THE CADMUS GROUP, INC.

Final Report

Energy*Wise* 2008 Program Evaluation

Prepared for:
National Grid

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Executive Summary

The Energy*Wise* Program provides residential customers with energy audits, installed measures, and education to improve energy efficiency. The program serves multifamily customers with high electricity consumption in Massachusetts, Rhode Island, and New Hampshire and single-family customers in Rhode Island with electric or non-electric heat and higher than average electricity consumption. Starting in July 2007, gas-heated multifamily and single-family homes in Rhode Island were targeted to receive gas-saving measures.

Three subcontractors—Rise Engineering (RISE), Conservation Services Group (CSG), and Action, Inc— perform implementation. For single-family homes, the program is advertised through bill inserts or targeted print marketing; multifamily complexes are marketed through direct telephone solicitation by the implementation subcontractors or through facility owner word of mouth.

The Energy*Wise* program offers a broad range of services. During audits, information is collected about the home or facility; for multifamily facilities and single-family gas homes, this information is then input to software that analyzes energy-efficiency opportunities for cost-effectiveness. For single-family electric homes potential measures were pre-screened and assumed to be cost-effective, Available measures depend on the type of home and its heating system, and may include: shell measures, lighting measures (CFLs and fixtures), water savings measures, new refrigerators, and heat pump tune-ups. Services offered through the Energy*Wise* Program are summarized in Table ES-1.

Table ES-1. Summary of Energy*Wise* Program Offerings

Customer Type	Massachusetts	Mass. Low Income	Rhode Island	New Hampshire
Single-family electric heat			Lighting, refrigerators w/co-payments, insulation, air sealing, duct sealing, domestic hot water measures, thermostats	
Single-family general use (electric customers with non-electric heat)			Lighting, refrigerators w/co-payments	
Single-family gas heating			Insulation, air sealing, duct sealing, heat pump tune-up, domestic hot water	
Multifamily electric heat	Lighting, refrigerators w/co-payments, insulation, air sealing, duct sealing, heat pump tune-up, domestic hot water, thermostat	Lighting, refrigerators w/co-payments, insulation, air sealing, duct sealing, heat pump tune-up, domestic hot water, thermostats	Lighting, refrigerators w/co-payments, insulation, air sealing, duct sealing, heat pump tune-up, domestic hot water measures, thermostats	Lighting, refrigerators w/co-payments, insulation, air sealing, duct sealing, heat pump tune-up, domestic hot water, thermostats, AC timers
Multifamily general use (electric customers with non-electric heat)	Lighting, refrigerators w/ co-payments	Lighting, refrigerators w/low or no co-payments	Lighting, refrigerators w/co-payments	
Multifamily gas heat[3]			Insulation, air sealing, duct sealing, duct insulation, domestic hot water	

Cadmus conducted an impact evaluation of the 2008 program to determine: total program savings; average savings per measure category (e.g., lighting) for single-family gas and electric participants in Rhode Island; realization rates for electric heated, gas and, general-use customers by state for multifamily homes; and program freeridership and spillover.

Cadmus also performed a process evaluation of the program to: understand stakeholders' perceptions of the program; and assess customer satisfaction, effectiveness of customer education, and participant follow-through on recommended installations (Participant Survey of Rhode Island single-family customers only). The portion of the process evaluation focusing on the implementation contractor is specific to Rhode Island only, customer satisfaction questions were asked only of Rhode Island single-family customers, while the National Grid program manager was asked about the program as a whole.

Cadmus also performed a detailed process review of the program data tracking system, because during the evaluation process we encountered challenges analyzing and interpreting program data, and for some segments, estimated energy savings to be significantly different from National Grid's planning assumptions. As such, National Grid requested that Cadmus review and critique the program's data tracking system for both the electric and gas components of the 2008 program.

Table ES-2 contains a summary of evaluation tasks.

Table ES-2. Summary of Evaluation Tasks

Action	Impact	Process	Details
Participant Survey	✓	✓	Determined customer satisfaction, education effectiveness, customer follow-through, freeridership, and spillover (Rhode Island, single-family only).
Stakeholder Interviews	✓	✓	Provided insight into program design and delivery. Follow-up interviews provided specific insight into data tracking.
Document Review		✓	Provided insight into program design and delivery.
Review and Analyze Tracking Database	✓	✓	Analyzed installed measures and provided inputs for billing analysis.
Secondary Research	✓		Reviewed similar program measure savings to validate billing analysis.
Billing Analysis	✓		Calculated measure savings and realization rates.

The Energy*Wise* program's energy savings achievements generally were less than predicted by National Grid (except for multifamily gas), and below previous program results. Tables ES-3 and ES-4 compare Cadmus' estimated program savings to National Grid's predicted results for each segment.

Table ES-3. Energy*Wise* Program Gross Electric Savings

Customer Segment	N	National Grid Predicted Savings per Participant (kWh)	Billing Analysis Estimated Savings per Participant (kWh)	Percent Difference	2001 Estimated Savings per Participant (kWh)
Single-family non-electric heat (RI only)	2183	787	339	-57%	713
Single-family electric heat (RI Only)	67	1,329	773	-42%	1,293
Multifamily non-electric heat (RI, MA)	138	4,733	4,455	-6%	Not available
Multifamily electric heat (RI, MA)	69	4,902	4,667	-5%	Not available

National Grid predicted electricity savings per participant were based on historical evaluation results for the Energy*Wise* program consisting of installations of broad groups of measures.. Differences in results may occur from a different mix of measures being implemented in 2008 versus other program years.

For gas participants, National Grid's program engineering savings estimates were based on calculations performed by the vendor using their audit software. Each estimate was particular to the home or building audited; for example, air sealing savings were calculated using a formula that included inputs of building size (volume) and estimated air changes per hour before and after installation. For single-family homes, the difference between actual savings and engineering savings may be due to a takeback effect (a change in consumer behavior) or inaccurate input assumptions. For multifamily buildings, however, the results are considered unreliable due to difficulty in obtaining adequate billing data for all participating buildings. As such, Cadmus recommends performing another multifamily gas customer billing analysis in the near future, and requiring that part of the audit time be spent verifying account numbers associated with the facility.

Table ES-4 Energy*Wise* Program Total Program Gross Gas Savings

Customer Segment	N	National Grid Predicted Savings (therms)	Billing Analysis Estimated Savings (therms)	Percent Difference
Single-family (RI Only)	512	44,274	29,491	-33%
Multifamily (RI, MA)	11	69,032	130,263	89%

Cadmus also surveyed a sample of participants to assess freeridership and spillover for two measures – insulation and refrigerators – that represented a substantial portion of the claimed savings. Freeridership levels were 16% for insulation 14.8% for refrigerators. According to the telephone survey, 41.6% of participants also installed at least one additional energy-efficiency measure beyond what was claimed through the program. The most frequently cited incremental purchases were CFLs and insulation.

Based on the process evaluation, Cadmus also recommends the program changes detailed below. These recommendations are based on interviews and customer surveys from the Rhode Island single-family program; however, some recommendations may also be applicable to other areas and customer types served by the Energy*Wise* program.

Enhance Communications with Implementers (All Program Areas)

Cadmus recommends National Grid prepare a detailed program description, including specific installation guidelines and strategies, and energy savings assumptions for all installed measures. These assumptions and savings definitions should be reflected in the tracking database; so tracking savings estimates can be more easily compared to evaluated results. This program description should also identify overall annual quantitative program goals, including program energy savings and assumptions behind them, allowing them to be tracked and known by every auditor. We further recommend regular contact between National Grid and the auditors to track progress towards goals and facilitate resolution of issues.

Create Formal Contract for Gas Add-On (Rhode Island Only)

Cadmus recommends National Grid and RISE create a formal contract documenting expectations for the gas program for both the Multifamily and Single-Family components in Rhode Island.[1] We also recommend reviewing gas measures' savings assumptions and tracking data to ensure these are appropriate and consistently monitored similar to electric programs using InDemand.. The detailed program description described in the above recommendation should include gas measures along with electric.

Eligible Measures (All Program Areas)

Additional measures that could be screened for cost-effectiveness (if this has not already been done) include installation of: efficient windows and doors; high-efficiency motors in large multifamily buildings; high-efficiency washers; and mechanical ventilation to provide better air

[1] At the time at which this study was conducted, a contract did not exist between National Grid and RISE for the gas component of the program; however, following the submission of the draft report a formal contract had been adopted

sealing. As water savings devices were less popular with participants, and those who had them installed tended to be more dissatisfied, we recommend National Grid research water savings technologies to find those most acceptable to homeowners. Additionally, informing homeowners of expected energy savings may aid them in accepting the technologies.

Marketing (Rhode Island Only)

If National Grid wishes to increase program participation, it should consider a broader marketing approach, involving the more general avenues of television, radio, and news releases, followed by targeted direct-mail solicitations. A targeted solicitation for single-family homes could focus on zip codes with higher incidences of older homes and a greater focus on homes with annual energy consumption greater than that of average residential customers.

Savings Estimates (Rhode Island Only)

Engineering formulas should provide the basis for individual measure savings predictions. National Grid already uses engineering formulas to predict savings for all multifamily homes and for single-family gas homes, but uses results from previoius evaluations to predict savings for single-family electric homes. Historical savings based on average installation rates in homes may not accurately predict savings for an individual home in the future if installation rates are different. Past evaluations should be used to inform the results and adjust assumptions associated with engineering formulas to improve estimates over time.

Data Tracking (All Program Areas)

The following changes to data tracking processes are recommended:

- One participant or facility identification number should be used to track across all data files.
- InDemand should not include variable names that are the same as or very close to variable names in National Grid's customer account system unless those fields house the same data. If an implementer assigns an ID code unique to InDemand or other tracked data, it should have a different variable name than any ID code used in the billing system.
- All data associated with a customer must include an account number, ideally, or at least one common and consistent identifier to link back to billing data.
- A data dictionary should be developed to describe all variables used in the tracking process and any formulas when applicable. When contractors receive data they should receive a list of the descriptions of all variables sent, as well as a list of available variables that were not sent but could be sent if needed for the analysis.
- For multifamily customers, InDemand should track all meters and account numbers for each facility and include a description of the units and common areas associated with each number. This will allow the evaluator to ensure all relevant data are available. Numbers of units and numbers of buildings should also be tracked to assist in interpreting billing analysis results.

Increase Homeowner Involvement in the Home Energy Action Plan (Rhode Island Only)

Cadmus recommends auditors set aside time in their audits to review and obtain homeowner agreement with the Home Energy Action Plan (HEAP). One approach may be to include a signature page at the end of the HEAP; this would be signed by both the homeowner and auditor, confirming the auditor reviewed the recommendations with the homeowner. If this is not already being done, we recommend auditors show homeowners each measure installed in the home and where it is identified on the HEAP. We also recommend expected energy savings be described in the HEAP for each measure and behavioral tip. We further recommend maintaining a copy or scanned versions of the HEAP to assist in future evaluations. Finally, Cadmus recommends auditors directly install low-cost measures rather than leaving them behind for homeowner installation.

Follow-up on Measure Installation (Rhode Island Only)

As implementers follow-up with audit participants to see if they wish to schedule installations, Cadmus recommends they also ask if participants have installed recommended measures on their own, gathering specifics on measures installed so this information can be tracked in the database and be credited to program savings.

Offer Audit Options (Rhode Island Only)

Cadmus recommends National Grid consider a two-tiered approach to audits—a free audit with an overview of potential savings; and a more in-depth audit to identify additional energy saving opportunities—with both approaches providing free CFLs and water-saving devices. More costly audits would be performed only for homeowners electing to undertake them and could utilize more expensive assessment technologies such as blower doors and/or infrared cameras. The more in-depth audit option could also include rebating the audit fee if follow-up measures are installed. Other utilities charge up to $250 for a detailed audit. Requiring a customer investment upfront could yield better follow-through on recommended measures.

1. Introduction

Program Description

The Energy*Wise* Program, initiated in February 1998, is designed to provide residential customers with energy audits, installed measures, and education to improve energy efficiency. The Energy*Wise* Program serves customers with both electrically and non-electrically heated homes, who experience high electricity consumption. The program serves multifamily homes in Massachusetts and New Hampshire, and both single-family and multifamily homes in Rhode Island. Starting in July 2007, gas-heated single-family and multifamily homes in Rhode Island were targeted to receive gas-saving measures.

Since the program's inception, implementation has been performed through three audit contractors: RISE Engineering (RISE), Conservation Services Group (CSG), and Action, Inc. RISE Engineering operates in Rhode Island and Massachusetts, while CSG operates in Massachusetts and New Hampshire, and Action, Inc. focuses on small (5-25 unit) income-eligible multifamily facilities in Massachusetts. These implementers often have subcontractors perform specific work such as fixture installations and weatherization for electrically heated homes. Additionally, customers with gas-heated homes in Rhode Island can choose from a list of approved weatherization service providers.

The program is primarily marketed through bill inserts for single-family homes. For multifamily complexes, the program is marketed through direct telephone solicitation by the implementation subcontractors, or through word of mouth by facility owners. In addition, multifamily complexes served seven or more years ago may be targeted for a second visit through direct calls. National Grid maintains a Web site describing the program, and offers a call center phone number to answer customers' questions about the program.

The Energy*Wise* program offers a broad range of services to both natural gas and electric customers. During the audit, the auditor collects information about the home (single-family) or facility (multifamily) and inputs it into software, which generates a Home Energy Action Plan for single-family homes at the time of the audit or a detailed proposal for multifamily facilities after returning to the office. Figure 1 and Figure 2 illustrate program delivery approach for single-family and multifamily facilities, respectively.

Figure 1. Single-Family Program Delivery (with Gas or Electric Heat)

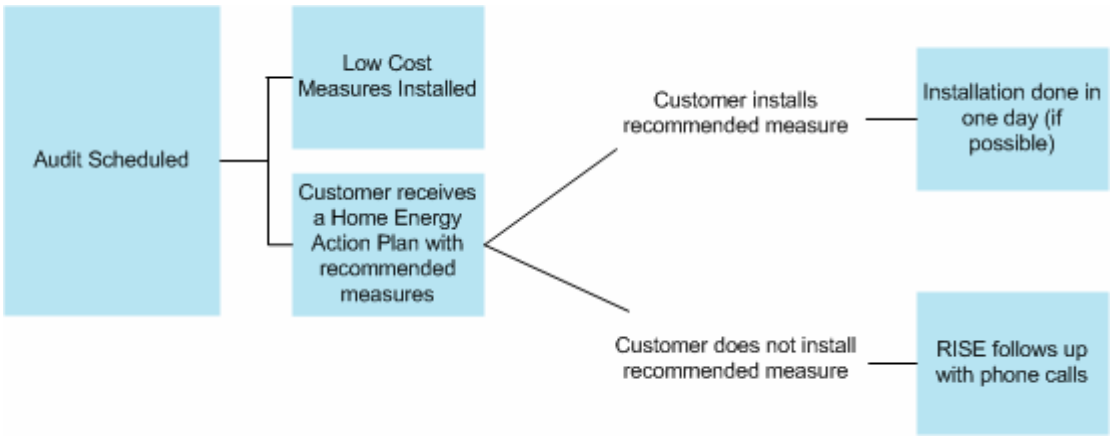
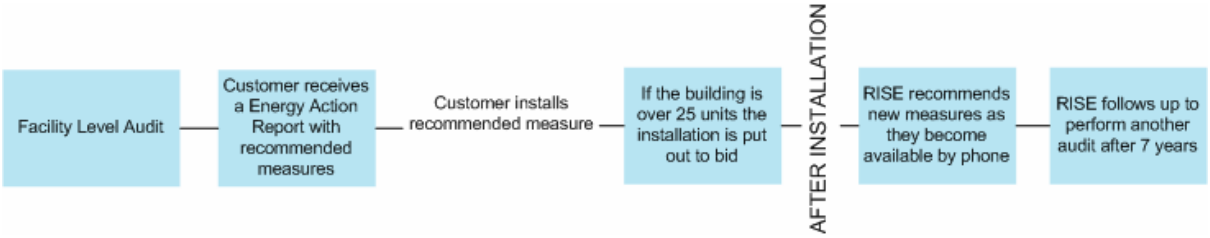


Figure 2. Multifamily Program Delivery (Gas or Electric Heat)



Single-family participants (1-4 dwelling units) receive the following services:

- A no-cost home energy audit.
- Installation of low-cost, energy-efficiency measures, including compact fluorescent lamps (CFLs), high-efficiency showerheads and faucet aerators, and hot water pipe wrapping.
- A Home Energy Action Plan, identifying low-cost measures installed, recommended behavioral tips to save energy, and recommendations for additional energy savings measures and available incentives.
- Referral to an independent installer for weatherization installations in gas-heated homes, and to program subcontractors for weatherization measures in electrically heated homes. An electrician subcontractor may be hired to install ENERGY STAR fixtures.
- Incentives for installation of recommended energy-saving measures.

Multifamily facilities (five or more units) receive:

- A building energy audit.
- A proposal or contract detailing recommendations for additional measures installed.
- Direct installation of low-cost, energy-efficiency measures, including compact fluorescent lamps (CFLs), high-efficiency showerheads and faucet aerators, and hot water pipe wrapping.
- Installation of weatherization (insulation and air sealing) for gas or electrically heated facilities by program subcontractors.
- Incentives for installation of recommended energy-saving refrigerators.
- Project management.

Measures eligible for installation depend on the type of home and heating system, and are summarized below in Table 1. National Grid provides incentives for weatherization measures only to customers who heat their homes with electricity or gas provided by National Grid, however advice is provided on a "fuel blind" basis.

Table 1. Summary of Energy*Wise* Program Offerings

Customer Type	Massachusetts	Mass. Low Income[2]	Rhode Island	New Hampshire[3]
Single-family electric heat[4]			Lighting, refrigerators w/co-payments, insulation, air sealing, duct sealing, domestic hot water measures, thermostats	
Single-family general use (electric customers with non-electric heat)			Lighting, refrigerators w/co-payments	
Single-family gas heat[5]			Insulation, air sealing, duct sealing, heat pump tune-up, domestic hot water	
Multifamily electric heat	Lighting, refrigerators w/co-payments, insulation, air sealing, duct sealing, heat pump tune-up, domestic hot water, thermostats	Lighting, refrigerators w/co-payments,[6] insulation, air sealing, duct sealing, heat pump tune-up, domestic hot water, thermostats	Lighting, refrigerators w/co-payments, insulation, air sealing, duct sealing, heat pump tune-up, domestic hot water measures, thermostats	Lighting, refrigerators w/co-payments, insulation, air sealing, duct sealing, heat pump tune-up, domestic hot water, thermostats, AC timers
Multifamily general use (electric customers with non-electric heat)	Lighting, refrigerators w/ co-payments	Lighting, refrigerators w/low or no co-payments	Lighting, refrigerators w/co-payments	
Multifamily gas heat[3]			Insulation, air sealing, duct sealing, duct insulation, domestic hot water	

In RI, in order for National Grid Gas single-family customers to receive weatherization incentives, customers must install measures using an approved, BPI accredited weatherization contractor. National Grid maintains a list of approved weatherization contractors (insulation, air sealing, etc.) As approved installation contractors, the audit subcontractors can also contract for installation immediately following the audit. Work can be scheduled once a contract is signed. Depending on a home's heating system, a BPI Field Inspector may visit the home before installation scheduling to do combustion safety pre-testing, prior to any air sealing work. In

[2] The low-income component of the program differs slightly from the standard-income component, as delineated in this table. However, for the purpose of the impact evaluation, savings achieved at low-income facilities in MA were included in the total multifamily savings estimates, rather than being treated separately.

