with this program, how would you rate your satisfaction? Would you say you are…
    1. Not at all satisfied
    2. Slightly satisfied
    3. Moderately satisfied
    4. Very satisfied
    5. Completely satisfied

45. **[If Q44=1 or 2]** Please tell us more about why you were not satisfied with your experience with this program, **[Fillable field/Open response].**

46. **[FOR INCOME-QUALIFIED ONLY]** How easy was income qualification process?
    1. Very easy
    2. Somewhat easy
    3. Neither easy nor difficult
    4. Somewhat difficult
    5. Very difficult
    98. Not sure

47. **[If Q46= 4 or 5]** What was difficult about the income qualification process?

    [Fillable field]

Demographics

Next, we'd like to ask you a few questions about your multifamily building.

48. Approximately what percent of your residents are owners?
    1. 0%-25%
    2. 26%-50%
    3. 51%-75%
    4. 76%-100%

49. Do you own/manage any other multifamily properties?
    1. Yes
    2. No

[If Q49=1]

50. How many other properties do you own/manage in RI? **[Fillable Field]**

[If Q49=1]

51. How many total units to you own/manage (across all your properties)? **[Fillable Field]**

[If Q49=1]

52. Did you participate in the Multifamily Program in other RI buildings?
    1. Yes
    2. No

Closing

We appreciate your feedback about your experience with the EnergyWise program. May we contact you via email or phone with any additional follow-up questions we may have?

1. Yes
2. No

Incentive Logistics

Thank you for your time and thoughts! Select the email address where you would like your Amazon gift card to be sent OR if you prefer a card to be mailed to you, please include your mailing address:

1. The email address used for this survey
2. A different email address: **[Fillable Field]**
3. I prefer a card to mailed by post to this address: **[Fillable Field]**
   NOTE: mailed cards are Visa gift cards (instead of Amazon)

Appendix H: Additional Building Contact Survey Results

Appendix H: Additional Building Contact Survey Results

Q1 - How would you best describe yourself? Are you a...

#	Answer	%	Count
1	Property owner	35%	8
2	Property manager	35%	8
3	Facilities/maintenance manager	9%	2
4	Condo Association Representative	9%	2
97	Other	13%	3
	Total	100%	23

Q2 - Do you recall receiving an energy assessment for this multifamily property?

#	Answer	%	Count
1	Yes	100%	23
2	No	0%	0
98	Don't Know	0%	0
	Total	100%	23

Q3 - Were you responsible for deciding which item(s) were installed in individual units of your multifamily property?

#	Answer	%	Count
1	Yes	78%	18
2	No	17%	4
98	Don’t know	4%	1
	Total	100%	23

Q5 - Below is a list of reasons you may have had for participating in the Multifamily program. For each reason, please indicate if it was very important, somewhat important, or not at all important in your decision to get an assessment...

#	Question	Not at all important		Somewhat important		Very Important		Not Applicable		Total
1	To learn more about how my building uses energy	5%	1	41%	9	55%	12	0%	0	22
2	To learn how to can reduce energy costs in my building/save energy	0%	0	9%	2	91%	20	0%	0	22
3	To get free energy saving items, such as LEDs, for my residents	0%	0	5%	1	95%	21	0%	0	22
4	To access incentives for energy improvements for my building	0%	0	17%	4	78%	18	4%	1	23
5	To improve resident comfort	13%	3	9%	2	78%	18	0%	0	23
6	To improve the air quality in my building	5%	1	27%	6	55%	12	14%	3	22
7	Because my condo/co-op association requested it	5%	1	14%	3	24%	5	57%	12	21
8	Because my tenants/residents requested it	18%	4	18%	4	23%	5	41%	9	22
9	Another reason?	0%	0	0%	0	38%	3	63%	5	8

Q6 - Did you inform your residents about the program?

#	Answer	%	Count
1	Yes	96%	22
2	No	0%	0
98	Don't know	4%	1
	Total	100%	23

Q7 - How did you inform your residents about the program? Select all that apply.

#	Answer	%	Count
1	Email	23%	7
2	Phone call	13%	4
3	Flyer or door hanger	42%	13
4	During a meeting with residents	19%	6
97	Other	3%	1
	Total	100%	31

Q8 - Approximately what percent of your residents allowed access into their units for the installation of energy-saving items?

#	Answer	%	Count
1	0%-25%	0%	0
2	26%-50%	9%	2
3	51%-75%	17%	4
4	76%-99%	13%	3
5	All of them	57%	13
98	Not sure	4%	1

	Total	100%	23

Q9 - For your residents who did not get energy-saving items installed in their units, please select the main reason why:

#	Answer	%	Count
1	Scheduling challenges with residents	30%	3
2	Privacy concerns	20%	2
3	Security concerns	0%	0
97	Other	50%	5
	Total	100%	10

Q11 - Did you receive any feedback from your residents about participating in the program?

#	Answer	%	Count
1	Yes	35%	8
2	No	65%	15
	Total	100%	23

Q13 - Were you present during the energy assessment?

#	Answer	%	Count
1	Yes	68%	15
2	No	32%	7

	Total	100%	22

Q14 - Who was present during the assessment? Select all that apply.

#	Answer	%	Count
1	Property Manager	13%	1
2	Property owner	13%	1
3	Facilities/maintenance manager	38%	3
4	Condo Association Representative	0%	0
97	Other	38%	3
	Total	100%	8

Q15 - How long did the energy assessment of your property take?

#	Answer	%	Count
1	2-3 hours	60%	9
2	4-5 hours	13%	2
3	More than 5 hours	7%	1
98	Don’t know	20%	3
	Total	100%	15

Q16 - We want to understand your experience getting a home energy assessment. Please rate your agreement or disagreement with the following statements.

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Not Applicable		Total
1	The scheduling process was straightforward	0%	0	7%	1	0%	0	33%	5	60%	9	0%	0	15
2	The time it took to complete my building's energy assessment was reasonable	7%	1	7%	1	0%	0	33%	5	53%	8	0%	0	15
3	The Energy Specialist who conducted the assessment was pleasant to interact with	0%	0	7%	1	7%	1	7%	1	80%	12	0%	0	15
4	The Energy Specialist was able to answer my questions	0%	0	7%	1	7%	1	13%	2	73%	11	0%	0	15

Q18 - Did you receive customized recommendations for your facility on how to save energy?