[3] While New Hampshire had two multifamily projects participate in the program, Cadmus and National Grid agreed that New Hampshire customers would not be included in the evaluation.

[4] Although thermostats may be recommended for electrically heated RI single-family homes, they are rebated through a separate National Grid program.

[5] Programmable thermostats or new heating systems may also be recommended to single-family gas heat customers in RI, but these are rebated through a separate National Grid gas rebate program. For multi family electric customers in MA, RI and NH, thermostats are installed at no cost to the customer

[6] Low-income customers may receive free refrigerators.

Massachusetts and New Hampshire, the audit contractor either installs approved measures using their staff or subcontracts all follow up measure installations.

Evaluation Goals

Through the impact and process approaches, evaluation of National Grid's Energy*Wise* program sought to answer the questions listed below.

Impact

- What are the total program energy savings and average savings per measure category (e.g., lighting, insulation, air sealing) for single-family homes in Rhode Island?
- What are the realization rates for electric heated, gas and general-use customers by state for the efficiency programs for multifamily homes?

Process

Stakeholder Perceptions

- Did all stakeholders have clear goals for and understanding of the program?
- Did implementers receive adequate training?
- Was program implementation smooth?
- How well were gas and electric measures integrated (where applicable)?
- Was program marketing effective?

Customer Satisfaction

- Were the program materials clear and easy to understand?
- Was the enrollment process straightforward?
- Did the respondent have any measures installed by the program?
- Did the installer arrive on time?
- Did the installation go smoothly?
- Was the respondent satisfied with the installed measures?
- Did the respondent notice any energy savings?

Educational Component

- Were the educational materials clear and easy to understand?
- Was the in-person customer educational component helpful?
- What energy-saving tips did the respondent remember?
- Did applicable customers receive assistance in saving both gas and electricity?

- Did the respondent adopt any of the recommendations? Which ones?

Follow Through

- For customers who did not install recommended additional measures, why not?

Freeridership and Spillover[7]

- Would the respondent have installed the measure in the absence of the incentive?
- Did the respondent take any additional actions to save energy?

Evaluation Approach

The evaluation work plan Cadmus developed for the Energy*Wise* program incorporated several different evaluation tools. Methods employed included a survey of Rhode Island single-family participants, stakeholder interviews of National Grid and RISE Engineering implementation staff, review of program documents and tracking database, billing analysis, and secondary research of similar measure savings from other sources and previous evaluations.. Table 2 summarizes the evaluation tasks.

Table 2. Summary of Evaluation Tasks

Action	Impact	Process	Details
Participant Survey		✓	Determined customer satisfaction, education effectiveness, customer follow through, freeridership, and spillover.
Stakeholder Interviews	✓	✓	Provided insight into program design and delivery. Follow-up interviews provided specific insight into data tracking.
Document Review		✓	Provided insight into program design and delivery.
Review and Analyze Tracking Database	✓	✓	Analyzed installed measures and provided inputs for billing analysis.
Secondary Research	✓		Reviewed similar program measure savings to validate billing analysis in other areas and from previous Energy*Wise* evaluations.
Billing Analysis	✓		Calculated measure savings and realization rates.

Impact evaluations were performed for single-family customers in Rhode Island, multifamily facilities in Rhode Island and multifamily electrically heated and general use electric customers in Massachusetts. Low income customers treated by the multifamily program in Massachusetts were evaluated with the other multifamily customers.

The process evaluation focused on single-family customers in Rhode Island only. Many of conclusions from the Rhode Island single-family focused process evaluation may be applicable to other customer segments.

The remainder of this report describes specific methodologies used for each of these evaluation tools and evaluation results.

[7] The freeridership and spillover section used the California net-to-gross approved battery of questions. Due to survey length constraints, only refrigerators and insulation measures were explored via this approach, and only for non-low-income participants. (i.e., the net-to-gross ratio for low-income customers was assumed to be 1.0).

2. Stakeholder Interviews

Methodology

Cadmus interviewed key program and Rhode Island subcontractor staff by phone. Interviewees included the National Grid program manager and six RISE Engineering implementation and management personnel. Table 3 identifies staff interviewed by position title. Interviews focused on assessing program delivery and integration of the gas customers into the Energy*Wise* program, which started during 2007.

Table 3. Titles of Program Staff Interviewed at RISE Engineering

RISE Staff Interviewed
Director of Residential Services
Multifamily Services
Multifamily Project Coordinator
Installations Supervisor
Residential Energy Auditor
President

The stakeholder interviews sought to document National Grid and implementer views on program activities, issues, and goals, and obtain implementer feedback on program processes. The interviews, which two Cadmus staff conducted by phone, were based on the interview guide included as Appendix C of this report. Interviews were structured to draw out detailed information by asking open-ended questions, offering Cadmus staff an opportunity to explore additional, relevant topic threads identified by interviewees.

A second set of interviews were conducted to investigate procedures and issues surrounding data tracking in further detail. The results of these interviews are reported in Section 3: Data Tracking.

Findings

Program Implementer

In 2005, National Grid requested proposals and considered various candidates as potential implementers of the Rhode Island Energy*Wise* program. National Grid sought an implementer: located within its service area, Building Performance Institute (BPI) accredited, and experienced with similar projects. RISE was selected through a competitive bid process.

Based in Cranston, Rhode Island, RISE specializes in implementation of demand-side management (DSM) programs for a variety of program sponsors. Now a division of Thielsch Engineering, RISE was founded as Rhode Islanders Saving Energy in 1977 with the support of Rhode Island government, banks, and private corporations. RISE has delivered energy-efficiency programs for utility companies for over 30 years, and has implemented National Grid's Energy*Wise* program since the program's 1997 inception. Staff interviewed estimated RISE has approximately 100 to 150 employees.

RISE currently implements both single-family and multifamily Energy*Wise* program components for both gas and electric customers in Rhode Island. In 2007, the Rhode Island program was expanded to cover gas customers, and RISE was retained as the gas program implementer through an expansion of its existing electric program contract with National Grid.

The long tenure of RISE as the Energy*Wise* implementer created a high level of institutional memory and program knowledge at the engineering firm. Three RISE employees interviewed by Cadmus had worked on the program since its inception. All six RISE employees conveyed a great sense of pride in their work and expressed personal investment in the program's success.

The long-standing relationship between National Grid and RISE also created a high level of trust between the parties. RISE staff reported their firm was directly involved in the process when National Grid filed the new Rhode Island gas program with the Rhode Island Public Utilities Commission. The close cooperation and trusting relationship between National Grid and RISE was further illustrated by the multiple extensions of the Energy*Wise* contract for the Rhode Island program. National Grid chose not to request implementation bids for the 2008 and 2009 program, opting instead to extend their contract with RISE.

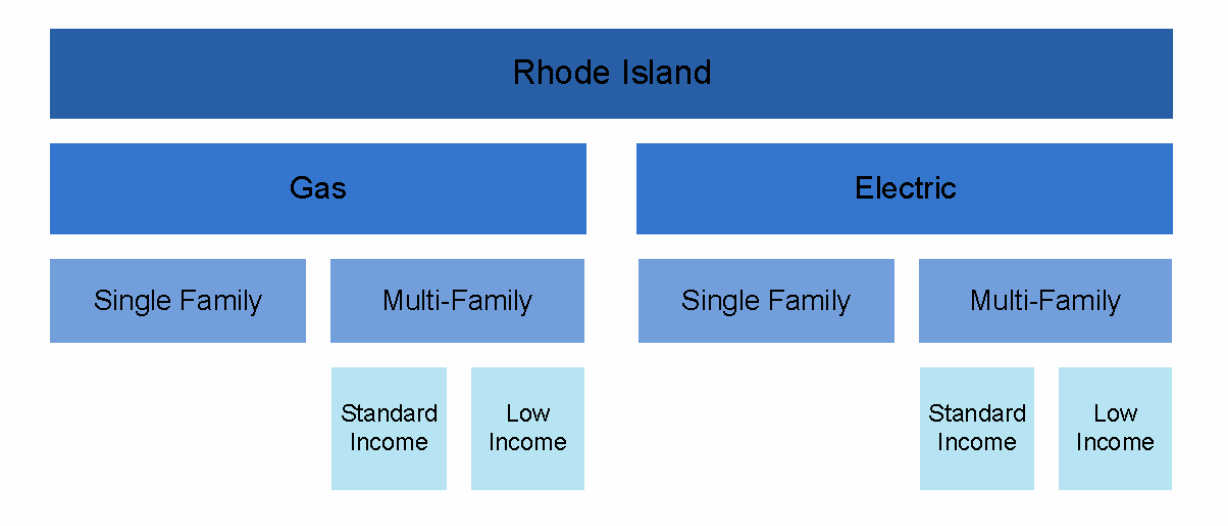
Program Goals

We asked stakeholder interviewees to identify their perceived goals of the Energy*Wise* program. Although responses tended to reflect particular duties of the individual, a majority of responses identified three major goals:

- Reducing kWh/therm consumption of electricity and natural gas;
- Helping customers save money and improve the efficiency and comfort of their homes; and
- Delivering high-quality audits and installations, and maintaining home safety.

Implementation staff put a strong emphasis on the high quality of their work, and their careful attention to customer service. Notably, none of our interviewees mentioned specific annual goals for kWh reduction or similar quantified targets. Two respondents mentioned meeting budget requirements as part of program goals, explaining budget targets have been set for various customer segments. Figure 3 shows the program's major budget categories, as reported by interviewees.

Figure 3. Major Budget Categories in the Rhode Island Energy*Wise* Program



All individuals interviewed felt the program was achieving its goals. One staff person felt the Energy*Wise* program was "less cumbersome" and therefore more successful than other programs with which he had worked. Other stakeholder respondents reported receiving significant positive feedback directly from customers. Across the board, program staff seemed to be very satisfied with the work they do.

Staff and Training

The roles of Energy*Wise* program staff at RISE appear to be very clearly defined, and training was indicated as a high priority. One staff member described his training as "absolutely comprehensive and complete," and all staff we spoke to reported their training had been at least sufficient; many stated that training exceeded that needed to perform their duties.

One staff member detailed the training process for installation staff, and noted the emphasis is on home safety. New employees begin with combustion safety training, and continue to receive additional training in-house and in the field. Less-experienced employees are paired with more senior employees on field crews to ensure quality control. According to one interviewee, this training process takes approximately 9 to 12 months, and brings a new employee up to speed in terms of identifying energy-saving potential and understanding safety and quality standards. Installers are not required to have BPI Certification prior to working at RISE, but staff members are encouraged to work toward Certification, and the installations department aims to achieve BPI Certification for its entire staff.

Marketing

RISE staff reported they had limited input on marketing, as National Grid carries most of that responsibility. National Grid asks certain program staff at RISE to comment on marketing materials before they are finalized. National Grid's marketing mostly consists of bill inserts, with RISE staff conducting some outreach for the program. National Grid and RISE staff both indicated most participation arises through word of mouth or people calling National Grid regarding their bills.

The program's multifamily portion is marketed mostly through RISE staff's direct contacts with property owners. Some inquiries for both condos and rental properties are received through word of mouth. However, the service territory is relatively limited, and multifamily services staff are very well-acquainted with eligible facilities. Frequently, RISE staff will know the buildings and the type of measures they need. One interviewee pointed out marketing the multifamily program faces some inherent challenges because individual rental tenants or condominium owners cannot make decisions for their unit. Rather, the property owner or condo association must initiate and coordinate program participation.

Findings from the participant survey indicate most participants learn about the program via word of mouth or bill inserts (see Section 6). Very few participants access the program via the Internet; in fact one staff member at RISE believed National Grid's energy-efficiency Web site (www.thinksmartthinkgreen.com) is difficult to remember; even people who work on the program have a hard time recalling the URL.[8] Most stakeholders perceived that interested customers most often call National Grid or RISE directly to gather information about the program.

Program Offerings

In 2007, the Energy*Wise* program was expanded to serve gas customers, following National Grid's acquisition of New England Gas Company's Rhode Island subsidiary and KeySpan, a natural gas and electricity utility serving parts of New York and New England. Interviews with stakeholders at both National Grid and RISE indicated several challenges in the first year of the gas program:

- There was no formal revision to the existing implementation contract when the gas program was added; rather, only informal communication occurred regarding the program's expansion.
- Details on measures and rebates offered through the gas program were simply copied from the electric side of the program.
- The development of data tracking and invoicing resources provided by National Grid took several months to be updated and become fully functional.

However, expansion appeared to be fairly seamless to the public as the program was able to launch quickly and successfully serve customers in 2008.

When asked if eligible measures should be expanded, most RISE staff felt the measures offered were sufficient; however, a few additions were suggested, including: installation of windows and doors, high-efficiency motors in large multifamily buildings, washers and dryers, blower-door testing to guide air sealing, and mechanical ventilation to allow more aggressive air sealing.[9]

[8] This Web site now redirects to a new URL, www.powerofaction.com.

[9] One of these—blower-door testing to guide air sealing—has already been implemented; as of July 22, 2009, gas heating homeowners who contract for at least 500 square feet of insulation are also eligible for a rebate on the full cost (up to $750 per home) of blower-door directed air sealing. (According to http://www.riseengineering.com/documents/RISE_EU_Resid_RI_072209.pdf)

Single-Family Audits and Installations

Auditors are typically scheduled to perform three single-family audits in a day, which, according to RISE staff, allows plenty of time for them to converse with the customer. The auditor is often able to help the homeowner select measures they would like to install, and explain various incentives and tax credits to help the customer determine final costs. RISE contacts the homeowner approximately 10 days after the audit to see if the customer would like to pursue installations through RISE.

RISE makes every effort to complete an installation in a single day for single-family customers, even when this means sending multiple installation crews to a home. Installations crews generally consist of three members—a crew chief and two installers. The homeowner is required to be present for the installation. The crew chief introduces the customer to the team, reviews the contracted work with the client, and takes responsibility for safety protocols and quality assurance during installation.

Once installations are complete, the homeowner signs off to certify satisfactory completion of the work. When RISE is the installer, the customer will be billed for the remaining cost after the utility rebate, and RISE bills National Grid for the rebate. If another contractor installs the measures, the customer pays the total cost, then applies for the rebate from National Grid.

Multifamily Audits and Installations

Because many multifamily facilities in National Grid territory have already been served through the Energy*Wise* program, RISE contacts previous multifamily customers served within the last seven years or more to see if additional measures are needed or measures originally recommended were not installed.

Contact with multifamily facilities can be initiated either by RISE or the facility owner, management, condominium owner, or tenants. After a building is identified, National Grid must certify the facility meets the following eligibility requirements: 1) having owner, manager, or homeowners association approval prior to the audit; or 2) an audit has not been performed in the previous seven years. If a tenant or condominium owner expresses interest in the program, RISE requests approval from the owner, manager, or homeowners association prior to conducting the audit. RISE staff report some condominium owners express frustration at having to wait for other homeowners in their association to agree.

RISE staff begins a multifamily audit by gathering information such as floor plans, tax assessor's information, and other available information. Unlike the single-family program, no measures are installed during multifamily audits. RISE staff aim to gain access to a representative sample of units during the audit. For example, if a building has three different types of units, RISE will request the manager or homeowner provide access to each unit type. They also tour the building's common areas, and assess any attic space, which may be accessed through individual units, before determining measures eligible for installation.

Upon the audit's completion, the facility owner or manager is presented with a proposal for installation of eligible and cost-effective measures, and a contract is signed between RISE and the owner or manager. In the case of individually owned condominiums, the unit owners are presented with a list of measures eligible for incentives, based on inspections of representative

units. Common area and building shell measures, such as attic insulation, are proposed to the association.

The multifamily installation process depends on the number of units in a facility. For facilities with 20 or fewer dwelling units, most measures are installed by RISE's staff. For 20 unit or larger facilities, RISE subcontracts the majority of work through a competitive bidding process, except for air sealing, which is performed directly by RISE to ensure compliance with RISE's safety requirements. Refrigerators are delivered and installed by Kenmore Sears, which also removes the existing refrigerators. Installations may take up to a few months, depending on their size and complexity; therefore, RISE has a project manager perform scheduling, reviews, and follow-ups with facility management.

Follow-up

RISE conducts inspections on all installations performed by in-house staff for both multifamily and single-family properties. Reportedly, National Grid staff is initiating third-party inspections, starting in 2009, to ensure a more robust quality assurance system. RISE installation staff reported they seek ongoing communication with clients to resolve problems as they occur.

Customers receive a client satisfaction survey, to be returned to RISE, for comments about their experiences. Staff reported the president of the company reads each of these surveys to ensure no problems are overlooked. If problems arise with installations, RISE follows up individually with customers to resolve complaints. Staff reported infrequent complaints, and, when they do occur, they tend to be about a measure not being installed or damage incurred during installation. RISE makes it a practice to repair damage and make appropriate adjustments to the customer's invoice.

Data Tracking and Invoicing

Data tracking and invoicing are prepared electronically using National Grid's InDemand work management tool for electric customers and a spreadsheet for gas customers. We asked National Grid and RISE staff to comment on this data management tool, its operation, effectiveness, and ease of use. InDemand was created by National Grid in 2004, and the Energy*Wise* Program was the first to use it for implementation. National Grid program managers and evaluation staff are responsible for requesting changes or updates in the system, and the IT department is responsible for responding to these requests and implementing changes.

The major concern with InDemand regarded its unavailability for gas data at the gas program's initiation. Therefore, during development of the InDemand gas module, RISE utilized a spreadsheet and a separate tracking system from a different gas program for storing and tracking data. RISE staff reports, as of August 2009, the In Demand system was updated with current pricing and incentive levels, and the gas module was available for National Grid's program. One RISE staff person complained InDemand occasionally freezes, making it difficult for work to proceed.

A more detailed discussion of data tracking in the Energy*Wise* program is presented in Section 3: Data Tracking.

Market Feedback

Individuals interviewed reported a very positive overall response from customers, and noted customers are pleased with the money and energy savings they have achieved. One staff person

believes technology improvements have allowed customers to benefit both in installation aesthetics and performance, making customer response even more positive. Another staff member noticed an increasingly high level of interest in energy conservation among property owners during recent years—both for multifamily facility owners and individual homeowners. Customer response is discussed in greater detail in Section 4: Participant Surveys.

3. Data Tracking

During the evaluation process, Cadmus encountered challenges analyzing and interpreting program data, and for some segments, estimated energy savings to be significantly different from National Grid's planning assumptions. As such, National Grid requested that Cadmus review and critique the program's data tracking system for both the electric and gas components of the 2008 program. This review, like the rest of the process evaluation, focused on the Rhode Island program, however, some of the resulting recommendations may be applicable to other states served by the Energy*Wise* Program. This section summarizes the review, which comprised the following tasks:

- Requested contact name and information for those involved in data tracking for the program
- Developed a list of questions for identified data tracking personnel
- Interviewed the three National Grid and two RISE employees identified by National Grid (see interview guides, included as Appendix D:)
- Reviewed sources of National Grid predicted savings for EnergyWise program impact results
- Described data quality issues and hurdles encountered in performing the EnergyWise program impact evaluation
- Made recommendations for future changes to tracking and data transfer for evaluation purposes.

A summary of the process of collecting the data and explain how these data move from the implementation contractor (RISE) to National Grid is provided, followed by a discussion of the savings estimates and the source for these estimates. Finally, an overview is given of problems with the data that complicate billing analysis for evaluation purposes. Recommendations for improvements are identified within each section. Table 4 summarizes the data tracking and savings estimates for each program segment.

Table 4. Energy*Wise* Data Tracking and Program Savings Estimation Approach

Customer Type	Massachusetts	Mass. Low Income	Rhode Island	New Hampshire
Single-family electric heat	N/A	N/A	In-Demand tracks participant data but does not estimate savings, instead deemed estimated from previous evaluations are used.	N/A
Single-family general use (electric customers with non-electric heat)	N/A	N/A	In-Demand tracks participant data but does not estimate savings, instead deemed estimated from previous evaluations are used.	N/A
Single-family gas heat	N/A	N/A	In 2008 a spreadsheet was used to track participant data. In-Demand calculated savings based on algorithms with specific home-level inputs. Savings estimates were added to tracking spreadsheet. In 2009 In-Demand was connected to gas customer information system for identifying accounts and tracking participation.	N/A
Multifamily electric heat	In Demand tracks participant data and estimates savings based on algorithms with specific building inputs.	In Demand tracks participant data and estimates savings based on algorithms with specific building inputs.	In Demand tracks participant data and estimates savings based on algorithms with specific building inputs.	In Demand tracks participant data and estimates savings based on algorithms with specific building inputs.
Multifamily general use (electric customers with non-electric heat)	In Demand tracks participant data and estimates savings based on algorithms with specific building inputs.	In Demand tracks participant data and estimates savings based on algorithms with specific building inputs.	In Demand tracks participant data and estimates savings based on algorithms with specific building inputs.	N/A
Multifamily gas heat	N/A	N/A	In 2008 a spreadsheet was used to track participant data. In-Demand calculated savings based on algorithms with specific home-level inputs. Savings estimates were added to tracking spreadsheet. In 2009 In-Demand to gas customer information system for tracking and identifying multiple customer accounts for multifamily buildings.	N/A

Collecting Participant Data

As described in Section 2, National Grid and its contractors use a system called InDemand to track data associated with the Energy*Wise* program. InDemand has been used since approximately 2004 to track customer and measure information and to calculate electricity savings resulting from the installation of energy conservation measures. National Grid initiated the Energy*Wise* program for gas customers in Rhode Island in late 2007, but did not simultaneously update the InDemand system for use in tracking gas customers and their associated installed measures. Therefore, throughout the year 2008 (which formed the basis for this evaluation), gas program customer information and estimated measure savings were separately developed by National Grid's contractor, RISE, and tracked in spreadsheets. RISE has its own in-house audit software containing measure savings estimates and formulas, and these were used to estimate 2008 savings.

In addition to customer identification data, InDemand contains either savings estimates (for single family homes) or the formulas for calculating savings estimates based on specified inputs for that type of measure (currently for electricity savings in multifamily facilities only). These savings estimates are developed jointly by RISE Engineering and National Grid implementation and evaluation staff. InDemand also performs calculations at customer sites to estimate costs and benefits of proposed measures and generates recommendations that are given to the customer at the end of the audit.

The InDemand system connects to National Grid's customer information system (historically for electric customers and starting in 2009 for gas customers). Using customer names and addresses, billing account numbers and usage information are obtained. Participant data (name, address, etc.) are collected from the participant by RISE and input into the InDemand data tracking system. Preliminary data are collected over the phone, and the information is verified once the site is visited.

RISE enters the information into InDemand, and pulls all accounts that link to the same building or complex, based on address or site information such as meter numbers. RISE personnel then verify this information during the site visit by collecting the meter numbers to ensure that they have the correct account numbers for the units inside. All accounts associated with the facility (including both gas and electric accounts for those facilities with multiple buildings with different addresses) are linked to the facility.

During 2008, when the gas program was in its first year of operation, InDemand did not connect to National Grid's gas customer billing system when customers were identified for the EnergyWise program. National Grid therefore pulled customer billing data for evaluation purposes after measures installation, without the benefit of a site visit and meter verification. We believe that the lack of site visits led to an inability to correlate billing data with measures data, as discussed later.

While gas customer information was linked to National Grid's billing system starting in early 2009, InDemand has not yet been updated with gas savings predictions.

Savings Estimates

According to National Grid, savings estimates for single-family electric measures used for the tracking system are reviewed and updated each time an external evaluation is performed.

Separate estimates are made for single-family gas, multifamily electric and multifamily gas measures.

Rhode Island Single-Family Electric. National Grid's predicted savings for the 2008 single-family electric customers were based on the results of the 2001 Energy*Wise* program evaluation. This program evaluation used billing analysis to estimate electricity savings by groups of measures (such as CFLs, domestic hot water measures, and insulation) rather than specific measures (such as replacing a 100 W incandescent with a 20 W CFL, installing a faucet aerator, or adding R-19 attic insulation per square foot), for both electrically and non-electrically heated single-family homes. A billing analysis evaluation was also performed in 2005, 2003, 2002, and 2001. Savings per home were based on the 2001 single-family billing analysis. In 2005, a realization rate[10] was estimated on a total home basis and not by end use or measure. Billing analysis is a useful evaluation tool and can provide accurate results, particularly on an aggregate basis. However, using billing analysis results for groups of measures to provide individual measure projections going forward may provide inaccurate results, as it is unlikely that future participants will install the same quantities and groups of measures as those in the billing analysis population.

Table 5 below shows the 2001 evaluation estimated savings results by end use. Interestingly, CFL savings in electrically heated single-family homes are almost double CFL savings in non-electrically heated homes.[11] Data were unavailable as to how many CFLs and what type were installed on average in each home type or assumed hours of use, but one would assume more CFLs were installed in the group of electrically heated homes during that program year since savings estimates are higher. It is also possible that the estimate for CFLs may "pick up" other energy variations occurring in that group of homes. For example if audit participants also make other energy efficiency upgrades (spillover) or make behavioral changes such as setting back thermostats and turning off lights when not in use, these energy savings may append to other measures in a billing analysis. Similar questions and inconsistencies are raised with the other measures as well, indicating that simply using previous billing analysis results without additional information to help interpret them (such as number or type of installations) could be problematic.

[10] A comparison to the average per-home savings calculated in the 2001 evaluation.

[11] Electrically heated homes, particularly in cooler climates, may be expected to save less electricity per home from CFLs due to potential interactive effects (i.e., CFLs produce less heat than incandescents, and may lead to a slight increase in heating load).

Table 5. 2001 EnergyWise Evaluation Billing Analysis Results

Measure	Electrically Heated Single-Family Homes Estimate (annual kWh per home)	Non-Electrically Heated Single-Family Homes Estimate (annual kWh per home)
CFLs	885	452
Lighting Fixtures	150	522
Domestic Hot Water Measures	799	611
Refrigerators	1,102	1,076
Insulation	663	390

Multifamily Electric. Multifamily electric savings estimates, which are used in all states served by the Energy*Wise* Program, were based on engineering estimates to a fine level of detail. InDemand contains 388 individual estimates of electricity savings tied to a specific unit of measurement and customized for the climate in each state; for example, the database lists domestic hot water pipe wrap as saving 55 kWh per linear foot per year. Auditors input the linear feet of pipe wrap installed and the location of the building, and InDemand computes predicted savings.

Single-Family and Multifamily Gas. Since the gas component of the program was new in Rhode Island, savings estimates for 2008 were computed in RISE's in-house audit software program based on engineering calculations. For each measure recommended, RISE input specifics of each home or facility to its audit software program and calculated estimated savings. For example, estimated savings associated with air sealing are calculated after the auditor inputs the building volume. These same calculations will be input to InDemand to expand its functionality and include gas savings estimates in February 2010.

> **Key Recommendation:** Engineering formulas should provide the basis for individual measure savings predictions. Past evaluations should be used to inform the results and adjust assumptions associated with engineering formulas to improve estimates over time.

Assessment of Received Data

Cadmus received multiple files with billing, participant and measure information from National Grid, both for gas and electric participants in the Energy*Wise* program. These files are summarized below in Table 6.

Table 6. Files Received from National Grid

State	Home Type	Fuel Type	Billing Data	Customer Information	Measure Information
RI	Single-Family	Electric	RI SF Billing Data.TXT	XEW Facility SF 2008.xls	EW Installed Measure Savings Info 2008a.xls
	Multifamily	Electric	MA MF and RI MF Billing Data.txt	EW Facility MF 2008a.xls	EW Installed Measure Savings Info 2008a.xls
	Single-Family	Gas	KCross readings 8-10.xls	RI gas – List for Billing Data2.xls	2009 Planning process-RI Gas Participants.xls
	Multifamily	Gas	RI MF Gas therms_serv address_unit.xls	Energy Wise Multifamily Gas Participants	Gas Data by unit.xls
MA	Multifamily	Electric	MA MF and RI MF Billing Data.txt	EW Facility MF 2008a.xls	EW Installed Measure Savings Info 2008a.xls

Since the gas program initiated in mid-2007, and data tracking for that program was performed outside of InDemand, Cadmus encountered more difficulties with the gas data than with the electric data in performing its evaluation of the Energy*Wise* program for 2008. Difficulties with data analysis are categorized as follows:

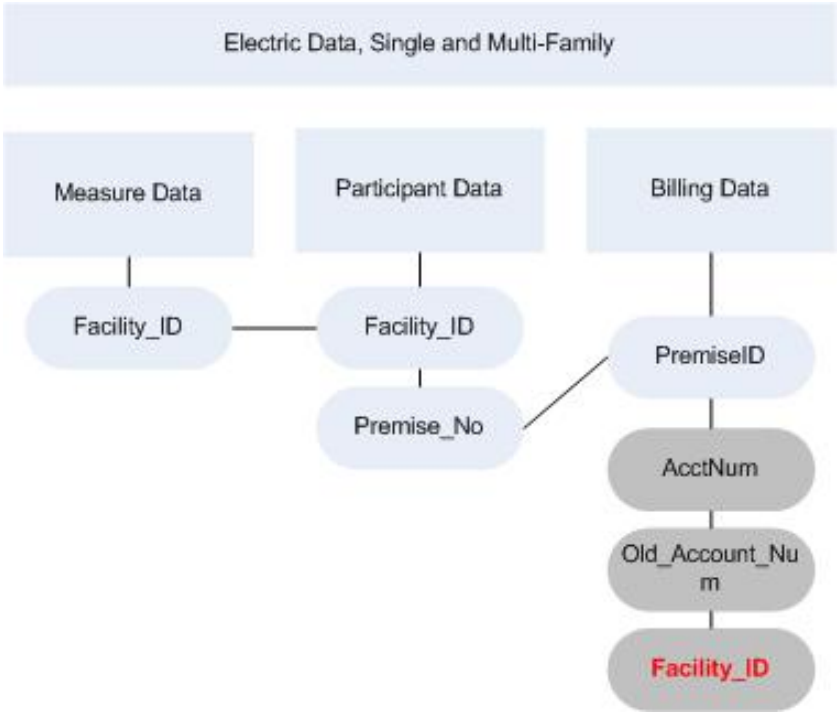
1. Inconsistent account identifiers
2. Measure information with missing account numbers
3. No data dictionary
4. Inability to ensure that multifamily data included all relevant accounts

Inconsistent Account Identifiers

Because Cadmus received data from several files (measure, participant and billing history files), the data needed to be integrated in order to conduct the analysis. An account identifier simplifies this process, allowing data to be linked through a common field. This section discusses the lack of a common link, the use of similar variable names to refer to data that were not the same, and the use of different variable names to signify the same data. This section first discusses the electric data and secondly the gas data.

Electric Data. Figure 4 shows the various types of electricity customer data and the numeric identifier fields that these data included. Neither the participant nor the measure information for the electric participants included an account number field; rather, it included a premise ID and/or a facility ID. Therefore, to link the data, the participant information needed to be linked to the measure information by facility ID and then linked to the billing data through the premise ID. Though the participant data did not include any fields required for the analysis, it still needed to be included in the analysis in order to link the measure and billing information.

Figure 4. Identifier Fields Linking the Electricity Data



Although all three data files had a facility ID field, the facility ID field in the measure data file contained a different facility ID than the same field in the billing data file. This problem arose because RISE and National Grid each had assigned a separate facility ID. This created some confusion, as Cadmus analysts needed to work with two separate, unrelated facility ID fields.

> **Key Recommendation:** One participant or facility identification number should be used to track across all data files.

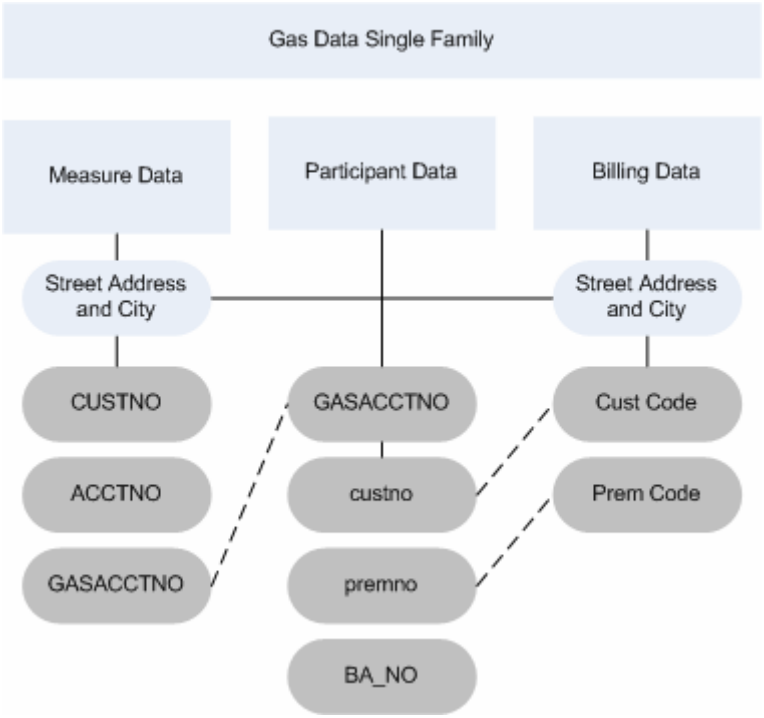
Gas Data. The main issues with the gas data included: (1) multiple missing values in the account number fields, (2) no common identifier to link the data, similar to the problem with the electric data discussed above, and (3) a variable with the same name in all three data sets that did not have common values. The first issue, missing account information, rendered the field unusable as a way to link data. This is discussed in the next section.

The second issue can cause problems, increasing the time needed both to conduct the analysis and check for accuracy. In this case, the participant data did not include any information necessary for analysis but rather contained the keys needed to link the data together. The preferred method of linking is shown by the dotted lines in Figure 5. However, since some of the account numbers were missing, Cadmus could not link the data as shown but instead had to resort to linking by street addresses. Street addresses can be problematic due to variances in spelling, and for multifamily accounts – different addresses for different units.

The third issue is similar to a problem seen with the electricity data. The gas measure data contained a field "CUSTNO" that appeared similar to "custno" and "Cust_Code" in the

participant and billing data. However, these data were not the same, as the values for a particular customer were different in each file, making the field confusing during the analysis. This problem arose because RISE had one identifier for each customer, and National Grid had a different identifier.

Figure 5. Identifier Fields Linking the Gas Data



Key Recommendation: InDemand should not include variable names that are the same as or very close to variable names in National Grid's customer account system unless those fields house the same data. If an implementer assigns an ID code unique to InDemand or other tracked data, it should have a different variable name than any ID code used in the billing system.

Measure Information with Missing Account Numbers

Missing information is problematic, as fields with multiple missing values are no longer reliable for linking purposes. For instance, if five customers do not have account numbers filled in with their measure data, the measure information will not link to the billing information, leading to the erroneous conclusion that the customers did not install measures or that the customers do not have a billing history. The measure information was missing multiple entries for ACCTNO and GASACCTNO, rendering those fields useless for linking purposes.

For some participants, gas account numbers were not included in the measure data. The largest percentage of missing gas data was for multifamily buildings, where the number of unique buildings (not accounts) for which Cadmus received data was 28. Of those, 13 were missing account numbers. These data did not have any other identifier included, except for street name

and city, which were used for the data merge. As such, we believe the billing analysis was missing some accounts and billing histories for customers who installed measures.

For single-family gas, some participants were missing the field ACCTNO, and others GASACCTNO. Again, this necessitated using street address fields to merge data together and resulted in lost billing data.

> **Key Recommendation:** All data associated with a customer must include an account number, ideally, or at least one common and consistent identifier to link back to billing data.

No Data Dictionary

Data provided to Cadmus did not include a data dictionary, and our later inquiries to RISE and National Grid staff did not uncover a data dictionary. The result was that the data needed additional review before analysis to decipher the variables, and Cadmus analysts needed to send multiple questions to National Grid to ensure that we understood the various fields.

For example, the initial measure data provided for electric participants did not include a date field, though the file with the participant information did have a field called "Participation_Date." As there were no other date fields provided with the installation date, we believed this field was the date that the measure was installed. However, after discussions with National Grid, we realized that this field was not the date of measure installation, and we received a new file with a field added called "Installation_Completed" that showed the date the measure was installed. Had there been a data dictionary, this confusion could have been avoided.

> **Key Recommendation**: A data dictionary should be developed to describe all variables used in the tracking process and any formulas when applicable. When contractors receive data they should receive a list of the descriptions of all variables sent, as well as a list of available variables that were not sent but could be sent if needed for the analysis.

Inability to Ensure That Multifamily Data Included All Relevant Accounts

The data Cadmus received did not have an identifier to allow analysts to distinguish between various buildings. Multifamily buildings can have various types of addresses; some buildings that share common walls but which are side by side may have different street numbers even though they are technically one building, or a facility may have the same street name for more than one building; or buildings on different street names still in the same complex. Having all account information is important to account for savings associated with insulation, as installation of these measures in one unit or in a common area generally lowers the consumption in multiple units.

National Grid used account numbers and street addresses to pull the consumption history for multifamily buildings, but it was not clear whether these histories included the entire building or only some of the units in all cases. Because of the way the billing data was pulled for 2008, we suspect some accounts may be missing. We do believe that RISE's newer procedures to verify meters through site visits, allowing measures data to link with billing data, should prevent future problems.

Key Recommendation: For multifamily customers, InDemand should track all meters and account numbers for each facility and include a description of the units and common areas associated with each number. This will allow the evaluator to ensure all relevant data are available. Numbers of units and numbers of buildings should also be tracked to assist in interpreting billing analysis results.

4. Participant Surveys

Methodology

Cadmus conducted telephone surveys with a sample of single-family participants from Rhode Island to: (1) understand how participants learned about and signed up for the program; (2) determine satisfaction with program delivery and installed measures; (3) determine ways to increase customer follow-through on audit recommendations; and (4) test for freeridership and spillover. Appendix A contains the survey questionnaire.

While 265 surveys were estimated to be required to achieve minimum accuracy, in reality the response rate was higher for those installing refrigerators or insulation, and 238 responses met the minimum required for each identified stratification level.[12] Those installing refrigerators and insulation more commonly responded to the telephone survey and therefore required a weighting of responses to eliminate possible self-selection bias.

For sampling purposes, National Grid provided Cadmus with four program databases of participating customers. Cadmus analyzed these databases and developed a sample with a 90% confidence interval, stratified into four types of participants: (1) gas heating customers who installed major measures;[13] (2) electric heating customers who installed major measures; (3) general use heating customers who installed major measures; and (4) customers who installed no major measures. These categories are first based on whether the participant installed major measures, then on heating type, and should not be confused with designations between National Grid's gas and electric customers. Additionally, two special segments of those installing either insulation measures or new refrigerators were targeted for oversampling to obtain information about freeridership and spillover regarding these measures, again with an accuracy of 90% confidence with +/- 10% on the results. Table 4 shows the sample size required for each stratum to achieve the required accuracy.