#	Answer	%	Count
1	Yes	95%	21
2	No	5%	1
	Total	100%	22

Q19 - Please indicate the extent to which you agree or disagree with the statements below:

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Total
1	The recommendations provided clear information on my property's performance	0%	0	0%	0	0%	0	33%	7	67%	14	21
2	The recommendations helped me make decisions about how to improve the efficiency of my property	0%	0	0%	0	0%	0	24%	5	76%	16	21

Q21 - As part of the assessment of your building, did you receive information about National Grid energy efficiency programs and available incentives and rebates?

#	Answer	%	Count
1	Yes	95%	20
2	No	5%	1
	Total	100%	21

Q22 - Please indicate the extent to which you agree or disagree with the statements below:

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Total
1	The information clearly described the rebates and incentives	0%	0	6%	1	0%	0	28%	5	67%	12	18
2	I learned about additional National Grid program opportunities from the Energy Specialist	0%	0	0%	0	6%	1	29%	5	65%	11	17

Q23 - Were there any additional energy saving upgrades that you hoped would be part of the recommendations you received?

#	Answer	%	Count
1	Yes	33%	5
2	No	67%	10
	Total	100%	15

Q25 - Did the assessment identify any health and safety issues or repairs that needed to be resolved before you could act on the program's recommended efficiency improvements?

#	Answer	%	Count
1	Yes	24%	5
2	No	76%	16
	Total	100%	21

Q26 - What health and safety or repair requirements were identified?

#	Question	Yes		No		Not sure		Total
1	Combustion safety, combustion gases, or gas leak	25%	1	75%	3	0%	0	4
2	Heating system, water heater, or oven carbon monoxide	50%	2	50%	2	0%	0	4
3	Knob and tube wiring	50%	2	0%	0	50%	2	4
4	Moisture, mold, or draft issue	50%	2	50%	2	0%	0	4
5	Mechanical ventilation	25%	1	50%	2	25%	1	4
6	Something else?	0%	0	0%	0	0%	0	0

Q27 - Did you address the issues identified?

#	Answer	%	Count
1	Yes, I addressed them all	75%	3
2	I addressed some of them	25%	1
3	No, I didn’t address any of them	0%	0
98	Not sure	0%	0
	Total	100%	4

Q28 - What prevented you completing all the health and safety or repair requirements? Select all that apply.

#	Answer	%	Count
1	Upfront/out of pocket cost too large	0%	0
2	The energy savings were too small given the estimated project cost	100%	1
3	There were too many recommendations to consider	0%	0

4	Work was invasive or inconvenient	0%	0
5	Didn’t have time	0%	0
6	Didn’t need the work done	0%	0
7	Complications related to COVID19 outbreak	0%	0
97	Other	0%	0
	Total	100%	1

Q30 - According to our records, the assessors installed the following free or low-cost energy saving equipment in your residents' units as part of your home energy assessment. Is that correct?

#	Question	Yes		No		Total
1	LED bulbs or fixtures in tenant living spaces	100%	16	0%	0	16
2	LED bulbs or fixtures in common areas	100%	8	0%	0	8
3	Faucet Aerators, Showerheads, or Pipe Wrap	88%	15	12%	2	17
4	Smart Power Strip	92%	12	8%	1	13
5	Programmable or Smart (Wifi) thermostat	90%	9	10%	1	10
6	Something else:	83%	5	17%	1	6

Q31 - Have you received any complaints from residents about the energy saving items?

#	Answer	%	Count
1	Yes	23%	5
2	No	77%	17
	Total	100%	22

Q33 - Please rate your agreement or disagreement with the following statement.

#	Answer	%	Count
1	Strongly disagree	9%	2
2	Somewhat disagree	4%	1
3	Neither agree nor disagree	0%	0
4	Somewhat agree	9%	2
5	Strongly agree	78%	18
99	Not Applicable	0%	0
	Total	100%	23

Q35 - National Grid is considering conducting energy assessments virtually. In virtual assessments, a live Energy Specialist would assess units at your property via video conferencing technology. Please rate your agreement or disagreement with the following statements.

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Total
1	In my opinion, a virtual assessment is an attractive option.	18%	4	5%	1	27%	6	18%	4	32%	7	22
2	Virtual assessments seem safer right now than in-building assessments.	5%	1	0%	0	23%	5	18%	4	55%	12	22

Q37 - Did your Energy Specialist recommend insulation or other weatherization work for your building?

#	Answer	%	Count
1	Yes	30%	3
2	No	50%	5
98	Don’t Know	20%	2
	Total	100%	10

Q38 - Did you complete the recommended work on your home?

#	Answer	%	Count
1	Yes	100%	2
2	No	0%	0
98	Don’t Know	0%	0
	Total	100%	2

Q39 - What prevented you from making the energy efficiency changes recommended after your assessment? Select all that apply.

#	Answer	%	Count
1	Upfront/out of pocket cost too large	0%	0
2	The energy savings were too small given the estimated project cost	0%	0
3	There were too many recommendations to consider	0%	0
4	Work was invasive or inconvenient	0%	0
5	I wasn’t sure how to move forward	0%	0
6	Didn’t have time	0%	0
7	Didn’t need the work done	0%	0
8	Complications related to COVID19 outbreak	0%	0

97	Other	0%	0
98	Not sure	0%	0
	Total	100%	0

Q42 - We want to understand your experience with the energy upgrades made to your building. Please rate your agreement or disagreement with the following statements.

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Not Applicable		Total
1	The time that passed between my assessment and when work on my building started was reasonable.	0%	0	0%	0	0%	0	25%	3	67%	8	8%	1	12
2	The contractor/crew that insulated my property was professional.	0%	0	8%	1	0%	0	0%	0	83%	10	8%	1	12
3	I am satisfied with the quality of work completed on my property.	8%	1	0%	0	0%	0	0%	0	83%	10	8%	1	12
4	I noticed a decrease in my energy bill.	8%	1	0%	0	17%	2	17%	2	42%	5	17%	2	12

Q44 - Thinking about your overall experience with this program, how would you rate your satisfaction? Would you say you are...

#	Answer	%	Count
1	Not at all satisfied	4%	1
2	Slightly satisfied	4%	1
3	Moderately satisfied	9%	2
4	Very satisfied	61%	14
5	Completely satisfied	22%	5
	Total	100%	23

Q46 - How easy was income qualification process?

#	Answer	%	Count
1	Very easy	50%	2
2	Somewhat easy	25%	1
3	Neither easy nor difficult	0%	0
4	Somewhat difficult	0%	0
5	Very difficult	0%	0
98	Not sure	25%	1
	Total	100%	4

Q48 - Approximately what percent of your residents are owners?