Table 4. Required Sample Size for Major Strata

Stratum	Population	Sample size needed to achieve +/- 10% precision with 90% confidence
Electric Heating	78	36
Gas Heating	596	61
General Use	434	58
Audit - No major measures	1,729	66
Total	2,837	221

Table 8 describes the sample size required for +/ 10% precision with 90% confidence for refrigerators and insulation measures.

[12] This is not surprising as these customers had a larger time and money investment in the program, thus, they were are more likely to spend the time to respond to a survey.

[13] Major measures for gas heating are defined as: Heating System Replacement, New Windows or Doors, Air Sealing, Duct Systems, Ventilation, and Heating System Tune-Ups. Major measures for electric heat customers also include refrigerators.

Table 8. Required Samples to Meet Accuracy Levels for Specialty Segments

Specialty Segment	Population	Sample size needed to achieve +/- 10% precision with 90% confidence
Refrigerators	148	47
Insulation	256	54
Total	404	101

Given the number of refrigerator and insulation samples needed on top of the original stratified samples by heating type, Cadmus estimated total sample requirements of 221 + 44 (or 265). However, more respondents from specialty segments than expected were surveyed in the initial sample, resulting in a final sample size of 238, which contained sufficient respondents in all specialty segments. The makeup of the final sample is shown in Table 95.

Table 95. Survey Respondents by Stratum and Specialty Segment

Stratum	Respondents who installed Refrigerators	Respondents who installed Insulation	Respondents not in a Specialty Segment	Total Respondents
Audit – No Major Measures	15	0	55	70
Electric Heating	7	18	12	37
Gas Heating	9	44	13	66
General Use	24	0	41	65
Total	55	62	121	238

Because we oversampled participants who installed refrigerators or insulation, the sample contains a much higher proportion of these segments compared to the whole population of participants. In cases where the disproportion of the sample would affect the survey results, we have presented weighted results that adjust for oversampling of specialty segment participants.

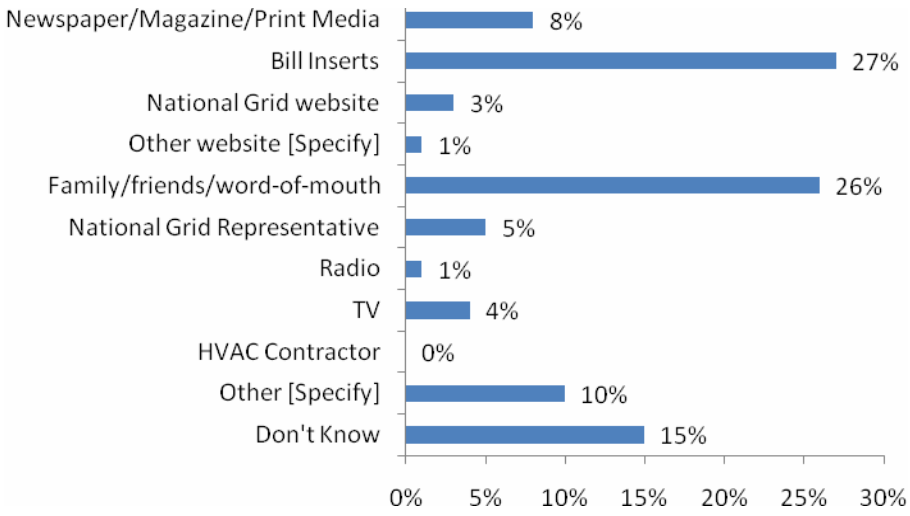
Findings

This section reports key participant survey findings, focusing on the following major topics: (1) how participants received program information; (2) participant decisions about measure installation; (3) participant satisfaction with installed measures, the program's educational component, and the program overall; and (4) freeridership and spillover effects.

How Participants Received Program Information

According to survey results, the two most common methods of learning about the program were (1) bill inserts (27% of respondents); and (2) family/friends/word of mouth (26%), as shown in Figure 6. Television and radio advertising reached fewer participants: 4% of respondents reported learning about the program through television advertising, and only 1% through radio advertising. Additionally, only 3% learned of the program through the Internet.

Figure 6. Customers' Initial Source of Information about National Grid's Energy Audit Program (n=238)



Once participants learned about the program, most respondents reportedly obtained further information by calling National Grid directly (62%). A smaller number of respondents (12%) used the National Grid Web site to gather further information.

Participants rated the ease of the information gathering process an 8.7 average on a scale of 0 to 10, with 0 meaning they "strongly disagree" and 10 meaning they "strongly agree" with the following statement: "The information about National Grid's energy audit program was easy to obtain and easy to understand."

The straightforwardness of the sign-up process had an average 9.1 rating, indicating most participants found the process of signing up for the program very easy. Only 5% of respondents gave a score of 5 or lower, indicating they felt the process was difficult. The most common reasons for dissatisfaction were National Grid took too long to return calls (2%) or customers were put on a waiting list (2%).

Measures Installed

Compared to the program implementer's records, respondents indicated records were incorrect for 16.1% of recorded measures. The largest total numbers of discrepancies were for the number of CFLs and number of water saving devices installed by the contractor, which are both smaller items and easier to forget.

Based on our experiences verifying similar programs, Cadmus does not expect that these results reflect a major problem with recordkeeping or reporting. It is likely that in many cases, the respondent did not recall some of measures installed. Table 10 lists discrepancies between customer's recollections and program records.

Table 106. Discrepancies between Reported and Recorded Installations

Measure	Number of responses	"Not Correct" responses	Percent reported "Not Correct"
Number of CFLs	212	22	10.4%
Insulation	70	9	12.9%
Air Sealing	57	13	22.8%
Refrigerator/Freezer	55	5	9.1%
Number of Water Saving Devices	47	18	38.3%
Number of Lighting Fixtures	26	1	3.8%
Duct or Pipe Insulation	25	7	28.0%
Programmable Thermostat	20	3	15.0%
Ventilation	10	4	40.0%
AC Timer	3	2	66.7%
Heating Tune-Up	2	1	50.0%
Total	527	85	16.1%

Another minor discrepancy arose when some respondents reported the contractor handed them certain measures without installing them, leaving customers to install the measures. Because of this specificity emerging without prompting, this information is likely to be accurate, even though the practice of handing the measure to the customer without installing is not allowed according to program rules. Such instances are reported in Table 7, below.

Table 7. Measures Reportedly Given to Participants by the Contractor, but not Installed

Measure	Total responses	"Just gave it, didn't install" responses	Percent reported "Just gave it, didn't install"
CFLs	212	19	9.0%
Water Saving Devices	47	3	6.4%
Duct or Pipe Insulation	25	1	4.0%
Total Number of Measures	284	23	8.1%

Follow Through on Measure Recommendations

According to program records, only 58% of measures recommended by the auditor were installed through the Energy*Wise* program. As shown in Table 12, measures with the lowest follow-through rates tended to be the most expensive to install. Fewer than half of recommendations to install insulation, for example, were followed. It should be noted that these installation rates do not account for customers who chose to install recommended measures independently, without receiving a rebate, which based upon the survey of single-family customers in Rhode Island, was 14%.

Table 12. Follow-Through on Measure Recommendations Given by Auditor

Measure	Installed	Recommended But Not Installed	Percent Of Recommendations Followed
Insulation	62	68	48%
Air Sealing	54	60	47%
Refrigerator/Freezer	55	23	71%
Duct/Pipe Insulation	23	17	58%
Heating System Tune-Up	1	9	10%
Programmable Thermostat	20	8	71%
Lighting Fixtures	26	0	100%
Ventilation	10	0	100%
Air Conditioner Timer	3	0	100%
Total	254	185	58%

The most common reason respondents reported for not installing a recommended measure was monetary (29 responses, 15%), followed by the participant having had the measure installed by a contractor, but not through the program (28 responses, 14%). It is also notable that 29% of responses given were "Don't know." The responses displayed in Table 8 include multiple reasons given by some participants, and highlight reasons for the three measures most often recommended but not installed—insulation, air sealing, and refrigerators or freezers.

Table 8. Reason for not Installing Recommended Measures

	Insulation	Air Sealing	Refrigerator or Freezer	All Measures
	n=68	n=60	n=23	n=185
I didn't want to spend the money required to install it	12	9	1	29
I don't know what to do next to make the arrangements	1	3	0	5
I don't want that measure installed in my home	13	7	1	27
I was unable to schedule the installation	7	2	0	11
Will be done in the future	3	2	3	9
Current measures sufficient	11	0	0	17
Installed by owner	1	9	0	11
Installed by contractor	4	2	18	28
Don't Know	21	25	0	56
Total responses	73	59	23	193

For refrigerators and freezers, respondents most commonly said they had the measure installed by a contractor. For programmable thermostats, the most frequent response was respondents thought the current equipment was sufficient. For all other measures, respondents most commonly reported cost as the reason they decided against installation.

Participant Satisfaction with Installed Measures

Customers were highly satisfied with the measures installed, with average satisfaction scores exceeding 8.0 for each measure type. Figure 7, below, illustrates satisfaction ratings for each of the four most commonly installed measures.

The only measures with average satisfaction scores below 9.0 were CFLs (average satisfaction score 8.4), water saving devices (8.5), and lighting fixtures (8.7). CFLs and water saving devices are both installed during the audit at no cost to the customer. Unsatisfied participants explained their dissatisfaction with these measures as follows:

- *CFLs:* 13% of participants who had CFLs installed reported a satisfaction score of 5 or below, and 10% of participants with installed CFLs reported they had removed at least one of the CFLs since the audit. The most common reason for the low scores (cited by 44% of dissatisfied customers) was the light was too dim.
- *Water saving devices:* Only 26 participants chose to have water saving devices installed. The low installation rate, along with the relatively low satisfaction scores from those who did install the measure, demonstrates water saving devices were not as well-accepted as other measures offered.
- *Lighting fixtures:* 8% of participants who had new lighting fixtures installed reported a satisfaction score of 5 or below, and cited dissatisfaction with the way lighting fixtures looked.

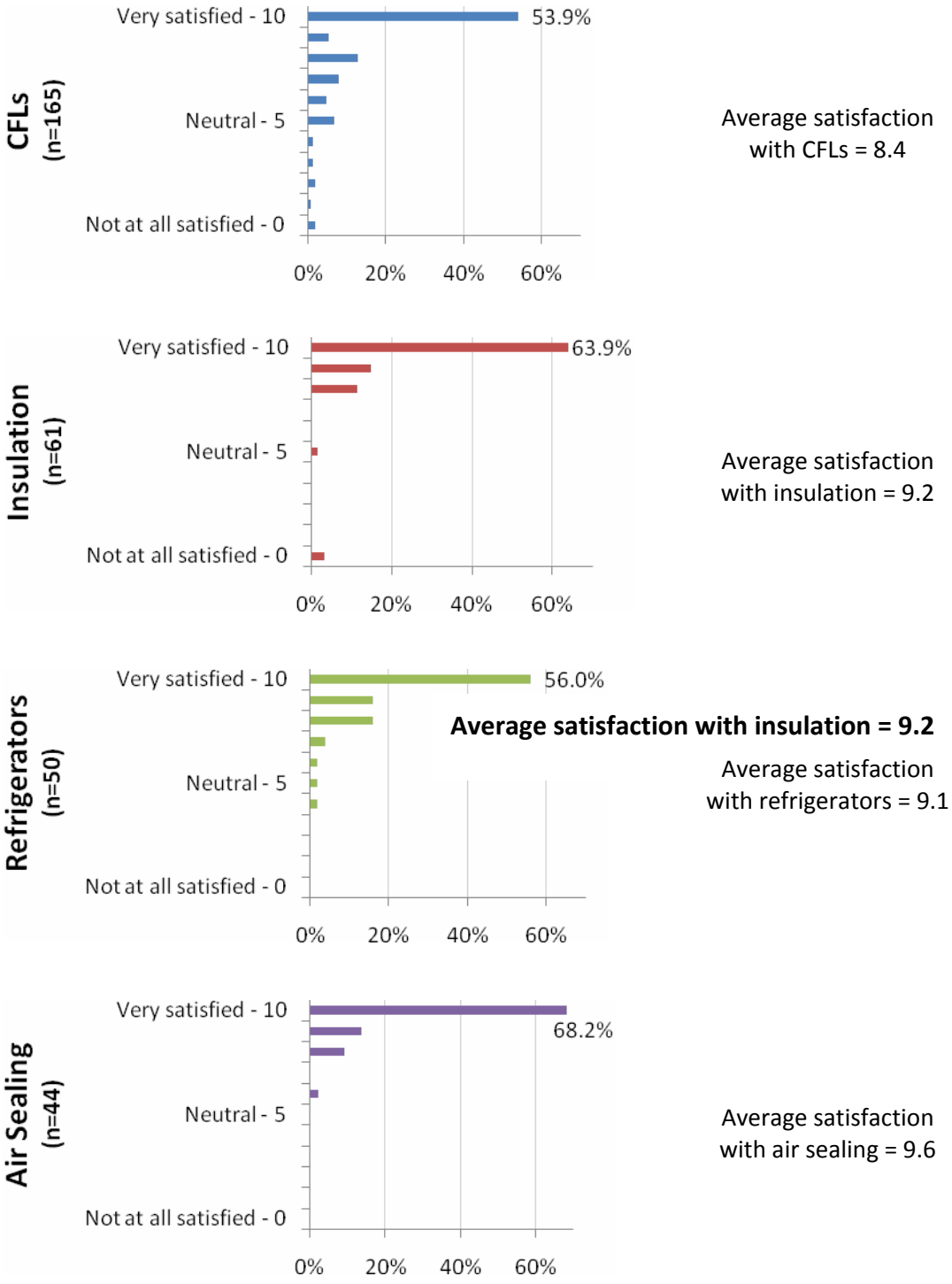
Satisfaction with Educational Component

Customers reported they found the Home Energy Action Plan (the document given to customers outlining recommended installations) very helpful, rating the helpfulness of the document an average of 8.3. However, this rating does not capture the 21% of respondents who did not recall receiving the action plan. Among participants rating the Home Energy Action Plan at a 5 or lower (12%), the two most common reasons for the low satisfaction were, first, the respondent did not agree with the contractor's suggestions, and second, the respondent had already installed most of the recommended measures. The total of those who either did not recall or were dissatisfied with the Home Energy Action plan (33%) is significant and represents an opportunity for improvement by ensuring everyone receives the plan and agrees with the savings opportunities.

Achieved Energy Savings

On average, participants rated energy savings they achieved as a result of their participation in the program at 5.7 out of 10, where 0 meant "no savings" and 10 meant "high savings," as displayed in Figure 8. (If weighted to account for the higher response from those installing refrigerators or insulation, the average response was 5.3.) An additional 21% of respondents reported that they did not know what level of energy savings they achieved. This low score, and the large number of participants who did not know how much savings they achieved, might point

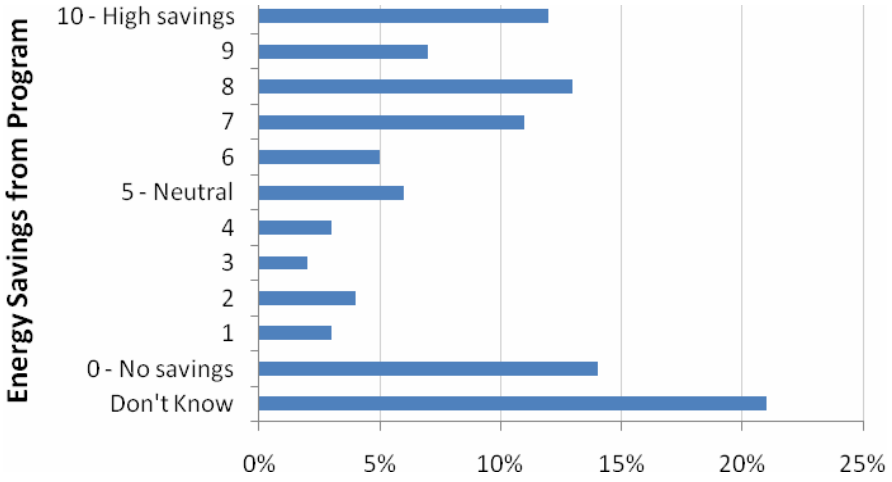
Figure 7. Satisfaction with Commonly Installed Measures: CFLs, Insulation, Refrigerators, and Air Sealing



Note: n = Number of participants with measure installed. Participants may have had more than one of each measure installed in their homes, and may have installed more than one type of measure.

to an opportunity to supply customers with more information regarding the savings they can expect to see from measures implemented through the program.

Figure 8. Customer Estimates of Level of Energy Savings Resulting from Participation in the Program



Data suggest participants were more likely to recall recommendations for changes in equipment than changes in behavior: 74% of respondents recalled the contractor providing them with information or tips regarding how to decrease their energy consumption. When asked to specify which tips they recalled, 31% of these respondents could not recall any specific tip they were given. Approximately 50% of specific tips participants reported were recommendations not for behavioral change, but for equipment replacements or installations. Table 14 shows the most commonly recalled behavioral tips.

Table 14. Commonly Recalled Behavioral Tips

Behavioral Tip	Frequency n=91
Turn off lights or install timers when not in use	18
Set thermostats high in summer and low in winter	10
Use power strip for electronics, turn off when possible	6
Turn off computer and monitor when not in use	5
Lower hot water thermostat to 120F	5

Respondents averaged a satisfaction score of 9.0 for the tips they recalled, and 67% of respondents reported implementing at least one of the tips since the audit. The most commonly implemented tips were "Turn off lights or install timers" and "Set thermostats high in summer and low in winter," corresponding to the most commonly recalled tips.

Gas Integration

The data indicate more attention may have been given to electricity-saving information during audits for gas customers. Participants who were gas customers and did not install any major measures were asked questions to determine whether more focus was given to one fuel or

another. Of the 43 respondents asked these questions, 58% (25 participants) stated the contractor provided them with information on saving both gas and electricity. Of those 25, 48% (12 participants) reported the contractor spent about equal amounts of time on each fuel, and 32% (eight participants) reported the contractor spent more time on electricity-saving than gas-saving information.

Overall Program Satisfaction

Overall satisfaction with the program was very high, with an average satisfaction rating of 8.3, and 46% of respondents reporting a satisfaction level of 10. (If weighted to account for the higher response from those installing refrigerators or insulation, the average response was 8.15.) When respondents giving scores of 5 or below were asked to specify what was unsatisfactory about the program, the most common response, reported by 33% of unsatisfied respondents (4% of total respondents), was that the contractor was not sufficiently thorough or helpful.

Roughly one-third of participants reported saving money was the greatest benefit of participating in the Energy*Wise* program. Table 9 displays responses participants gave when asked an open-ended question to name the greatest benefit of participation.

Table 9. Program Benefits According to Participants

Greatest Benefit	Percent of respondents (n=238, multiple responses allowed)
Saving money	31%
Hands-on help from contractor	27%
Saving energy	26%
Information	13%
Rebates	11%
Environmental impact	4%
The audit is free	4%
Nothing/no benefit	7%
Other	7%

Additional questions regarding program satisfaction also drew a positive response:

- Participants reported an average score of 8.9 for their satisfaction with how smoothly the audit and installations went, with 55% of respondents giving a rating of 10. (If weighted to account for the higher response from those installing refrigerators or insulation, the average response was 8.8.)
- Respondents would be very likely to recommend the Energy*Wise* program to friends and family (average score of 8.7, with 68% giving a score of 10). (If weighted to account for the higher response from those installing refrigerators or insulation, the average response was 8.7.)
- Forty-six percent of respondents said they had no suggestions for improving the program. Of suggestions offered, the most common were: increase incentive levels or decrease costs to customers (9%); and provide a more thorough audit (8%).

5. Freeridership and Spillover Effects

Methodology

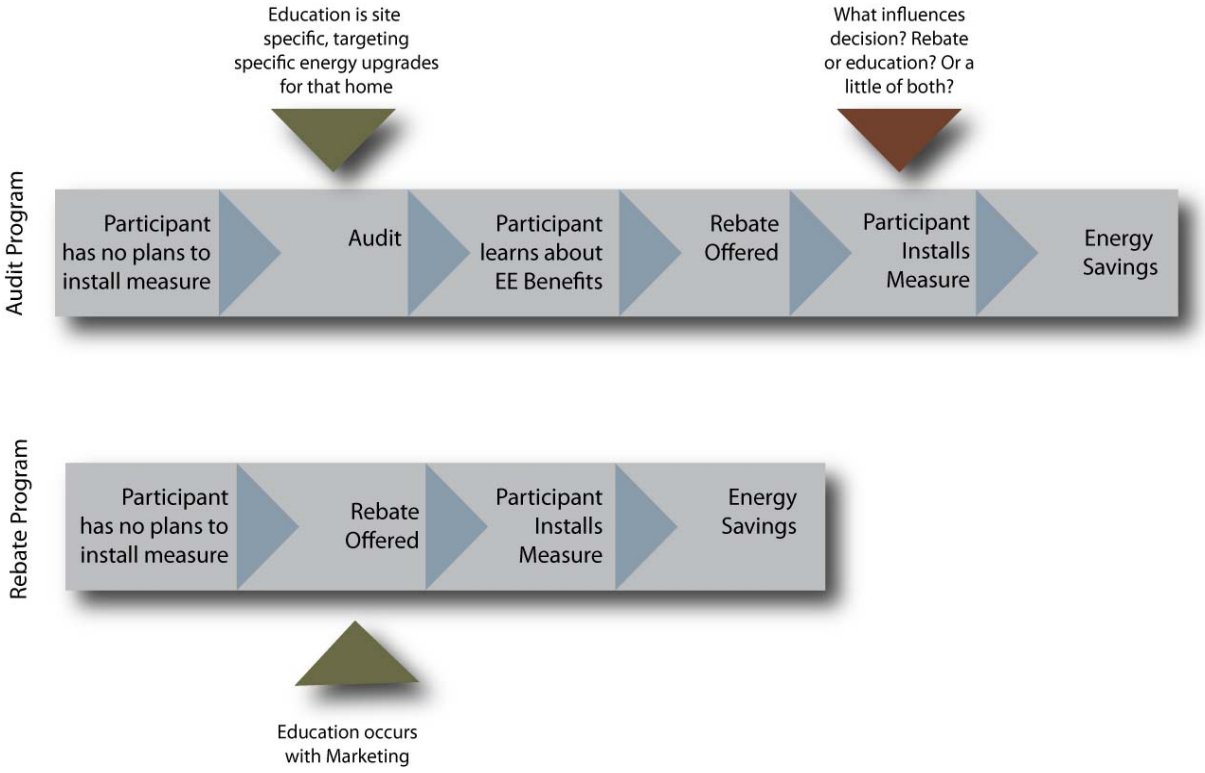
To assess freeridership and spillover effects in the Energy*Wise* program, we asked Participant Survey respondents a battery of questions based upon the California net-to-gross methodology. Our aim was to answer the following research questions:

- Would the respondent have installed the measure in the absence of the incentive?
- Did the respondent take any additional actions to save energy?

Participant responses to the battery of detailed questions are analyzed using an algorithm that assigns a freeridership "score" to each participant. The scores for the sample of participants are then averaged to arrive at measure-level freeridership estimates. This scoring system allows some participants to be considered partial freeriders, meaning that the program had some influence over their decision to install the measure, but other factors influenced them as well. Due to survey length, only one to two measures can be explored via this approach, and this evaluation examines freeridership for participants installing refrigerators and insulation.

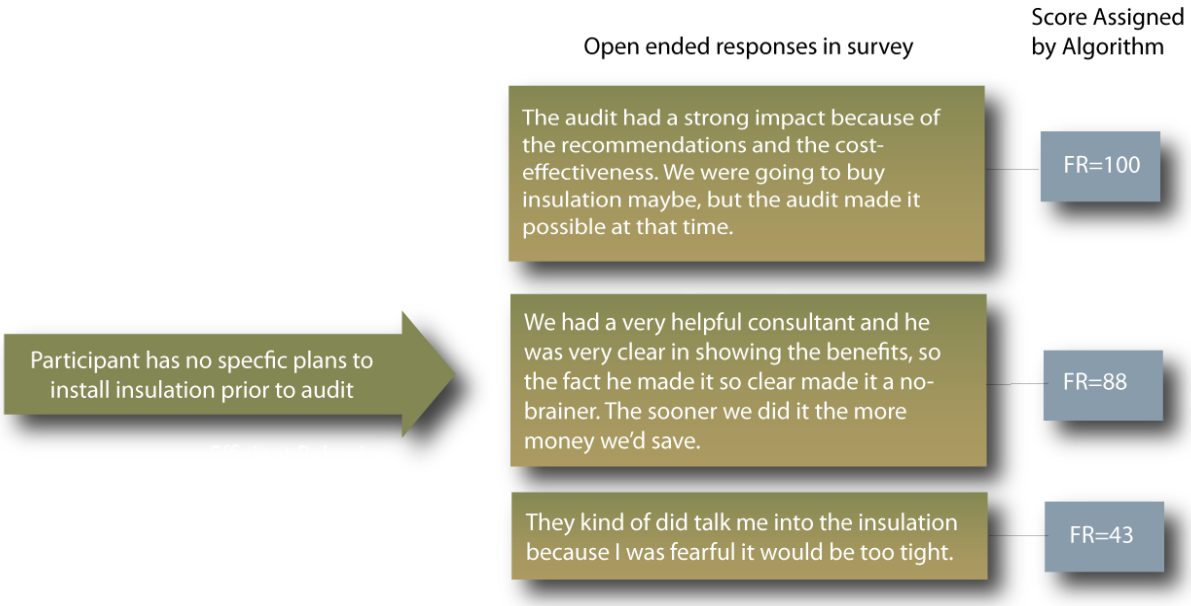
The methodology used for this analysis differs slightly from that approved for use by the California Public Utilities Commission in August 2009; the California methodology focuses on rebate-only programs rather than programs such as Energy*Wise*, which include an audit component. The essential differences between these two types of programs are illustrated in Figure 9.

Figure 9. Participation Process in Audit Programs and Rebate Programs



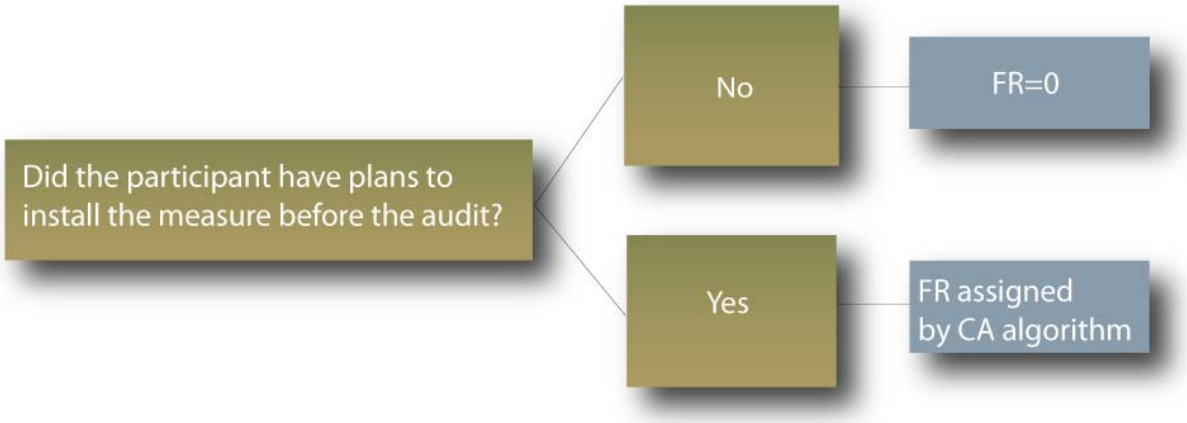
Cadmus found the California methodology could be modified to be applicable to *EnergyWise* by adjusting it slightly. Figure 10 illustrates how the methodology was adjusted using examples from the survey of Rhode Island Energy*Wise* participants.

Figure 10. Examples of Freeridership Scores Assigned to Individual Participants by the California Algorithm



We found these scores unreasonable given the obvious influence of the audit on the participant's purchase decision and adjusted our analytical methodology to remove this "audit bias." The adjusted methodology is illustrated in Figure 11.

Figure 11. Methodology for Assigning Unbiased Freeridership Scores to Audit Participants



Using this adjusted methodology, our analysis produced results consistent with logical evaluation of individual open-ended responses.

California has yet to settle on an algorithm to measure spillover, and it unclear whether spillover will or should be quantified as savings. Meaningful results were nonetheless achieved through survey questions determining participant behavior and motivation. The battery of questions intended to evaluate spillover asked participants to specify what type of additional energy-efficiency measures they installed after participating in the Energy*Wise* program, and asked to what degree their participation in the program influenced them to install additional measures.

Freeridership Results

Insulation

The average freeridership score for customers installing insulation was 16%: 62 participants installed insulation and were asked the battery of freeridership questions; and 12 observations were dropped because of inadequate data or unclear responses.

Refrigerators

The average freeridership score for customers installing refrigerators was 14.8%: 55 participants installed refrigerators and were asked the battery of freeridership questions; five observations were dropped because of inadequate data or unclear responses.

Spillover Results

In our sample, 41.6% of participants (99 out of 238) reported they had implemented at least one additional energy-efficiency measure since participating in the program.

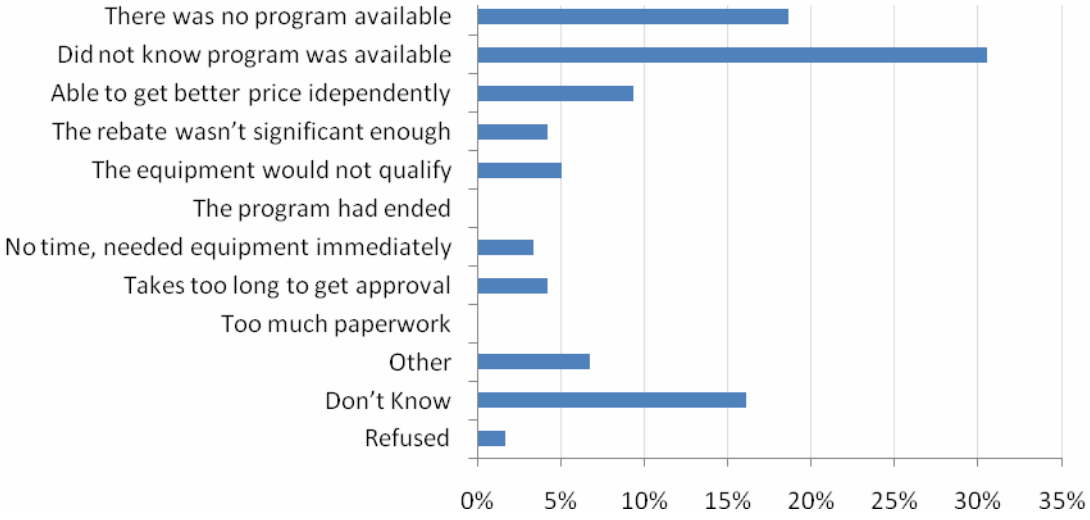
Table 10 delineates the measures they reported and the percentage of these installations resulting from a high level of influence from the program. Participants were asked to rank the degree that the program influenced them to purchase or install the additional measure, and we classified any response of 7 or higher as "high program influence."

Table 10. Installation of Additional Energy Efficiency Measures

	Reported installations	Percentage of reported installations with high program influence
Measures offered through the program		
Refrigerator	5	100%
CFLs	26	69%
Insulation	20	70%
Air Sealing	9	56%
Duct or Pipe Insulation	1	100%
Ventilation	2	50%
*Measures **not** offered through the program*		
Washing Machine	7	86%
Dryer	4	100%
Stove	3	67%
Dishwasher	4	100%
Other Appliance	5	60%
Heating/Cooling System	14	79%
Windows	13	69%
Doors	6	67%
Other Shell Measures	4	50%
Other	8	38%
	Total: 131	Average: 72%

Participants reported why they chose not to install the measure through Energy*Wise* or another utility program. Results are displayed in Figure 12. Notably, 30.5% reported they did not know a program was available; 9.3% reported they were able to install the measure at a better price without going through a utility program.

Figure 12. Participant Reasons for not Using a Utility Program to Install Additional Measures



6. Impact Evaluation

An impact evaluation was performed by customer segment for single-family electric, single-family gas, multifamily electric, and multifamily gas customers. A billing analysis was used to estimate savings. Analysis was further segmented by state and by implementation vendor.

Data Clean-Up

Three types of data were used for the billing analysis:

- Program tracking information
- Billing data
- Weather data

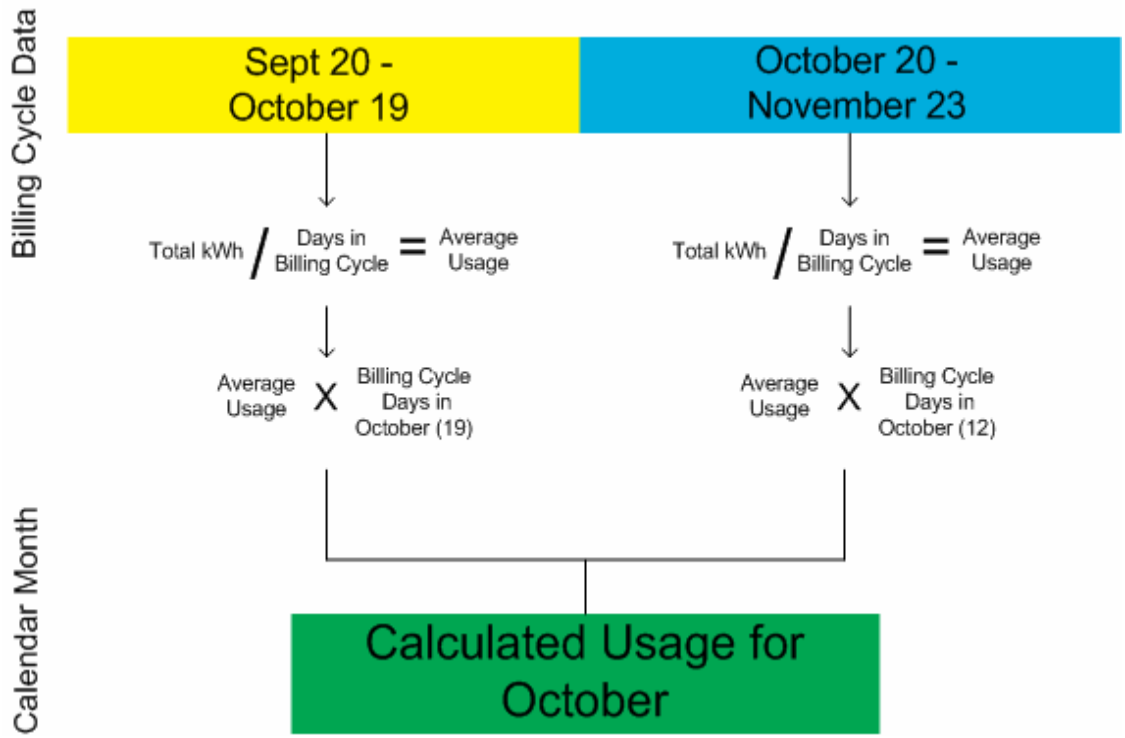
Program tracking information was used to identify households that installed gas and electric measures through the 2008 Energy*Wise* program. Program participation data used in the billing analysis included:

- Facility identifier
- Type of measures installed
- An engineering-based estimate of kWh savings (for multifamily only)
- Approximate installation completion date

The engineering-based estimate of kWh savings was used as the participation variable in the statistically adjusted engineering (SAE) models.

Billing data consisting of energy consumption for each program participant was matched to local weather data. Because billing periods vary between customers and do not correspond to calendar months, Cadmus adjusted the billing data to calculate usage for each calendar month. Total usage from each customer's billing period was divided by the number of billing cycle days. The resulting average usage was multiplied by monthly calendar days, then added to the same calendar month usage from the following billing cycle. This process is illustrated in Figure 13.

Figure 13. Shifting Billing Cycle Usage to a Calendar Month



Additionally, Cadmus obtained average daily temperature data from NOAA for 14 weather stations in Rhode Island and Massachusetts. Cadmus mapped each service address to the closest weather station using ZIP codes. Daily temperature data were matched to the customer's billing cycle. Cadmus calculated HDD and CDD, using 65 degrees as a base.

After the billing and weather data were prepared, Cadmus merged the participant and measure data using a unique identifying variable. The *premise ID* or *facility ID* of the customer was used to link the customer's billing, participation, and measure records. In addition, in multifamily buildings customer billing data were aggregated to the building level. *Premise ID* allowed aggregation up to the building level for multifamily complexes, and was the most reliable identifier.

Cadmus performed a number of quality checks of the measure and billing data. In general, our strategy for dealing with anomalous data such as abnormally low or high monthly consumption was to leave the data in the analysis unless it was obvious there was a billing or tracking error.[14] As we explain below, the estimation strategy of year over year monthly differencing is robust to the inclusion of months with abnormally low or high consumption. In cases of obvious data error, the monthly observation was dropped. There were only a small number of monthly observations in the billing analyses that were dropped, but the estimation strategy is also robust to dropping some observations. In instances in which we dropped the whole billing history of

[14] Cadmus adopted this approach after consulting with National Grid staff about their preferences regarding the treatment of suspect data.

one or more buildings, which occurred only in the analysis of multi-family gas program, Cadmus tested the sensitivity of the estimation results to dropping the buildings from the analysis.

- **Measure data:** The single-family billing analysis estimated measure impacts on monthly electricity or gas consumption. Cadmus reviewed the measures installed in each home or facility to ensure they were reasonable. For example, installation of more than two refrigerators in a home would raise a flag as to a possible problem. No unreasonable measure installations were found.
- **Engineering savings estimates:** Billing analysis of multifamily facilities estimated the savings realization rate by regressing monthly consumption on an estimate of monthly engineering savings for the facility. For measures with savings not sensitive to weather, Cadmus allocated the annual engineering estimates of annual savings evenly across the months of the year. For measures with savings sensitive to weather such as insulation, Cadmus allocated the annual engineering estimates of annual savings according to the monthly distribution of heating degree days. For example, if 15 percent of heating degree days occurred in a month, then the engineering estimate of savings for the month was 0.15 * the engineering estimate of annual savings.
- Cadmus reviewed the savings estimates to ensure reasonability relative to total consumption. Facilities with annual savings estimates greater than 20% of annual consumption were flagged and inspected to ensure savings estimates were reasonable in comparison to the billing data. Cadmus tested the sensitivity of the results to exclude facilities with savings estimates greater than 30% of consumption. Large percentage savings may indicate that unit data could be missing.
- **Missing or duplicate billing months:** Each observation was also checked for missing or duplicate billing months; none were found.
- **Abnormally low or high monthly electricity consumption:** Cadmus searched for any months with electricity consumption below 50 kWh or greater than 3,000 kWh. These months were dropped from the analysis, although, in some cases, part of a customer's billing history could be used.
- **Large changes in annual consumption:** As is our standard practice, Cadmus checked for very large increases or decreases in weather-normalized annual electricity or gas consumption between pre-installation and post-installation periods of single-family homes. Large changes in weather-normalized consumption could indicate significant behavioral changes in a home unrelated to program impacts, and could confound the results. In general, there were a small number of buildings with such changes. Except for multi-family gas heat buildings, Cadmus left facilities with large changes in weather-normalized annual consumption in the analysis.