#	Answer	%	Count
1	0%-25%	61%	14
2	26%-50%	4%	1
3	51%-75%	0%	0
4	76%-100%	35%	8

	Total	100%	23

Q49 - Do you own/manage any other multifamily properties?

#	Answer	%	Count
1	Yes	61%	14
2	No	39%	9
	Total	100%	23

Q50 - How many different properties do you own/manage in Rhode Island?

#	Answer	%	Count
0	0	7%	1
1	1	7%	1
3	3	29%	4
4	4	21%	3
6	6	7%	1
7	7	7%	1
10	10	7%	1
30	30	7%	1
33	33	7%	1
	Total	100%	14

Q51 - How many total units to you own/manage (across all your properties)?

#	Answer	%	Count
2	2	7%	1
3	3	7%	1
20	20	7%	1
25	25	7%	1
125	125	7%	1
240	240	7%	1
375	375	7%	1
400	400	7%	1
500	500	7%	1
1100	1100	7%	1
1250	1250	7%	1
1500	1500	7%	1
2601	2601	7%	1
14000	14000	7%	1
	Total	100%	14

Q52 - Did you participate in the Multifamily Program in other Rhode Island buildings?

#	Answer	%	Count
1	Yes	71%	10
2	No	29%	4
	Total	100%	14

Appendix I: Participating Tenant Survey

National Grid Rhode Island: Residential Retrofit

EnergyWise and Income-Eligible Multifamily- Resident Survey

E-mail

SENDER: National Grid Research

EMAIL SUBJECT: Share your experience with National Grid – Get $10!

Hello <**Customer Name**>,

Our records indicate that you participated in National Grid's Multifamily program in 2018 or 2019.

We are interested in hearing about your experience with the program, including any no-cost energy efficiency services you received, **[FOR MARKET-RATE: include the following**: as well as any weatherization work that may have been completed on your home.]

Please take a short 15-minute survey using the link provided below. Please respond by [Date].

We understand that this is a difficult and strenuous time. Your input is valuable to us. As a thank you for completing the survey, you'll be able to choose a $10 Amazon e-gift card or a $10 Visa gift card. Gift cards are limited and offered only while supplies last.

<Survey Link>

Si prefiere tomar esta encuesta en español, por favor llamenos al numero: (202) 506-4487.

National Grid is here for you in during the COVID-19 outbreak. Learn more about how we are supporting the health and safety of customers and employees here.

Thank you for helping us improve our program especially during this unprecedented time!

Sincerely,
Multifamily Services Team
National Grid

EMAIL FOOTER

If you would like to verify the legitimacy of this research, please contact Romilee Emerick at National Grid by calling (781) 907-3709.

If you prefer not to receive National Grid survey invitations by email, you can unsubscribe here: <insert link>.

Cadeo, an independent research firm, is conducting this research on behalf of National Grid and using Qualtrics to gather feedback from program participants. This message was sent by Cadeo, 1660 L St NW, Suite 216, Washington, DC 20036.

Introduction

Thank you for completing this survey on behalf of National Grid. Your responses will help improve energy efficiency programs for other customers like you.

Our questions are primarily about your experience with the Multifamily program, which provides free in-home energy upgrades, such as LED lights, power strips, thermostats, showerheads, and other low-cost energy saving equipment. [**FOR EWMF ONLY:** The program also provides a set of options for how to further reduce your home's energy consumption with larger energy efficiency upgrades.]

To thank you for your time, we will e-mail you a $10 Amazon e-gift card or mail a $10 Visa gift card within one week of completing the survey. You can choose which option you prefer at the end of the survey.

As we navigate through the challenges of the COVID-19 pandemic, we'd also like to take this opportunity to thank you for being a valued customer.

Let's get started…

Awareness, Experience, & Verification

1. Do you own or rent your home?
    1. Own
    2. Rent

2. The building where you live participated in National Grid's Multifamily Program in **[MONTH/YEAR].** This means you likely received free energy saving upgrades, such as LED lights, power strips, or other energy saving items. Did you know your home was serviced through this program?
    1. Yes
    2. No **[Thank and terminate]**
    98. Don't know **[Thank and terminate]**

3. Were you responsible for deciding which item(s) were installed in your home?
    1. Yes
    2. No

4. **[IF Q3=2]** Can you refer us to someone else we can speak to about decisions related to which items were installed in individual units? Please provide a name and contact information if possible. **[Fillable field]**

5. Did your building owner/manager inform you about this program?
    1. Yes
    2. No
    98. Don't recall

6. How did you learn about the program? Select all that apply.
    1. Email
    2. Phone call
    3. Flyer or door hanger
    4. Neighbor
    5. During a meeting with other building residents
    97. Other **[Fillable field]**

7. Were you present when someone installed the energy-saving items in your home?
    1. Yes
    2. No **[Skip to Q10]**
    98. Don't know **[Skip to Q10]**

[IF Q7=1]

8. We want to understand your experience with the installation of these free energy saving items. Please rate your agreement or disagreement with the following statements.

	Strongly Agree [5]	Somewhat Agree [4]	Neither Agree nor Disagree [3]	Somewhat Disagree [2]	Strongly Disagree [1]	Not applicable [99]
The time the installer was in my home was reasonable.						
The installer was pleasant to interact with.						
The installer was able to answer my questions.						

9. **[IF ANY RESPONSES TO Q8 = Somewhat Disagree or Strongly Disagree]** Please tell us more about why you disagree. **[Fillable Field]**

10. According to our records, you received the following free or low-cost energy saving equipment in your home. Is that correct?