Table 11 summarizes data files received from National Grid and used in the billing analysis.

Table 11. Data Files

			Billing Data	Customer Info	Measure Info
RI	Single-family	Electric	RI SF Billing Data.TXT	XEW Facility SF 2008.xls	EW Installed Measure Savings Info 2008a.xls
		Gas	KCross readings.xls	RI Gas - List for Billing Data2.xls	2009 Planning process-RI Gas Participants.xls
	Multifamily	Electric	MA MF and RI MF Billing Data.txt	EW Facility MF 2008a.xls	EW Installed Measure Savings Info 2008a.xls
		Gas	RI MF Gas therms_serv_address_unit.xls	Energy*Wise* Multifamily Gas Participants 061609.xls	Gas Data by unit 2008_prepped.xls
MA	Multifamily	Electric	MA MF and RI MF Billing Data.txt	EW Facility MF 2008a.xls	EW Installed Measure Savings Info 2008a.xls

Billing Analysis Model Description

The billing analysis is based on the development and estimation of an econometric model combining billing data, weather data, and National Grid's program-tracking information. The analysis sought to estimate electric and gas savings achieved by program participants during 2008. Separate gas and electric econometric models were estimated for single- and multifamily facilities.

The model developed for this billing data analysis is similar to the fixed effects model used in previous evaluations of Energy*Wise*. Our method of estimating the model is different than the method used in previous evaluations in that we used a year-over-year differencing strategy to estimate the regression equation. We believe it results in more precise estimates of program impacts on energy consumption. The general features of the model are described below.

For this analysis, data are available both across facilities (i.e., cross-sectional) and over time (i.e., time-series). With this type of data, known as "panel" data, it becomes possible to control at once for differences across facilities ("facility" refers to single-family or multifamily) as well as differences across periods in time through the use of a "fixed-effects" panel model. The fixed-effect refers to the assumption that differences across facilities can be explained in large part by facility-specific intercept terms, as discussed below.

Because consumption data in the panel model includes months before and after the installation of program measures, the period of program participation (or the participation window) is defined specifically for each facility/home. This feature of the panel model allows for the pre-installation consumption months to act as controls for post-participation months. In addition, unlike annual pre/postparticipation models, this model does not require a full year of post-participation data.

The fixed effects model can be viewed as a type of differencing model in which all facility characteristics that both: (1) are independent of time, and (2) determine the energy consumption level, are captured within the facility-specific constant terms. In other words, unobservable differences in housing characteristics, appliances, or energy-using behavior that cause variation in the energy consumption level, such as building size and structure, are captured by constant terms representing each unique housing unit. In addition, unobservable facility characteristics

and behavior affecting energy consumption, in particular months such as annual February vacations, are captured by month terms specific to each facility.

Algebraically, the fixed-effect panel data model is described as follows:

$$e_{it} = \beta_0 + \boldsymbol{\beta_1}\mathbf{Weather_{it}} + \delta Measure_{k,it} + \lambda_i + \rho_{im} + \varepsilon_{it} \quad (1)$$

where:

e_{it} is energy consumption in kWh or therms for facility *i* during period (year-month) *t*

$\mathbf{Weather_{it}}$ is a vector of weather variables, such as heating degree days, cooling degree days, and interactions between heating source (electricity or gas) and degree days, to capture the impact of weather on energy consumption.

$\mathbf{Measure}_{it}$ is a vector of indicator variables for the presence of measures (e.g., insulation) in facility i in period t. The k^{th} element of the vector would equal zero in the pre-installation period and one in the post-installation period if measure k was installed.

λ_i isa facility-specific effect (e.g., to capture effect of an unobservable flat-screen television on energy consumption).

ρ_{im} is a facility i in month m specific effect (e.g., to capture the effect of unobservable annual February vacation to Florida on energy consumption).

ε_{it} is a random error term reflecting our ignorance about other factors affecting facility i's consumption in period t.

β_0 is constant term to be estimated.

$\boldsymbol{\beta_1}$ is a vector of coefficients to be estimated and showing the impact of weather on energy consumption; it and should have a positive sign.

$\boldsymbol{\delta}$ is a vector of coefficient to be estimated and showing the impacts of one unit of a measure on monthly energy consumption. The coefficients should have negative signs if the measures reduced energy consumption.

A statistically adjusted engineering (SAE) model would substitute an engineering estimate of energy savings for the vector of measure indicator variables:

$$e_{it} = \beta_0 + \boldsymbol{\beta_1}\mathbf{Weather_{it}} + \delta ESE_{it} + \lambda_i + \rho_{im} + \varepsilon_{it} \quad (2)$$

ESE_{it} is an engineering estimate of the energy savings for facility i in period t.

δ is a coefficient to be estimated and represents the average savings realization rate in the Program. δ indicates the percentage of the engineering savings realized. For example, an estimate of δ=1 would suggest that the actual savings were equal to the predicted savings.

All other variables are defined as before.

The model was estimated using a year-over-year monthly differencing strategy. Facility i's energy consumption in period t (a month and year) can be described by equation 1. Facility i's energy consumption in the same month in the preceding year is given by:

$$e_{it-12} = \beta_0 + \boldsymbol{\beta_1 Weather_{it-12}} + \delta \square Measure_{k,it-12} + \lambda_i + \rho_{im} + \varepsilon_{it-12} \qquad (3)$$

Taking the difference between equation (2) and (3) yields the estimating equation[15]:

$$\Delta e_{it} = \boldsymbol{\beta_1 \Delta Weather_{it}} + \delta \square \Delta Measure_{k,it} + \Delta\varepsilon_{it} \qquad (4)$$

Differencing removes the facility-specific constant term λ_i (the customer's baseline monthly consumption) as well as facility-specific effects that vary by month ρ_{im}. The year-over-year monthly change in energy consumption between the pre- and pos-tinstallation period is a function of the change in weather, the installation of measures, and unobservable, idiosyncratic changes in energy consumption. The coefficient δ_k in equation (1), which represents the impact of measure k on monthly consumption, can be obtained by estimating the differenced equation (4).

The year-over-year differencing approach has two advantages over typical fixed-effects estimation in which a separate intercept term would be included for each customer, as in equation (1). First, it is a more flexible specification of monthly consumption because it accommodates effects on the consumption of a customer specific to a month (ρ_{im}). This allows for more precise estimation of the impacts of weather and measures on consumption.[16] Second, the year-over-year differencing approach is more robust to anomalous low or high monthly consumption caused by unobservable household behavior or billing system errors in a sample of home with relatively short billing histories. In such a sample, months with anomalous consumption have large impacts on the estimate of the customer intercept in typical fixed effects models. This is not the case in the differencing model, which explains the year-over-year change in monthly consumption instead of consumption levels.

Regression equation (3) was estimated by dividing each facility's billing history into a pre-installation and post-installation period. Typically, there were less than 12 months in the post-installation period and 24 or more months in the pre-installation period. For each post-installation month, a 12-month difference was formed by taking the difference between the values for the post-installation month and the values for the same month in the pre-installation period in the preceding year. Similarly, a 24 month difference was formed by taking the difference between the values for the post-installation month and the values for the same month in the pre-installation period two years ago. The model was then estimated by pooling the 12- and 24-month pre-post differences. Standard errors were adjusted for clustering at the account and post-installation (year-month) period to account for a post-installation month being associated with two or possibly more observations.

[15] The year-over-year differencing strategy can also be and is applied to the SAE model.

[16] In the typical fixed effects model, consumption effects particular to a month (such as reduction in use because of a annual February vacation) cannot be separately estimated and are reflected in the customer intercept term, which captures baseline monthly consumption. A regular February vacation would bias down the estimate of baseline consumption.

Results

Single-Family Electric Impact Analysis

Single-family electric billing analysis began with 2,250 customers in Rhode Island from all heating types: electric, gas, and general use (meaning a heating fuel other than gas or electric). Table 12 shows the breakdown of single-family electric customers by heating type. Table 13 shows the number and percentage of homes with different program measures installed by heating fuel, while Figure 14 illustrates the percentage of homes with different program measures installed by heating fuel.

Table 12. Heating Type Breakdown of Single-Family Electric Customers

Heating Type	N	Percent
Electric	67	3.0
Gas	1,198	53.2
General Use	985	43.8
Total	2,250	100.0

Table 13. Installed Measures by Heating Type in Single-Family Electric Customers

Heating Type	Electric (number out of 67)	Electric (percent)	Gas (number out of 1198)	Gas (percent)	General Use (number out of 985)	General Use (percent)	Total (number)	Total (n=2250)
Air Sealing/ Insulation/ Ventilation (Space)	19	28%	0	0%	0	0%	19	1%
CFLs	64	96%	1102	92%	941	96%	2107	94%
Fluorescent Fixtures or Torchieres	7	10%	24	2%	18	2%	49	2%
H20 Saving Devices	9	13%	8	1%	104	11%	121	5%
Refrigerators	6	9%	61	5%	55	6%	122	5%
Brush Refrigerator Coils	21	31%	517	43%	385	39%	923	41%
Programmable Thermostat	17	25%	0	0%	0	0%	17	1%

Table 20 reports the average number of measure installations of each type in the home. CFLs averaged the highest installations, at an average of 2.42 installed per home. Air sealing/ insulation/ventilation, only installed in electric-heated homes, had the lowest installation rates.

Figure 14. Percentage of Single-Family Homes with Measure Installed by Heating Type

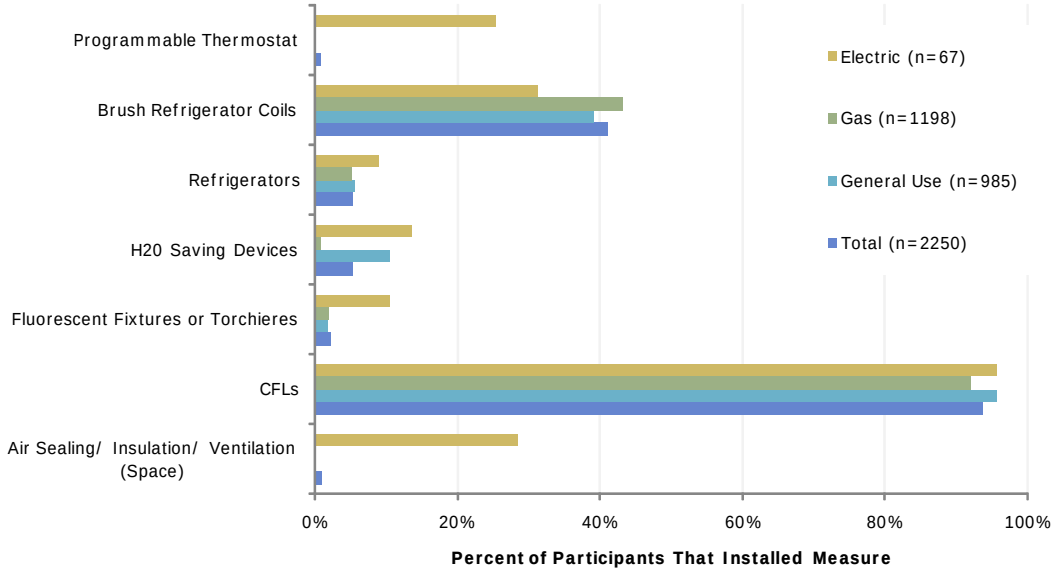


Table 20. Average Number of Measure Installations Per Single-Family Electric Customer

	N	Air Sealing/ Insulation/ Ventilation (Space)	CFLs	Fluorescent Fixtures or Torchieres	H20 Saving Devices	Refrigerator	Brush Refrigerator Coils	Programmable Thermostat
Electric Heat	67	0.30	2.58	0.51	0.36	0.09	0.31	1.25
Gas Heat	1198	0.00	2.42	0.10	0.02	0.05	0.43	0.00
General Use	985	0.00	2.42	0.12	0.26	0.06	0.39	0.00
All fuel types	2,250	0.01	2.42	0.12	0.13	0.06	0.41	0.04

Most participating homes had at least one CFL installed (approximately 90%), and a large percentage had the coils on the refrigerator brushed (40%) regardless of heating type. Only a small percentage of general-use homes (non-electric heat) had a high-impact measure such as a refrigerator installed. None of the non-electric heat homes had insulation installed through the program. The number of electric heat homes in the sample is much smaller (67), but such homes had a significantly higher likelihood of having high-impact measures installed. Thirty percent of electric heat homes had insulation installed, and 10% had a refrigerator replaced.

The impacts of program measures on electricity consumption in electric heat and non-electric heat homes were estimated using the differencing regression approach with indicator variables for the presence of efficiency measures described above.[17] A single regression model comprising all single-family homes was estimated instead of separate models for electric and non-electric

[17] The indicator variable for presence of a water-saving measure was interacted with an indicator variable for electric heat because some non-electric heat homes had water-saving measures installed. No electricity would be saved in non-electric heat homes from the installation of such measures. Cadmus did not have information about a home's water heat system, so it was assumed that electric heat homes also had electric water heat.

heat homes. The effects of some measures in electric heat homes could not be estimated precisely when separate models were employed. Conversely, the effects of many measures were estimated more precisely by pooling the data. The model and the estimation strategy control for differences between electric and non-electric heat homes in the impacts of weather-sensitive program measures on electricity consumption.

The dependent variable in the regression model is the annual change in monthly electricity consumption between the pre- and post-installation periods. The model includes heating degree days (65 degrees base), cooling degree days (65 degrees base), and an interaction term between heating degree days and a dummy variable for whether the home was heated with electricity to capture the impact of heating and cooling demands on electricity use and the higher demand for electricity of electric heated homes during the winter months. The model also includes quantities for the program measures as regressors as an estimate of the engineering savings was unavailable. The one exception was space heating/cooling, which includes air sealing, insulation, and ventilation measures, and enters the model as a dummy variable equaling one if one or more of these measures is/are present. In addition, the model allows the impact of space heating/ cooling measures on electricity consumption to vary by heating and cooling season. The coefficient on a program measure variable indicates the average monthly change in electricity consumption from the installation of one unit of the measure.

Table 14 reports results from the estimation of the single-family electric model. All the coefficients have the expected signs and most of the program measure coefficients are statistically significant.[18] Estimated standard errors were adjusted for clustering at the facility and postinstallation period levels. For example, the model indicates the installation of an energy-efficient refrigerator reduces electricity consumption by approximately 40 kWh per month.

Table 14. Single-Family Electric Regression Model Results

Parameter	Parameter estimates	Standard error	T Stat	Lower Bound 95% CI	Upper Bound 95% CI
HDD	0.02**	0.01	2.40	0.00	0.04
HDD * Electric Heat	0.16	0.10	1.51	-0.05	0.36
CDD	1.11***	0.08	13.44	0.95	1.27
CFLs	-9.05***	0.83	-10.93	-10.68	-7.43
Fluorescent Fixtures and Torchieres	-5.38***	1.47	-3.66	-8.26	-2.50
Refrigerators	-39.95***	5.39	-7.41	-50.52	-29.38
Refrigerator Brushes	-4.82	3.40	-1.42	-11.49	1.84
Water Saving Devices*Electric Heat	-12.95***	3.28	-3.94	-19.38	-6.51
Set Thermostat	-8.35	10.39	-0.80	-28.70	12.01
Space - Heating Season (D)	-120.63*	70.26	-1.72	-258.34	17.08
Space - Cooling Season (D)	-53.87	65.71	-0.82	-182.65	74.92
N	33,572				

Notes: Dependent variable is the year-over-year change in monthly electricity consumption. All measures are in quantities except Space-Heating and Space-Cooling, which are zero-one indicator variables. Model

[18] The regression results are robust. Cadmus performed checks of collinearity between the program measure variables and did not find problems. The estimates of the measure coefficients are not sensitive to dropping one or more measures from the model. Also, estimates of the coefficients obtained by pooling 12 and 24 month differenced observations are similar to those seen when the model is estimated using 12 or 24 month differences but not both.

estimated by OLS. Standard errors are clustered at the account and the post-installation period (year-month) levels. R2 statistic is not defined in this model. ***,**,* denote statistically significant at the 1, 5, and 10% levels, respectively.

Cadmus used the regression results and program tracking information to estimate the mean annual reduction in electricity consumption for Program participants by heating fuel type (electric and non-electric heat). Table 15 shows the results of this analysis and estimates of Program impacts from previous evaluations.[19]

Table 15. Estimated Single-Family Program Impact by Heating Fuel Type

Heating Type	N	2008 EWISE Evaluation Estimated annual savings per participant (kwh)	Lower bound 95 percent confidence interval savings per participant (kwh)	Upper bound 95 percent confidence interval savings per participant (kwh)	NGRID 2008 assumptions about annual savings per participant (kwh)*	2001 EWISE Evaluation Estimated annual savings per participant (kwh)**
Non-electric	2183	339	300	379	787	713
Electric	67	773	543	1003	1329	1293
Average		352	312	392	809	811

[19] This table shows how the estimates of participant and program electricity savings were derived.

Parameter	Regression Estimate of Monthly Unit Savings (kWh)	Months	Annual Unit Savings (kWh)	Number of Units Electric Heat	Number of Units Non-electric Heat	Annual Program Savings (kWh)Electric Heat	Annual Program Savings (kWh) Non-electric heat	Annual savings (kWh) per electric heat customer (N=67)	Annual savings (kwh) per non-electric heat customer (N=2183)
CFLs	9.05	12	109	173	5278	18,788	573,191	280	263
Fluorescent Fixtures and Torchieres	5.38	12	65	34	240	2,195	15,494	33	7
Refrigerators	39.95	12	479	6	118	2,876	56,569	43	26
Refrigerator Brushes	4.82	12	58	21	904	1,215	52,287	18	24
Water Saving Devices	12.95	12	155	24	278	3,730	43,201	56	20
Set Thermostat	8.35	6	50	84	0	4,208	-	63	-
Space - Heating Season (D)	120.63	6	724	20	0	14,476	-	216	-
Space - Cooling Season (D)	53.87	4	215	20	0	4,310	-	64	-
Total						51,797	740,743	773.1	339.3

Cadmus also estimated models with Space – Shoulder Season (D) included as a regressor. This variable equaled one if the home had a space heat measure installed and the month was May or October and zero, otherwise. However, the coefficient on this variable was always small and statistically insignificant, so we did not include it in the final specification.

Note: Savings impacts estimated using sample means of measure variables and regression-based measure savings estimates (annualized).
*Source: Excel spreadsheet "RI SF ewisex08.xls" received September 14, 2009.
**"Impact Evaluation of the 2001 Single-Family Energy Wise Program." Report submitted to NGRID dated July 3, 2003.

The mean impact of program participation for non-electric heat homes is estimated to be 339 kWh per year. The mean impact for electric heat homes is estimated to be 773 kWh per year. The overall weighted (by heat type) mean program impact is estimated to have been 352 kWh per year.

Estimates of program impacts for 2008 are significantly less than National Grid's assumptions and estimates of program impacts in previous evaluations. Cadmus checked the regression-based estimates of measure impacts from this evaluation against independent engineering estimates of measure savings and found our estimates are within generally accepted ranges. [20] The relatively small program impact for 2008 appears to be the result of the limited variety and the small number of program measures installed.

Multifamily Electric Impact Analysis

Multifamily electric billing analysis began with 207 customers in Rhode Island and Massachusetts from all heating types: electric, gas, and general use (meaning a heating fuel other than gas or electric). The billing analysis pools the facilities but allows the impacts of measures sensitive to heating type to vary. Table 16 shows the breakdown of multifamily electric customers by heating type. Table 17 shows the saturation of each measure type among heating fuel segments and for total multifamily electric customers. Figure 15 shows the percentage of facilities with different program measures installed.

Table 16. Multifamily Electric Customer by Heating Type

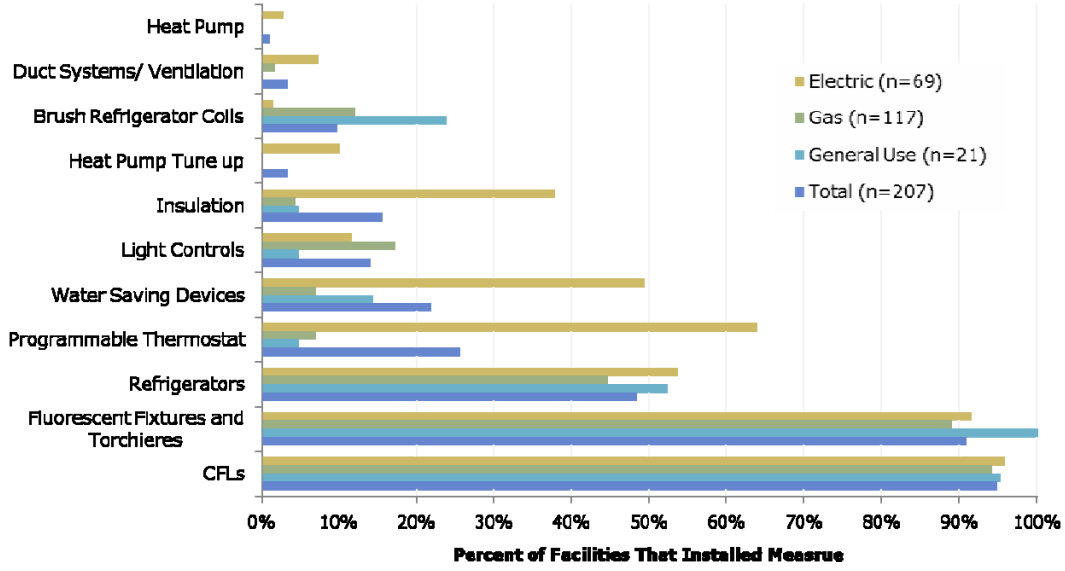
Heating Type	N	Percent
Electric	69	33.3%
Gas	117	56.5%
General Use	21	10.1%
Total	207	100.0%

[20] Cadmus compared the estimates of the unit impacts to estimates in Cadmus evaluations for other utilities, from the Energy Star website, and the Weatherization Assistance Program Technical Assistance Center website.

Table 17. Installed Measures by Heating Type in Multifamily Electric Facilities

Heating Fuel	N	CFL	Fluor. Fixtures and Torchieres	Refrig.	Program. Therm.	Water Saving Devices	Light Controls	Insulation	Heat Pump Tune up	Brush Refrig. Coils	Duct Systems/ Vent.	Heat Pump Tune-Up
Electric	69	66	63	37	44	34	8	26	7	1	5	2
		96%	91%	54%	64%	49%	12%	38%	10%	1%	7%	3%
Gas	117	110	104	52	8	8	20	5	0	14	2	0
		94%	89%	44%	7%	7%	17%	4%	0%	12%	2%	0%
General Use	21	20	21	11	1	3	1	1	0	5	0	0
		95%	100%	52%	5%	14%	5%	5%	0%	24%	0%	0%

Figure 15. Percentage of Multifamily Facilities with Program Measures Installed



As in single-family homes, the most frequently installed measure was a CFL or fluorescent fixture. However, in contrast to single-family homes, a large percentage of multifamily facilities had at least one high-impact measure installed, such as a refrigerator or insulation. For example, almost 50% of multifamily facilities had one or more efficient refrigerators installed.

The program's impact on electricity use in multifamily facilities was estimated in an SAE framework. The dependent variable was the year-over-year change in monthly electricity consumption between the pre- and post-installation periods. The right hand side of the regression equation included controls for changes in heating degree days and cooling degree days and the change in the estimate of the engineering savings. The coefficient on the change in engineering savings is an estimate of the percentage of the estimated engineering savings that were realized. Separate regression models for electric heat and non-electric heat facilities were estimable because of the small number of independent variables in the model.

As Table 19 shows, the parameter estimates in the non-electric heat and electric heat multifamily electricity use models have the expected signs and are statistically significant at the 5% or 1% levels. In the non-electric heat model, the coefficient on the engineering savings estimate is -0.986, indicating 99% of estimated engineering savings were realized. In the electric heat model, the coefficient on the engineering savings estimate is -0.909, indicating a 91% realization rate.

Table 18. Multifamily Regression Model Estimates

Non-Electric Heat Model					
	Parameter Estimates	Standard Error	T stat	Lower Bound 95% CI	Upper Bound 95% CI
HDD	6.31***	1.81	3.49	2.77	9.85
CDD	36.00*	21.01	1.71	-5.18	77.18
Engineering Savings Estimate	-0.986***	0.25	-3.93	-1.48	-0.49
N	1990				
Electric Heat Model					
	Parameter Estimates	Standard Error	T stat	Lower Bound 95% CI	Upper Bound 95% CI
HDD	28.45***	5.56	5.11	17.54	39.35
CDD	48.84**	22.24	2.20	5.25	92.42
Engineering Savings Estimate	-0.909***	0.28	-3.28	-1.45	-0.37
N	996				

Notes: Dependent variable is the year-over-year change in monthly facility electricity consumption. Model estimated by OLS. R2 statistic is not defined in this model. ***,**,* denotes statistically significant at the 1, 5, and 10% levels, respectively. Standard errors are clustered at the facility and post-installation period (year-month) levels. N is the number of pre-post monthly observations used in the estimation.

Table 19. Multifamily Estimated Program Impact by Fuel Type

	Facilities	Annual Engineering Savings Estimate per participant (kWh)	Estimated savings realization rate	Estimated Realized Energy Savings per participant (kWh)	Lower Bound 95% CI	Upper Bound 95% CI
Electric heat	69	4,901	90.9%	4,455	1,792	7,119
Non-electric heat	138	4,733	98.6%	4,667	2,338	6,997
Total	217	9,634		9,123	6,095	13,172

Cadmus applied the estimated savings realization rates to the estimates of engineering savings for electric heat and non-electric heat facilities to estimate multifamily program savings as shown in Table 26. Annual program savings are estimated to be 4,455 kWh for electric heat facilities and 4,667 kWh for non-electric heat facilities.

Analysis of Electric Results Compared to Predicted

The Energy*Wise* program achieved energy savings generally less than predicted by National Grid and below previous year's calculations. Table 20 compares the estimated program electricity savings. Savings estimates from the 2001 evaluation of single-family electric homes are also displayed for comparison. Results indicate estimated savings were approximately one-half the predicted savings for single-family homes closer and only 5% to 6% lower than predicted for multifamily homes.

Table 20. Energy*Wise* Program Gross Electric Savings

Customer Segment	National Grid Predicted Savings per participant (kWh)	Billing Analysis Estimated Savings per participant (kWh)	Percent Difference	2001 Estimated Savings per participant (kWh)
Single-family non-electric heat	787	339	-57%	713
Single-family Electric Heat	1,329	773	-42%	1,293
Multifamily non-electric heat	4,733	4,455	-6%	Not available
Multifamily Electric Heat	4,902	4,667	-5%	Not available

The large discrepancy for single-family homes' estimated and expected savings may be due to a different mix of measures being installed in 2008 than predicted or historically installed. The economic downturn could have influenced participants' abilities to pay their share of larger measure costs, therefore result in fewer installations than expected. To further analyze single-family electric homes, Cadmus reviewed the program's anticipated savings by measure. As shown in Table 21, below, significant differences between estimated and predicted measure savings existed for the following:

- Refrigerator replacement: 473 kWh estimated vs. approximately 1,100 kWh predicted. The difference in refrigerator estimates may be due to an increasingly efficient stock of refrigerators being replaced. As the stock grows more efficient, it is expected savings from upgrades will decrease. Also, the program assumes replacements rather than removals of secondary units, savings are based on the differences between older and newer units (i.e., early replacement).

- CFLs: The evaluation found an average of 2.5 CFLs per home, with total CFL savings of approximately 260 kWh per participant (or about 105 kWh per CFL per home). Program projections, however, assumed savings of 885 per electric heated home and 452 kWh per non-electric heated home. Estimated annual savings of 105 kWh per CFL may be quite high, but they are possible, assuming the program targets only the highest-use fixtures (e.g., external lights). The high estimate may also reflect many homes reported, during the participant survey, they put in additional CFLs because of the program. Predicted CFL savings of 400–800 kWh per home assumed far more CFLs per home being installed through the program or by participants.

Table 21. Energy*Wise* Measure Savings Differences

Customer Segment	National Grid Predicted Savings (kWh)	Billing Analysis Estimated Savings (kWh)
Single-family Electric Heat		
Refrigerators	1,102	473
CFLs	885	260
Single-family Non-Electric Heat		
Refrigerators	1,076	473
CFLs	452	260

Results by State and by Vendor

Cadmus also analyzed multifamily electric results by implementation contractor and by state.[21] Table 29 shows the realization rates for each implementation contractor of multifamily non-electric heated facilities. The number of electric-heated facilities was too small to yield significant results when segregated by implementation contractor. It should be noted that savings realization rates could reflect factors other than contractor competency or effort such as socio-economic class of customers, home type, etc.

Table 29. Multifamily Savings by Implementation Contractor

Implementation Contractor	Realization Rate	Number of facilities
Rise Engineering	167.2%	65
Action Inc.	66.0%	30
Conservation Services Group	81.1%	41

Table 30 shows the realization rate by state and heating type for multifamily facilities in Rhode Island and Massachusetts. Due to the small number of facilities in Rhode Island the standard error is large relative to the point estimate making it difficult to draw firm conclusions about the results.

Table 30. Multifamily Savings by State and Heating Type

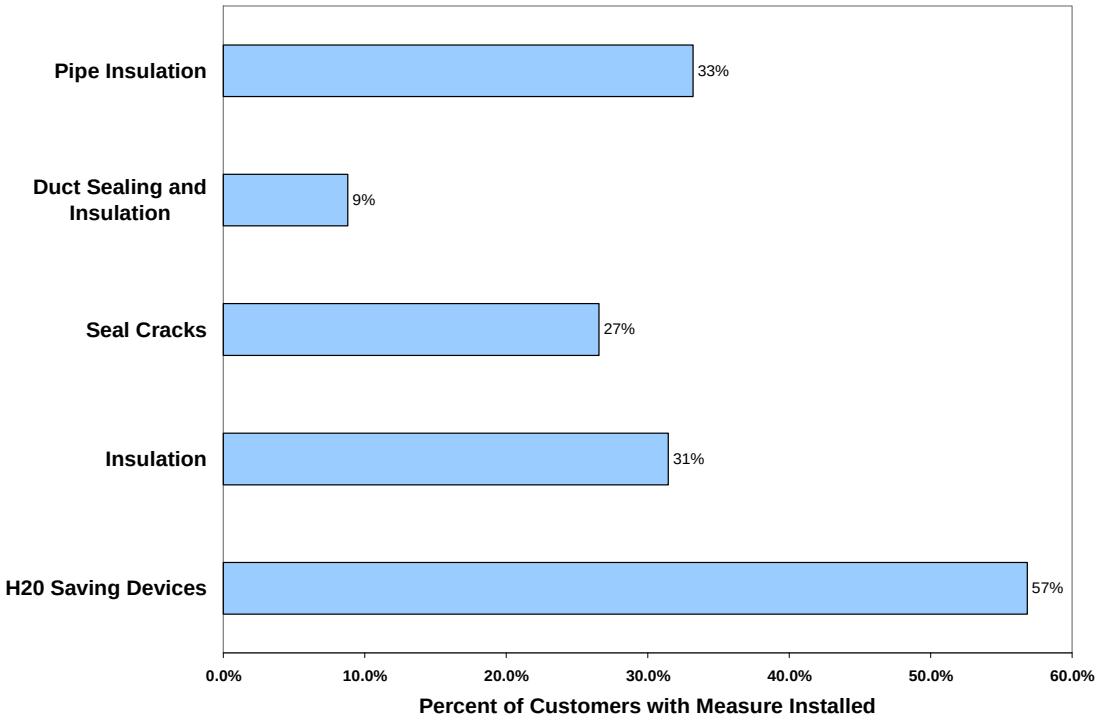
State	Heating Type	Number of Facilities	Realization Rate	Standard Error
MA	Electric	63	76%	.337
RI	Electric	6	132%	.479
MA	Non-Electric	111	81%	.258
RI	Non-Electric	27	253%	.998

Single-Family Gas

The evaluation of the single-family gas Energy*Wise* Program involved a billing analysis of 512 single-family gas homes in Rhode Island. Figure 16 shows the percentage of homes with different types of measures installed. Water saving devices such as aerators and low flow showerheads were the most popular measures (57% of homes). High impact measures such as insulation or duct sealing were installed less frequently (40%).

[21] Multifamily electric program was the only sector in multiple states and using multiple vendors.

Figure 16. Percentage of Single-Family Gas Customers with Program Measures Installed



Cadmus specified a monthly regression model that included dummy variables for heating degree days, the presence of a space heat measure (insulation, duct sealing, and crack sealing), and the presence of a water heat measure (pipe insulation or water saving devices such as aerators). The model allowed the impact of space heat measures to vary between winter and shoulder seasons. The dependent variable was the monthly therm consumption. The model was estimated using the year-over-year monthly differencing approach.

Table 31 reports the regression results. The parameters of the model have the expected signs and are statistically significant. For example, the coefficient on *Presence of water heat measure* implies that the installation of one or more water saving devices reduces gas consumption by -1.5 therms per month. The coefficients are estimated precisely.

Table 31. Single-Family Gas Program Regression Estimates

Parameter	Parameter Estimate	Standard Error	T Stat	Lower Bound 95% CI	Upper Bound 95% CI
HDD	0.031***	0.003	8.86	0.024	0.037
Presence of water heat measure	-1.507***	0.398	-3.79	-2.288	-0.727
Presence of space heat measure - heating season	-20.332***	1.099	-18.50	-22.487	-18.178
Presence of space heat measure - shoulder season	-5.285***	0.954	-5.54	-7.155	-3.414
N	10,764				
Dependent variable is the year-over-year change in monthly gas consumption. Model estimated by OLS and standard errors are clustered at the account and post-installation period (month-year) levels. R2 statistic is not defined in this model. ***denotes statistically significant at the 1% level.					

Table 32 shows the average program participant and total program savings implied by the regression results.[22] The average reduction in therm consumption was 58 therms. This implies annual program savings of 29,491 therms. These savings represent 67 percent of the engineering estimate of savings.

National Grid's Program engineering savings estimates were based on calculations and formulae from the audit software. Each estimate was particular to the home audited; for example, air sealing savings were calculated using a formula including inputs of building size (volume) and estimated air changes per hour before and after installation. As such, differences between actual savings and engineering savings may be due to a takeback effect (change in consumer behavior) or to inaccurate input assumptions.

[22] This table shows how the estimates of participant gas savings were derived.

Parameter	Regression Estimate of Monthly Unit Savings (therms)	Months	Annual Unit Savings (therms)	Number of Units	Annual Program Savings (therms)	Annual savings (therms) per gas customer (N=511)
Presence of water heat measure	1.507	12	18	392	7,089	14
Presence of space heat measure - heating season	20.332	6	122	169	20,617	40
Presence of space heat measure - shoulder season	5.285	2	11	169	1,786	3
Total					29,492	57.7

Table 32. Single-Family Gas Program Impact Estimates

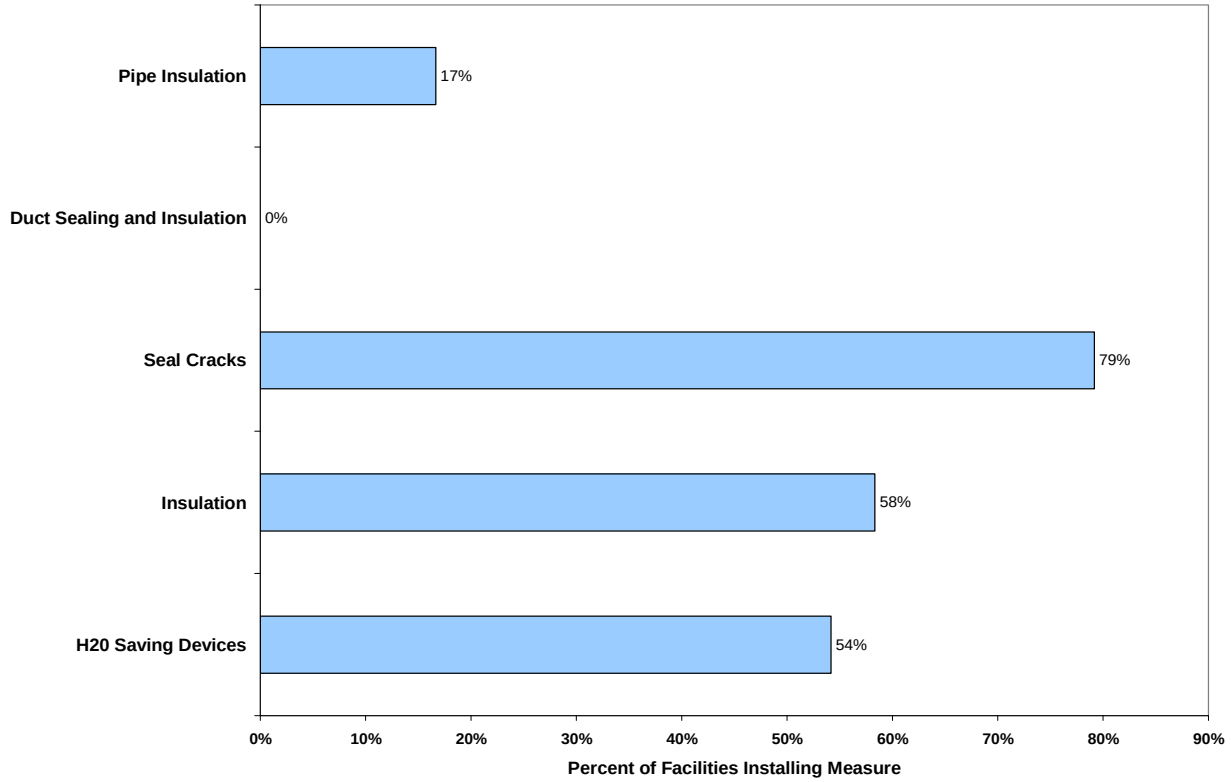
	N	Regression estimated annual savings per participant (therms)	Regression estimated annual program savings (therms)	Lower bound 95% confidence interval annual program savings	Upper bound 95% confidence interval annual program savings	Program engineering savings estimate	Implied Savings Realization Rate
SF Gas Participating Customers	512	57.6	29,491	25,384	33,599	44,274	66.6%
Note: Savings impacts estimated using sample means of measure variables and regression-based measure savings estimates (annualized).							