	Yes [1]	No [2]	Not Sure [98]
[IF Lighting=YES] LED light bulbs			
[IF Domestic Hot Water=YES] Faucet Aerators, Showerheads, or Pipe Wrap			
[IF Appliances & Plug Load=YES] Smart Power Strip			
[IF Controls=YES] Programmable or Smart (Wifi) thermostat			
Something else:			

[If Q10 Appliance & Plug load = Yes]

11. Did you install your smart power strip after your home energy assessment?
    1. Yes
    2. No
    98. Don't know

[If Q11 = 1]

12. Where did you install the smart strip(s)? Select all that apply.
    1. Entertainment (TV's, gaming systems, cable boxes)
    2. Office/Desk (Home office setup, computers, monitors, desk lamp)
    3. Other (Kitchen, garage)

13. Please rate your agreement with the following statements.

	Strongly Agree [5]	Somewhat Agree [4]	Neither Agree nor Disagree [3]	Somewhat Disagree [2]	Strongly Disagree [1]
[IF Q10 Lighting=YES] I am satisfied with the LED light bulbs I received.					
[IF Q10 Error! Reference source not found. **Domestic Hot Water=YES]** I am satisfied with the Faucet Aerators, Showerheads, or Pipe Wrap I received.					
[IF Q10 Appliances & Plug Load=YES and Q11 =YES] I am satisfied with the Smart Power Strips I received.					
[IF Q10 Controls=YES] I am satisfied with the Programmable or Smart (WiFi) thermostat I received					

14. Have you removed any of the items installed through the program?
    1. Yes
    2. No **[Skip to Q18]**
    98. Don't know **[Skip to Q18]**

[If Q14=1]

15. Which items have you removed? **[Program with check box to indicate.]**

Item	Select all that apply
LED lightbulbs	
Faucet aerators	
Showerheads	
Pipe wrap	
Smart power strip	
Programmable or Smart (wifi) thermostat	

[If Q14=1]

16. Please indicate whether you removed all the items, some of the items, or are not sure how many you removed.

Item	Did you remove all of them? Yes **[1]**	Did you remove some of them? Enter number of items removed	Not sure how many you removed? Not sure **[98]**
LED lightbulbs			
Faucet aerators			
Showerheads			
Pipe wrap			
Smart power strip			
Programmable or Smart (wifi) thermostat			

17. Why did you remove the item(s) installed through the program? [**Fillable Field**].

18. Please rate your agreement or disagreement with the following statement.

	Strongly Agree [5]	Somewhat Agree [4]	Neither Agree nor Disagree [3]	Somewhat Disagree [2]	Strongly Disagree [1]	Not applicable [99]
Overall, I am satisfied with how the installation of these items in my home went.						

19. **[IF ANY RESPONSES TO Q18 = Somewhat or Strongly Disagree]** Please tell us more about why you were dissatisfied with this. **[Fillable Field]**

F. Free Ridership

[NTG ASKED ONLY IF EWMF = YES AND RESPONDENT IS DECISION MAKER (Q3=1)]

[FR SET PROGRAMMED FOR UP TO TWO SAMPLED MEASURES]

[DIRECT INSTALL MEASURE COUNTERFACTUAL]

We have some questions about items installed at your home during the assessment.

F1. **[EWMF ONLY]** **[IF SAMPLED MEASURE=LED]** In the year prior to the installation, had you installed any LED bulbs in your home?

1. Yes
2. No

F2. **[EWMF ONLY]** **[ALL SAMPLED MEASURES]** If you had **NOT** received the free **[measures]** as part of the installation, what is the likelihood you would have purchased a(n) **[measures]** **within 6 months** of having the items installed in your home? Please use a scale of 0 to 10, where 0 is "not at all likely" and 10 is "extremely likely."

[Show 0-10 scale, with end-point labels]

[EWMF ONLY] **[ASK IF SAMPLED MEASURE INSTALLED QUANTITY>1]**

F3. If you had not received the item(s) during the installation, what is the likelihood you would have installed **FEWER** energy efficient **[measures]**?

[Show 0-10 scale, with end-point labels]

[EWMF ONLY] **[ASK IF SAMPLED MEASURE=LED, F1=1 AND F2<7)]**

F4. Given that you had purchased **LED bulbs** before the free installation, why is it unlikely that you would have purchased additional **LED bulbs** on your own without the program? **[OPEN END]**

[EWMF ONLY] **[ASK IF SAMPLED MEASURE=LED, F1=2 AND F2>6)]**

F5. Given that you have not purchased **LED bulbs** before receiving the installation, why is it likely that you would have purchased **LED bulbs** on your own without the program? **[OPEN END]**

[IF BOTH SAMPLED MEASURES ARE DIRECT INSTALL]

F2a. **[EWMF ONLY]** **[ALL SAMPLED MEASURES]** If you had **NOT** received the free **[measures]** as part of the installation, what is the likelihood you would have purchased a(n) **[measures]** **within 6 months** of having the items installed in your home?

[Show 0-10 scale, with end-point labels]

[EWMF ONLY] **[ASK IF SAMPLED MEASURE INSTALLED QUANTITY>1]**

F3a. If you had not received the item(s) during the installation, what is the likelihood you would have installed **FEWER** of the **[measures]**?

[Show 0-10 scale, with end-point labels]

F10a. **[If Weatherization=0]** Please explain how the program influenced you to install the energy efficient item(s) at the time you did? [OPEN END]

ASK IF MARKET RATE PROGRAM PARTICIPANT & UNIT OWNER (Q1=1 (OWN)); OTHERWISE, SKIP TO Q21

20. **[EWMF ONLY]** Did you receive an offer for additional energy upgrades, such as insulation or equipment upgrades for your home?
    1. Yes
    2. No **[Skip to Q27]**
    98. Don't know **[Skip to Q27]**

[If Q20 = 1]

21. **[EWMF ONLY]** Please indicate the extent to which you agree or disagree with the statements below:

	Strongly Agree [5]	Somewhat Agree [4]	Neither Agree nor Disagree [3]	Somewhat Disagree [2]	Strongly Disagree [1]	Not applicable [99]
The offer clearly detailed the work my home needed						
The offer gave me clear information on the cost estimate						

[ASK IF MAJOR MEASURE = FALSE]

22. **[EWMF ONLY]** Have you installed any of the recommended measures since you received the offer?
    1. Yes tested
    2. No **[SKIP TO Q27]**
    98. Don't know **[SKIP TO Q27]**

[IF Q22=1]

23. **[EWMF ONLY]** What did you install? [**Fillable field**]

24. **[EWMF ONLY]** **[If Q22=2 (NO)]** What prevented you from making the energy efficiency upgrades offered to you? **[MULTIPLE RESPONSE. RANDOMIZE OPTIONS.]**
    1. Upfront/out of pocket cost too large
    2. The energy savings were too small given the estimated project cost
    3. There were too many recommendations to consider
    4. Work was invasive or inconvenient
    5. I wasn't sure how to move forward
    6. Didn't have time
    7. Didn't need the work done
    8. Complications related to COVID19 outbreak
    97. Other **[Fillable Field]**
    98. Not sure

[IF Q24 = 8]

25. Can you tell us more about how COVID19 prevented you from making energy efficiency changes to your home? [**Fillable Field]**.

26. **[If Q24<98]** What could the program have done to help you overcome these barriers to making recommended changes? **[Fillable Field]**.

[MAJOR MEASURE COUNTERFACTUAL - ASK IF MAJOR MEASURE = TRUE]

Our records indicate that you installed **[SAMPLED MEASURE]** in your home following your home energy assessment.

27. **[EWMF ONLY]** How did you choose your contractor?
    1. I chose a contractor off the approved list
    2. The program recommended/assigned me a contractor
    97. Other **[Fillable field]**
    98. Not sure

28. **[EWMF ONLY]** We want to understand your experience completing these additional energy upgrades. Please rate your agreement or disagreement with the following statements.

	Strongly Agree [5]	Somewhat Agree [4]	Neither Agree nor Disagree [3]	Somewhat Disagree [2]	Strongly Disagree [1]	Not applicable [99]
The time that passed between the installation of free energy saving items and when the additional work on my home started was reasonable.						
The contractor/crew that installed energy saving upgrades in my home was professional.						
I am satisfied with the quality of work completed on my home.						
I noticed a decrease in my energy bill.						

29. **[EWMF ONLY]** **[IF ANY RESPONSES TO Q28 = Strongly disagree OR Somewhat disagree]** Please tell us more about why you disagreed with the statement(s). **[Fillable Field]**

F6. **[EWMF ONLY]** Without the program, what is the likelihood you would have installed the **[SAMPLED MAJOR MEASURE]** within 12 months of your installation of free energy saving items? Please use a scale of 0 to 10, where 0 is "not at all likely" and 10 is "extremely likely."

[Show 0-10 scale, with end-point labels]

F7. **[EWMF ONLY]** **[ASK IF MAJOR MEASURE = TRUE and QUANTITY>1 or (INSULATION=1)]** Without the program, what is the likelihood you would have installed less insulation?

[Show 0-10 scale, with end-point labels]

PROGRAM INFLUENCE [ONLY MAJOR MEASURE]

F8. **[EWMF ONLY]** **[ASK IF MAJOR MEASURE=TRUE]** Please rate the importance of each factor that may have influenced your decision to install the **[MEASURE NAME].** Please use a scale of 0 to 10, where 0 is "not at all influential" and 10 is "extremely influential." [Programming note: Not sure = 98, Not applicable = 99.]

1. The rebate or discount I received for **[MEASURE NAME]**
2. Recommendation from the Energy Specialist
3. Information provided during the assessment
4. Program materials or website
5. Recommendation from someone else

F9. **[ASK IF F8=5]** Did the person who gave you a recommendation participate in National Grid's EnergyWise program in the past?

1. Yes
2. No

F10. **[If Weatherization=1]** Please explain how the program influenced you to install energy efficient item(s) at the time you did? **[OPEN END]**

S. Spillover

[ASKED ONLY IF EWMF = YES AND RESPONDENT IS DECISION MAKER (Q3=a)]

S1. Since your participation in the EnergyWise Multifamily program, have you installed any ADDITIONAL energy efficient products?

1. Yes
2. No **[SKIP TO OVERALL SATISFACTION/DEMOGRAPHICS]**
98. Not Sure **[SKIP TO OVERALL SATISFACTION/DEMOGRAPHICS]**

S2a. **[ASK IF 0=1]** What additional energy efficient products did you install? Please enter the quantity of each energy efficient product installed.

1. LED Lighting
2. Clothes Washer
3. Electric Clothes Dryer
4. Gas Clothes Dryer
5. Low Flow Faucet Aerator
6. Low Flow Showerhead
7. Programmable Thermostat
8. Smart Thermostat

9. Smart Strip Plug Outlet
10. Refrigerator
11. Freezer
12. Dishwasher
13. Dehumidifier
14. Central A/C
15. Furnace
16. Boiler
17. Air Source Heat Pump
18. Ductless Heat Pump
19. Electric Water Heater
20. Gas Water Heater
21. Solar Water Heater
22. Heat Pump Water Heater
23. Other Water Heater (propane, fuel oil, etc.)
24. Insulation
25. Low-e Storm Windows
26. Doors

97. [Other][Specify]
98. [Not Sure]

S2b. **[IF S2a=1, S2a=5, S2a=6, S2a=7, S2a=8, S2a=9, S2a=24, S2a=25, S2a=26]**
How many did you install? **[NUMERIC ENTRY]**

S3. **[IF S2a< 98]** You indicated that you installed the following energy efficient products after your EnergyWise assessment. Please indicate if you received a rebate from National Grid to help offset the cost.

Received a rebate?

1. Yes 2. No 98.Not sure

[List each item selected in S2aa]

[PROGRAMMING NOTE: For any measures where S3=1 (they received a rebate) remove from selected items in S2aa and do not display in subsequent questions]

S4. **[IF ANY S3=2 ASK]** Why didn't you receive a rebate for the item(s) you installed?

1. Did not know rebate was available
2. Applied for rebate but item did not qualify

3. Did not think rebate amount was worth the effort
4. Did not apply because item did not qualify for a rebate
97. [Other][Specify]
98. [Not Sure]

S5. **[IF S2a< 98]** How influential, if at all, was your experience with the EnergyWise Multifamily program in your decision to install these efficient product(s) for which you did not receive a rebate on your own?

PROGRAMMING NOTE: Display 0 to 10 rating scale for each of the items selected in S2a] [IF S2a=1]

1. LED Lighting
2. **[IF S2a=2]** Clothes Washer
3. **[IF S2a=3]** Electric Clothes Dryer
4. **[IF S2a=4]** Gas Clothes Dryer
5. **[IF S2a=5]** Low Flow Faucet Aerator
6. **[IF S2a=6]** Low Flow Showerhead
7. **[IF S2a=7]** Programmable Thermostat
8. **[IF S2a=8]** Smart Thermostat
9. **[IF S2a=9]** Smart Strip Plug Outlet
10. **[IF S2a=10]** Refrigerator
11. **[IF S2a=11]** Freezer
12. **[IF S2a=12]** Dishwasher
13. **[IF S2a=13]** Dehumidifier
14. **[IF S2a=14]** Central A/C
15. **[IF S2a=15]** Furnace
16. **[IF S2a=16]** Boiler
17. **[IF S2a=17]** Air Source Heat Pump
18. **[IF S2a=18]** Ductless Heat Pump
19. **[IF S2a=19]** Electric Water Heater
20. **[IF S2a=20]** Gas Water Heater
21. **[IF S2a=21]** Solar Water Heater
22. **[IF S2a=22]** Heat Pump Water Heater
23. **[IF S2a=23]** Other Water Heater (propane, fuel oil, etc.)
24. **[IF S2a=24]** Insulation
25. **[IF S2a=25]** Low-e Storm Windows
26. **[IF S2a=26]** Doors
27. **[IF S2a=97]** Display B2"Other" response text

S6. **[IF S2a<98]** How likely is it that you still would have installed the efficient product(s) on your own if the EnergyWise Multifamily program did not exist? **[RECORD 0-10; 98=Don't Know for each]**

[PROGRAMMING NOTE: Display 0 to 10 rating scale for each of the items selected in S2a]

1. **[IF S2a=1]** LED Lighting
2. **[IF S2a=2]** Clothes Washer
3. **[IF S2a=3]** Electric Clothes Dryer
4. **[IF S2a=4]** Gas Clothes Dryer
5. **[IF S2a=5]** Low Flow Faucet Aerator
6. **[IF S2a=6]** Low Flow Showerhead
7. **[IF S2a=7]** Programmable Thermostat
8. **[IF S2a=8]** Smart Thermostat
9. **[IF S2a=9]** Smart Strip Plug Outlet
10. **[IF S2a=10]** Refrigerator
11. **[IF S2a=11]** Freezer
12. **[IF S2a=12]** Dishwasher
13. **[IF S2a=13]** Dehumidifier
14. **[IF S2a=14]** Central A/C
15. **[IF S2a=15]** Furnace
16. **[IF S2a=16]** Boiler
17. **[IF S2a=17]** Air Source Heat Pump
18. **[IF S2a=18]** Ductless Heat Pump
19. **[IF S2a=19]** Electric Water Heater
20. **[IF S2a=20]** Gas Water Heater
21. **[IF S2a=21]** Solar Water Heater
22. **[IF S2a=22]** Heat Pump Water Heater
23. **[IF S2a=23]** Other Water Heater (propane, fuel oil, etc.)
24. **[IF S2a=24]** Insulation
25. **[IF S2a=25]** Low-e Storm Windows
26. **[IF S2a=26]** Doors
27. **[IF S2a=97] Display S2"Other" response text**

S7. **[IF S2a< 98]** For each item installed, please specify how you knew that the product(s) you installed were energy efficient? (Select all that apply) **[PROGRAMMING NOTE: Randomize list and allow respondents to select all that apply (1-98) for each of the measures displayed]**

1. Efficiency rating or label of equipment, such as an "ENERGY STAR®" logo
2. Equipment dealer/retailer said it was energy efficient
3. Personal experience
4. Met utility rebate requirements
5. Third party report, such as Consumer Reports
6. Recommendations from the contractor/installer
7. Did not rely on any specific type of information
8. Internet/website

97. [Other][Specify]
98. [Not Sure]

1. **[IF S2a=1]** LED Lighting
2. **[IF S2a=2]** Clothes Washer
3. **[IF S2a=3]** Electric Clothes Dryer
4. **[IF S2a=4]** Gas Clothes Dryer
5. **[IF S2a=5]** Low Flow Faucet Aerator
6. **[IF S2a=6]** Low Flow Showerhead
7. **[IF S2a=7]** Programmable Thermostat
8. **[IF S2a=8]** Smart Thermostat
9. **[IF S2a=9]** Smart Strip Plug Outlet
10. **[IF S2a=10]** Refrigerator
11. **[IF S2a=11]** Freezer
12. **[IF S2a=12]** Dishwasher
13. **[IF S2a=13]** Dehumidifier
14. **[IF S2a=14]** Central A/C
15. **[IF S2a=15]** Furnace
16. **[IF S2a=16]** Boiler
17. **[IF S2a=17]** Air Source Heat Pump
18. **[IF S2a=18]** Ductless Heat Pump
19. **[IF S2a=19]** Electric Water Heater
20. **[IF S2a=20]** Gas Water Heater
21. **[IF S2a=21]** Solar Water Heater
22. **[IF S2a=22]** Heat Pump Water Heater
23. **[IF S2a=23]** Other Water Heater (propane, fuel oil, etc.)

24. **[IF S2a=24]** Insulation
25. **[IF S2a=25]** Low-e Storm Windows
26. **[IF S2a=26]** Doors
27. **[IF S2a=97]** Display B2"Other" response text

S8. **[IF INSTALLED WATER HEATER: S2a=19 OR S2a=20 OR S2a=21 OR S2a=22 OR S2a=23]** What type of water heater(s) did the new water heater(s) replace?

1. Electric water heater
2. Gas water heater
3. Solar water heater
4. Heat pump water heater
5. Fuel oil water heater
6. Propane water heater
98. Don't know
99. Not applicable

S9. **[IF ASHP or DHP: S2a=17 OR S2a=18]** What type of heating system did the new air source heat pump or ductless heat pump replace?

1. Electric furnace
2. Gas furnace
3. Fuel oil furnace
4. Propane furnace
5. Electric boiler
6. Gas boiler
7. Fuel oil boiler
8. Propane boiler
9. Other **[Fillable field]**
98. Don't know
99. Not applicable

S10. **[IF INSTALLED TSTAT: IF S2a=7 or S2a= 8]** What does the thermostat you installed control?

1. Heating
2. Air conditioning
3. Both heating and air conditioning

97. [Other][Specify]

98. [Not Sure]

OVERALL SATISFACTION

30. **[ASK ALL]** Thinking about your overall experience with this program, how would you rate your satisfaction? Would you say you are…
    1. Not at all satisfied
    2. Slightly satisfied
    3. Moderately satisfied
    4. Very satisfied
    5. Completely satisfied

31. **[If Q30=1 or 2]** Please tell us more about why you were not satisfied with your experience with this program, **[Fillable field/Open response].**

32. Would you recommend the program to family or friends?
    1. Yes
    2. No

33. Did your experience in the program change your perception of National Grid?
    1. Yes, favorably
    2. Yes, negatively
    3. No

34. Do you have any recommendations for how National Grid could improve the program? **[Fillable field/Open response]**

Demographics

Next, we'd like to ask you a few questions about your household.

35. Including yourself, how many total people reside in your home?
    1. 1
    2. 2
    3. 3
    4. 4
    5. 5

6. 6 or more

Income1-6. What was your total annual household income in 2019 (before taxes)? Please include income generated by all members of your household.**[Programmed based on Q35 and State median income**]

1. Below **$A**
2. Between **$A** and **$B**
3. Between **$B** and **$C**
4. Greater than **$C**

99. Prefer not to answer

36. What is the highest level of education that you have completed so far?

1. Less than high school diploma or equivalent
2. High school diploma or equivalent
3. Technical or business school certificate/2-year college degree/some college
4. 4-year college degree/bachelor's degree
5. Graduate or professional degree/masters or PhD

99. Prefer not to answer

Closing

We appreciate your feedback about your experience with the EnergyWise program. May we contact you via email or phone with any additional follow-up questions we may have?

1. Yes
2. No

Incentive Logistics

Thank you for your time and thoughts! Select the email address where you would like your Amazon gift card to be sent OR if you prefer a card to be mailed to you, please include your mailing address:

1. The email address used for this survey
2. A different email address: **[Fillable Field]**
3. I prefer a card to mailed by post to this address: **[Fillable Field]**
   NOTE: mailed cards are Visa gift cards (instead of Amazon)

Appendix J: Additional Tenant Survey Results

Appendix J: Additional Tenant Survey Results

Q1 - Do you own or rent your home?

#	Answer	%	Count
1	Own	83%	83
2	Rent	17%	17
	Total	100%	100

Q2 - The building where you live participated in National Grid's Multifamily Program in [Field-AssmtMonth] [Field-AssmtYear]. This means you likely received free energy saving upgrades, such as LED lights, power strips, or other energy saving items. Did you know your home was serviced through this program?

#	Answer	%	Count
1	Yes	100%	100
2	No	0%	0
98	Don't Know	0%	0
	Total	100%	100

Q3 - Were you responsible for deciding which item(s) were installed in your home?

#	Answer	%	Count
1	Yes	90%	88
2	No	10%	10

	Total	100%	98

Q5 - Did your building owner/manager inform you about this program?

#	Answer	%	Count
1	Yes	76%	70
2	No	24%	22
	Total	100%	92

Q6 - How did you learn about the program? Select all that apply.

#	Answer	%	Count
1	Email	46%	58
2	Phone call	3%	4
3	Flyer or door hanger	14%	17
4	Neighbor	10%	13
5	During a meeting with other building residents	14%	18
97	Other	12%	15
	Total	100%	125

Q7 - Were you present when someone installed energy-saving items in your home?

#	Answer	%	Count
1	Yes	92%	90
2	No	8%	8

Total	100%	98

Q8 - We want to understand your experience with the installation of these free energy saving items. Please rate your agreement or disagreement with the following statements.

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Not Applicable		Total
1	The time the installer was in my home was reasonable	0%	0	3%	3	6%	5	11%	10	79%	70	1%	1	89
2	The installer was pleasant to interact with	1%	1	0%	0	12%	10	6%	5	80%	69	1%	1	86
3	The installer was able to answer my questions	2%	2	3%	3	8%	7	10%	9	75%	65	1%	1	87

Q10 - According to our records, you received the following free or low-cost energy saving equipment in your home. Is that correct?

#	Question	Yes		No		Total
1	LED bulbs	100%	64	0%	0	64
2	Faucet Aerators, Showerheads, or Pipe Wrap	100%	27	0%	0	27

3	Smart Power Strip	0%	0	0%	0	0
4	Programmable or Smart (Wifi) thermostat	91%	20	9%	2	22
5	Something else:	77%	34	23%	10	44

Q11 - Did you install your smart power strip(s) after your home energy assessment?

#	Answer	%	Count
1	Yes	0%	0
2	No	0%	0
	Total	100%	0

Q12 - What does the installed smart strip(s) control? Select all that apply.

#	Answer	%	Count
1	Entertainment system (TV's, gaming systems, cable boxes)	0%	0
2	Office/Desk (Home office setup, computers, monitors, desk lamp)	0%	0
3	Something else (Kitchen appliances, garage set up, etc.)	0%	0
	Total	100%	0

Q13 - Please rate your agreement with the following statements.

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Total
1	I am satisfied with the LED Light bulbs that I received	2%	1	2%	1	3%	2	6%	4	87%	55	63

2	I am satisfied with the Faucet Aerators, Showerheads, or Pipe Wrap I received	4%	1	11%	3	0%	0	19%	5	67%	18	27
3	I am satisfied with the Smart Power Strips I received	0%	0	0%	0	0%	0	0%	0	0%	0	0
4	I am satisfied with the Programmable or Smart (WiFi) thermostat I received	5%	1	0%	0	10%	2	5%	1	80%	16	20

Q14 - Have you removed any of the items installed through the program?

#	Answer	%	Count
1	Yes	7%	7
2	No	93%	91
	Total	100%	98

Q15 - Which items have you removed?

#	Answer	%	Count
1	LED lightbulbs	25%	1
3	Showerheads	50%	2
4	Pipe wrap	0%	0
5	Smart power strips	0%	0
6	Programmable or Smart (wifi) thermostat	25%	1
	Total	100%	4

Q16#1 - Please indicate whether you removed all the items, some of the items, or are not sure how many yo... - Did you removed some of them?

Q16#1_1_1 - LED lightbulbs - (Enter number of items removed) - LED lightbulbs

LED lightbulbs - (Enter number of items removed)
2

Q16#1_1_1 - LED lightbulbs - (Enter number of items removed) - Showerheads
LED lightbulbs - (Enter number of items removed)

Q16#1_1_1 - LED lightbulbs - (Enter number of items removed) - Pipe wrap
LED lightbulbs - (Enter number of items removed)

Q16#1_1_1 - LED lightbulbs - (Enter number of items removed) - Smart power strips
LED lightbulbs - (Enter number of items removed)

Q16#1_1_1 - LED lightbulbs - (Enter number of items removed) - Programmable or Smart (wifi) thermostat
LED lightbulbs - (Enter number of items removed)

Q16#2 - Please indicate whether you removed all the items, some of the items, or are not sure how many yo... - Did you remove all of them?

#	Question	Yes		Total
1	LED lightbulbs	100%	1	1
2	Faucet Aerators	100%	2	2
3	Showerheads	100%	1	1
4	Pipe wrap	0%	0	0
5	Smart power strips	0%	0	0
6	Programmable or Smart (wifi) thermostat	100%	1	1

Q16#3 - Please indicate whether you removed all the items, some of the items, or are not sure how many yo... - Not sure how many you removed?

#	Question	Not sure		Total
1	LED lightbulbs	0%	0	0
2	Faucet Aerators	0%	0	0
3	Showerheads	0%	0	0
4	Pipe wrap	0%	0	0
5	Smart power strips	0%	0	0
6	Programmable or Smart (wifi) thermostat	0%	0	0

Q18 - Please rate your agreement or disagreement with the following statement.

#	Answer	%	Count
1	Strongly disagree	6%	6
2	Somewhat disagree	6%	6
3	Neither agree nor disagree	6%	6
4	Somewhat agree	18%	18
5	Strongly agree	64%	63
99	Not Applicable	0%	0
	Total	100%	99

Q20 - Did you receive an offer for additional energy upgrades, such as insulation or equipment upgrades for your home?

#	Answer	%	Count
1	Yes	56%	43
2	No	44%	34
	Total	100%	77

Q21 - Please indicate the extent to which you agree or disagree with the statements below:

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Total
1	The offer clearly detailed the work my home needed	5%	2	3%	1	15%	6	28%	11	50%	20	40
2	The offer gave me clear information on the cost estimate	3%	1	5%	2	13%	5	28%	11	51%	20	39

Q22 - Have you installed any of the recommended measures since you received the offer?

#	Answer	%	Count
1	Yes	53%	17
2	No	34%	11
98	Don’t Know	13%	4
	Total	100%	32

Q24 - What prevented you from making the energy efficiency changes recommended after your assessment? Select all that apply.

#	Answer	%	Count
1	Upfront/out of pocket cost too large	13%	2
2	The energy savings were too small given the estimated project cost	0%	0
3	There were too many recommendations to consider	0%	0
4	Work was invasive or inconvenient	0%	0
5	I wasn't sure how to move forward	7%	1
6	Didn't have time	0%	0
7	Didn't need the work done	33%	5
8	Complications related to COVID19 outbreak	20%	3
97	Other	27%	4
98	Not sure	0%	0
	Total	100%	15

Q27 - How did you choose your contractor?

#	Answer	%	Count
1	I chose a contractor off the approved list	5%	1
2	The program recommended/assigned me a contractor	85%	17
97	Other	0%	0
98	Not sure	10%	2
	Total	100%	20

Q28 - We want to understand your experience completing these additional energy upgrades. Please rate your agreement or disagreement with the following statements.

#	Question	Strongly disagree		Somewhat disagree		Neither agree nor disagree		Somewhat agree		Strongly agree		Not Applicable		Total
1	The time that passed between the installation of free energy saving items and when the additional work on my home started was reasonable	5%	1	0%	0	0%	0	45%	9	50%	10	0%	0	20
2	The contractor/crew that installed energy saving upgrades in my home was professional	11%	2	0%	0	11%	2	21%	4	58%	11	0%	0	19
3	I am satisfied with the quality of work completed on my home	0%	0	5%	1	16%	3	26%	5	53%	10	0%	0	19
4	I noticed a decrease in my energy bill	0%	0	11%	2	26%	5	42%	8	11%	2	11%	2	19

Q30 - Thinking about your overall experience with this program, how would you rate your satisfaction? Would you say you are…

#	Answer	%	Count
1	Not at all satisfied	3%	3
2	Slightly satisfied	10%	10
3	Moderately satisfied	20%	20

4	Very satisfied	34%	34
5	Completely satisfied	33%	33
	Total	100%	100

Q32 - Would you recommend the program to family or friends?

#	Answer	%	Count
1	Yes	91%	91
2	No	9%	9
	Total	100%	100

Q33 - Did your experience in the program change your perception of National Grid?

#	Answer	%	Count
1	Yes, favorably	61%	61
2	Yes, negatively	7%	7
3	No	32%	32
	Total	100%	100

Q35 - Including yourself, how many total people reside in your home?

#	Answer	%	Count
1	1	46%	46
2	2	49%	49
3	3	1%	1

4	4	3%	3
5	5	1%	1
6	6 or more	0%	0
	Total	100%	100

Income1 - What was your total annual household income in 2019 (before taxes)? Please include income generated by all members of your household. - 1 household member

#	Answer	%	Count
1	Below $34,800	15%	7
2	Between $34,800 and $46,350	7%	3
3	Between $46,350 and $69,550	20%	9
4	Greater than $69,550	28%	13
99	Prefer not to answer	30%	14
	Total	100%	46

Income2 - What was your total annual household income in 2019 (before taxes)? Please include income generated by all members of your household. - 2 household members

#	Answer	%	Count
1	Below $39,750	8%	4
2	Between $39,750 and $53,000	10%	5
3	Between $53,000 and $79,500	14%	7
4	Greater than $79,500	35%	17
99	Prefer not to answer	33%	16
	Total	100%	49

Income3 - What was your total annual household income in 2019 (before taxes)? Please include income generated by all members of your household. - 3 household members

#	Answer	%	Count
1	Below $44,750	0%	0
2	Between $44,750 and $59,600	0%	0
3	Between $59,600 and $89,400	0%	0
4	Greater than $89,400	0%	0
99	Prefer not to answer	100%	1
	Total	100%	1

Income4 - What was your total annual household income in 2019 (before taxes)? Please include income generated by all members of your household. - 4 household members

#	Answer	%	Count
1	Below $49,700	33%	1
2	Between $49,700 and $66,250	33%	1
3	Between $66,250 and $99,350	0%	0
4	Greater than $99,350	33%	1
99	Prefer not to answer	0%	0
	Total	100%	3

Income5 - What was your total annual household income in 2019 (before taxes)? Please include income generated by all members of your household. - 5 household members

#	Answer	%	Count
1	Below $53,700	0%	0
2	Between $53,700 and $71,550	0%	0
3	Between $71,550 and $107,300	100%	1
4	Greater than $107,300	0%	0
99	Prefer not to answer	0%	0
	Total	100%	1

Income6 - What was your total annual household income in 2019 (before taxes)? Please include income generated by all members of your household. - 6+ household members

#	Answer	%	Count
1	Below $57,650	0%	0
2	Between $57,650 and $76,850	0%	0
3	Between $76,850 and $115,250	0%	0
4	Greater than $115,250	0%	0
99	Prefer not to answer	0%	0
	Total	100%	0

Q36 - What is the highest level of education that you have completed so far?

#	Answer	%	Count
1	Less than high school diploma or equivalent	0%	0
2	High school diploma or equivalent	11%	11
3	Technical or business school certificate/2-year college degree/some college	17%	17
4	4-year college degree/bachelor’s degree	29%	29

5	Graduate or professional degree/masters or PhD	32%	32
99	Prefer not to answer	11%	11
	Total	100%	100