Because the estimated program savings were significantly less than expected, additional checks of the results were performed. First, the average difference in weather normalized gas consumption between the pre-installation and post-installation periods was estimated for homes with at least 12 months of billing data in both periods. The mean pre-post difference was 70 therms, which is close to our original, regression-based estimate. Second, program savings were estimated using a statistically adjusted engineering model that included an engineering estimate of savings for each home and heating degree days as independent variables. For measures with savings not sensitive to weather, Cadmus allocated the engineering estimates of annual savings evenly across the months of the year. For measures with savings sensitive to weather such as insulation, Cadmus allocated the engineering estimates of annual savings according to the monthly distribution of heating degree days.

Multifamily Gas

The analysis of gas savings in the multifamily program involved 24 facilities in Rhode Island. Figure 17 shows the percentage of multifamily facilities with different measures installed. A large percentage of facilities undertook high impact measures such as sealing cracks (79%) or insulation (58%).

Figure 17. Percentage of Multifamily Facilities with Program Measures Installed



A program savings realization rate was estimated using a statistically adjusted engineering savings regression model. The analysis of savings was complicated by two factors, however. First, there were a very small number of facilities included in the analysis. Second, there are concerns about the completeness of the billing and program participation data. These concerns prompted Cadmus to explore different strategies of filtering the data to achieve a reliable sample.

Three estimates of the program savings realization rate and program savings are presented below. The first estimate of program savings is based on an unfiltered analysis of all facilities in the sample. The second estimate is based on a filtered sample of 18 facilities. The filter was conservative and applied to facilities with engineering estimates of annual savings exceeding 100 percent of weather normalized annual consumption. The third estimate is based on a sample that was filtered using less conservative criteria. Facilities with insulation installed with engineering estimates of savings greater than 30 percent of weather normalized annual consumption or without insulation and engineering estimates of savings greater than 10 percent of weather normalized consumption were dropped from the analysis.

Table 33 shows estimates of savings realizations rates and program savings. It should be noted that for each regression model program savings were estimated by applying the regression estimated savings realization rate to the estimate of engineering savings for all facilities.

Table 33. Multifamily Gas Program Impact Estimates

	Facilities Used In Regression / Estimate Of Savings	Annual Engineering Gas Savings Estimate (Therms)†	Regression Estimated Savings Realization Rate	Estimated Realized Energy Savings (Therms)	Lower Bound 95% CI (Therms)	Upper Bound 95% CI (Therms)	Weather Normalized Annual Savings Rate
No filter	24 / 24	69,032	53.2%	36,725	552	72,898	11.9%
Conservative filter	18 / 24	69,032	188.7%	130,263	83,874	176,653	42.2%
Less conservative filter	11 / 24	69,032	185.1%	127,778	83,184	172,511	41.4%

† For each filter, the regression savings estimate was applied to the estimate of savings in the population of multi-family facilities (N=24), not the estimation sample. This is why the annual engineering estimate of gas savings in the Table do not change with the filters,

The results are sensitive to which filter is applied, which is expected given the small sample size. With no filter, the estimated savings realization rate is 53.2 percent and program savings are estimated to have been 36,725 therms. With the conservative filter the estimated savings realization rate is approximately 185 percent and the program savings are estimated to be 127,778 therms, while the less conservative filter yields similar results. Until a revised analysis is complete, Cadmus recommends the most conservative estimate of the No filter case above, which resulted in a realization rate of 53.2%.

As in the single-family gas predicted savings, National Grid's program engineering savings estimates were based on calculations and formulae from the audit software. Each estimate was particular to the building audited; for example, air sealing savings were calculated through a formula including inputs of building size (volume) and estimated air changes per hour before and after installation. As noted above, Cadmus was concerned about the sample size and potential for missing units in the analysis. In our experience, 40% savings of annual energy use (filtered scenarios) are unlikely. As such, Cadmus recommends performing multifamily gas analysis again in the near future, and requiring part of the audit time be spent verifying account numbers associated with the facility.

7. Conclusions and Recommendations

Impact Recommendations

The energy savings achievements of Energy*Wise* program were generally less than predicted by National Grid (except for multifamily gas) and below previous program results. Table 34 compares the estimated program electricity savings and Table 35 compares the estimated gas savings to National Grid's predicted results for each segment. Savings estimates from the 2001 evaluation of single-family electric homes are also displayed for comparison. Electric results indicate estimated savings were approximately one-half predicted savings for single-family homes but closer (5-6% below predicted savings) for multifamily homes.

Table 34. Energy*Wise* Program Gross Electric Savings

Customer Segment	National Grid Predicted Savings per participant (kWh)	Billing Analysis Estimated Savings per participant (kWh)	Percent Difference	2001 Estimated Savings per participant (kWh)
Single-family non-electric heat	787	339	-57%	713
Single-family Electric Heat	1,329	773	-42%	1,293
Multifamily non-electric heat	4,733	4,455	-6%	Not available
Multifamily Electric Heat	4,902	4,667	-5%	Not available

The large discrepancy between the estimated and expected electricity savings for single-family homes may be due to a different mix of measures having been installed in 2008 than was predicted or historically installed. It appears that CFLs and refrigerator savings estimates in particular, were higher than estimated savings and those achieved in other similar programs. Predicted savings for customers served by the electric PAs were based on previous year's program evaluations.

For single-family gas homes, savings were also less than predicted (by 33%, Table 35). For gas audits, National Grid's program engineering savings estimates were based on calculations and formulae from the InDemand Software. Each estimate was particular to the home or building audited; for example, air sealing savings were calculated using a formula that included inputs of building size (volume) and estimated air changes per hour before and after installation. For single-family homes, the difference between actual savings and engineering savings may be due to a takeback effect (a change in consumer behavior) or inaccurate input assumptions.

Table 35. Energy*Wise* Program Gross Gas Savings

Customer Segment	National Grid Predicted Savings (therms)	Billing Analysis Estimated Savings (therms)	Percent Difference
Single-family	44,274	29,491	-33%
Multifamily	69,032	130,263	89%

However, Cadmus does not have confidence in the gas multifamily savings results. About one-half of the facilities were master metered while the remaining included individually metered units (e.g. condos). We were unable to ensure billing data from all individually metered units and the common areas were included in the analysis. Combining unit billing histories, with common areas and measure data was difficult given inconsistencies in account numbers, customer names and addresses between National Grid's different databases and billing data sources.

Cadmus attempted to "clean" the data and eliminate observations with outlying savings estimates relative to weather normalized annual consumption; however, the estimated realization rate varied significantly (from 55% to 188%) depending on which observations were included in the analysis. Because of this, Cadmus recommends performing multifamily gas analysis again in the near future, and requiring that part of the audit time be spent verifying account numbers associated with the facility. In the meantime, using the most conservative results having the realization rate of 53.2% (Table 33) may be appropriate.

A separate calculation of net savings (net of freeridership and spillover) was not performed, although Cadmus believes net savings are close to gross savings. Overall freeridership estimates were 16% for insulation and 14.8% for refrigerators based on self-reports through the participant survey. Cadmus believes it is inappropriate to penalize savings results by these freeridership estimates without considering spillover as well. It is inherently difficult to quantify spillover results without performing an additional detailed audit to assess additional equipment installed and associated energy savings. However, based on survey responses 41.6% of participants installed at least one additional energy efficiency measure. The most frequently cited incremental purchases were CFLs and insulation. Due to the lack of specific information regarding spillover savings, we cannot conclude any resulting net to gross ratio.

Process Recommendations

Based on the process evaluation, the following conclusions and recommendations are also offered.

Enhance Communications with Implementers (All Program Areas)

RISE is an experienced and effective implementer that appropriately emphasizes safety as part of the overall training of employees to perform audits and installations. RISE has very little employee turnover and reportedly receives very few customer complaints. Any complaints that do arise are reviewed by RISE's president and appear to be resolved quickly. While RISE employees are known to be professional and knowledgeable, the program lacks consistent quantitative goals and written comprehensive program description documentation. It also appears

that due to the maturity of the program and long-term relationship of National Grid and Rise there is limited direct communications between the two firms. While this speaks positively of the trusting relationship between RISE and National Grid, it can allow for ambiguity and a lack of focus on energy savings. One example of an issue that should be discussed and agreed upon is the number of CFLs RISE should attempt to install in each home. According to the tracking database an average of 2.5 CFLs per home were installed by 2008 program auditors. National Grid's expectations of savings for CFL measures were 885 kWh per year in electric heated homes and 452 kWh per year in non-electric heated homes (single-family, Rhode Island), which suggests that National Grid assumes a greater number of CFLs installed per single-family home. Cadmus believes it is appropriate to direct install at least 6-8 CFLs per typical home through an audit program and if done, we estimate National Grid would have experienced even greater CFL savings.

To address these issues, Cadmus recommends National Grid prepare a detailed program description including specific installation guidelines and strategies and energy savings assumptions about installed measures. These assumptions and savings definitions should be reflected in the tracking database so that savings estimates can be more easily compared to expectations. This program description should also identify overall annual quantitative goals for the program including program energy savings and the assumptions behind them to be tracked and known by every auditor. We further recommend regular contact between National Grid and the auditors to track progress towards goals and facilitate resolution of any issues.

Create Formal Contract for Gas Add-On (Rhode Island Only)

National Grid relied on RISE when deciding to expand the program to include gas measures in 2007 and no formal contract between the two was prepared, creating a potential liability risk for National Grid and the opportunity for misunderstandings. Accordingly, rebates offered were copied from the electric program and the development of data tracking and invoices occurred after program launch, requiring ad hoc tracking in the meantime. While relatively seamless to program participants, the lack of detailed planning created difficulties and inconsistencies in data tracking. Also, participant surveys did indicate a slight bias towards electricity savings in the combined gas and electric audits – which could be another symptom of the casual implementation of the gas program. Cadmus recommends National Grid and RISE create a formal contract documenting expectations around the gas program. We also recommend a review of gas measures and tracking data to ensure they are appropriate and consistently monitored. The detailed program description described earlier should include gas measures as well as electric.

Eligible Measures (All Program Areas)

The list of eligible measures is comprehensive although dependent on whether or not National Grid supplies the fuel potentially impacted by the measures. Additional measures that could be screened for cost effectiveness (if not already done) include installation of efficient windows and doors, high-efficiency motors in large multifamily buildings, high efficiency washers, and mechanical ventilation to allow for better air sealing.

According to the survey, the least popular measures were CFLs and water savings devices. Although participants were generally satisfied with installations (average satisfaction was 8.4 for lighting and 8.5 for water heating out of 10 possible), they were less satisfied than with other measures. Reasons for dissatisfaction with CFLs were light color and brightness. Water savings

devices were unpopular and those who had them installed tended to be more dissatisfied. We recommend that National Grid research water savings technologies to find ones acceptable to homeowners. In addition, informing homeowners of the expected energy savings may help them to accept the technologies.

Marketing (Rhode Island Only)

Participants reported most often learning about the program through bill inserts or word of mouth. Should National Grid wish to increase program participation it should consider a broader marketing approach, which would involve general approaches of television, radio, and news releases followed by targeted direct mail solicitations. A targeted solicitation for single-family homes could focus on zip code areas with higher incidences of older homes and a further focus on homes with annual energy consumption greater than average residential customers.

Savings Estimates (Rhode Island Only)

Engineering formulas should provide the basis for individual measure savings predictions. National Grid already uses engineering formulas to predict savings for all multifamily homes and for single-family gas homes, but uses results from previoius evaluations to predict savings for single-family electric homes. Historical savings based on average installation rates in homes may not accurately predict savings for an individual home in the future if installation rates are different. Past evaluations should be used to inform the results and adjust assumptions associated with engineering formulas to improve estimates over time.

Data Tracking (All Program Areas)

The following changes to data tracking processes are recommended:

- One participant or facility identification number should be used to track across all data files.
- InDemand should not include variable names that are the same as or very close to variable names in National Grid's customer account system unless those fields house the same data. If an implementer assigns an ID code unique to InDemand or other tracked data, it should have a different variable name than any ID code used in the billing system.
- All data associated with a customer must include an account number, ideally, or at least one common and consistent identifier to link back to billing data.
- A data dictionary should be developed to describe all variables used in the tracking process and any formulas when applicable. When contractors receive data they should receive a list of the descriptions of all variables sent, as well as a list of available variables that were not sent but could be sent if needed for the analysis.
- For multifamily customers, InDemand should track all meters and account numbers for each facility and include a description of the units and common areas associated with each number. This will allow the evaluator to ensure all relevant data are available.

Numbers of units and numbers of buildings should also be tracked to assist in interpreting billing analysis results.

Increase Homeowner Involvement In Home Energy Action Plan (Rhode Island Only)

Participant responses regarding whether or not certain measures were installed were sometimes inconsistent with the measure tracking database. This was more prevalent with smaller, more difficult to remember measures such as CFLs or water saving devices and does not appear to be a significant problem. However, almost 10% of participants receiving CFLs, water saving devices, or duct or pipe insulation reported that the materials were handed to them to install themselves, rather than RISE installing the measure directly. Further, approximately one-third of those audited either did not recall or were dissatisfied with the Home Energy Action Plan (HEAP). Also, customers remembered very few of the many behavioral tips provided in handouts and brochures. When asked by interviewers to report the tips, many customers responded with a recommendation for an equipment change rather than a behavioral tip. All of these findings point to the need for the auditor to spend more time with the homeowner reviewing recommendations, behavioral tips, and additional brochures about saving energy. Cadmus recommends that the auditors set aside time in the audits to review and obtain homeowner agreement with the HEAP. One idea may be to include a signature page at the end of the HEAP, to be signed by both the homeowner and the auditor, confirming that the auditor reviewed the recommendations with the homeowner. If this is not already happening, we recommend the auditors show homeowners each measure installed in the home and where it is identified on the HEAP. We also recommend keeping a copy or scanned versions of the HEAP to assist in future evaluations. Finally, Cadmus recommends low cost measures be installed directly by the auditor, rather than left behind for homeowner installation.

The participant survey indicated relatively low scores for customers' perceptions of energy savings after installation relative to their expectations (an average of 5.7 out of 10). A significant portion (21%) had no idea what savings to expect. We recommend that expected energy savings be described in the HEAP for each measure and behavioral tip. As discussed above, these estimates should be formally reviewed with the customer to set realistic savings expectations and encourage the behavioral changes.

Follow-up on Measure Installation (Rhode Island Only)

According to survey respondents, overall follow-through on measure installation recommendations was 58%. Measures not installed tended to be more expensive, indicating cost as a reason for lack of follow-through. Upon further analysis of the results, however, it appears that 20% of those responding negatively to this question actually did install the recommended measure – either themselves or by using a different contractor. Since RISE does follow-up with audit participants to see if they'd like to schedule installations, we recommend that they also ask if the participant has installed a recommended measure on her own, and gather the specifics of what was installed to be tracked in the database – so it can be credited to program savings.

Offer Audit Options (Rhode Island Only)

In the survey, 30% of participants were unable to state why they did not install the measure, and another 15% answered generically "they didn't want the measure installed in their home." We

believe this response indicates a lack of interest in installing any measures. The audit is free to users and there is no requirement for further installation. Cadmus recommends National Grid consider a two-tiered approach to audits – a free audit with an overview of potential savings and a more in-depth audit to identify additional energy saving opportunities, with both providing free CFLs and water saving devices. The more costly audits would be performed only for homeowners who elected to have them and could include blower door or infrared camera testing. The more in-depth audit option could also rebate the audit fee if follow-up measures are installed. Other utilities charge up to $250 for a detailed audit, which could yield better follow-through on recommended measures.

Overall Satisfaction

Overall participants were highly satisfied with the program. The only specific recommendations made by participants were to increase incentives (9%) and offer a more detailed audit (8%).

Appendix A: Participant Survey

RHODE ISLAND PARTICIPANT SURVEY

NATIONAL GRID ENERGY*WISE* PROGRAM 2008

Hello, my name is _____ from Population Research Systems. I'm calling on behalf of National Grid.

I am calling to ask you a short survey for the National Grid's energy audit program *[CUSTOMERS MAY ALSO KNOW THIS PROGRAM AS THE "RISE" PROGRAM]*. This is not a sales call. My questions are for research purposes only. We are only interested in your opinions to help improve our programs, and understand how to assist customers in saving money on their utility bills. Your individual answers will be used by National Grid to evaluate the energy audit program. [*IF RESPONDENT ASKS HOW LONG, SAY: "APPROXIMATELY 15 MINUTES"]*

S. SCREENING QUESTIONS

Before we get started, I'd like to ask a few SCREENING QUESTIONS.

S1. According to our records, *[INSERT CUSTOMER NAME]* contacted National Grid for an energy audit. May I please speak to *[INSERT CUSTOMER NAME]* or the person familiar with the National Grid Energy audit?

1 Yes [*GO TO S2*]
2 No
98 Don't know
99 Refused

[*IF NOT AVAILABLE, ASK TO CALL BACK*]
No *[ARRANGE CALLBACK*]
DK/Refused [*TERMINATE*]

[*FOR TERMINATIONS*] I have been asked to conduct interviews with people who have recently contacted National Grid for an energy audit. Since you have not called, these are all the questions I have at this time, and I thank you for your time.

[If "*NO, NOT A CONVENIENT TIME," ASK IF RESPONDENT WOULD LIKE (1) TO START NOW AND DO PART OF THE SURVEY, or (2) ARRANGE A MORE CONVENIENT TIME WE CAN CALL THEM AT HOME. EMPHASIZE THAT*]: "It is important for National Grid to include your opinions in this study so they can serve your needs better."

S2. Which one of the following best describes the home that received the energy audit?

1 Single-family detached (no common walls)
2 Single-family attached (attached to 1 to 3 other units)
3 Multi family home such as an apartment or condo
4 Mobile home or trailer
5 Other [Specify] _____
98 Don't Know
99 Refused

[IF S2 = 3 OR 5 (AND OTHER IS INTERPRETED AS OTHER THAN SINGLE-FAMILY) THANK THE PARTICIPANT AND CLOSE, OTHERWISE SKIP TO A1]

A. PARTICIPATION

A1. How did you first hear about National Grid's energy audit program? *[INTERVIEWER RECORD AND VERIFY ANSWER, DO NOT READ LIST]*

1 Newspaper/Magazine/Print Media
2 Bill Inserts
3 National Grid Web site
4 Other Web site *[IF YES, WHICH WEBSITE(S)?]*
_____
5 Family/friends/word-of-mouth
6 National Grid Representative
7 Radio
8 TV
9 HVAC Contractor
10 Other *[SPECIFY AND RECORD VERBATIM]* _____
98 Don't know
99 Refused

A2. Which of the following did you do to get more information about the program? Did you…

1 visit the National Grid Web site
2 obtain printed program materials *[WHAT MATERIALS?]* _____
3 visit other Web sites *[WHICH?]* _____
4 call National Grid
5 call a contractor
6 Other *[SPECIFY]*_____
7 Did not do anything to get more info
98 Don't Know
99 Refused

A3. Using a scale of 0 through 10 with 0 meaning strongly disagree and 10 meaning strongly agree, please rate how well you agree with the following sentence "The information about National Grid's energy audit program was easy to obtain and easy to understand."

____ Rating *[IF RATING > 5, SKIP TO A5]*
98 Don't know *[SKIP TO A5]*
99 Refused *[SKIP TO A5]*

A4. What was unsatisfactory about the program information sources? *[DO NOT READ, MARK ALL THAT APPLY]*

1 It was difficult to find any program information
2 The information was confusing
3 The information was inconsistent with the actual program
4 The materials were too long to read
5 Other *[SPECIFY]* _____
98 Don't know
99 Other

A5. Using a scale of 0 though 10 with 0 meaning extremely difficult and 10 meaning very easy, how straightforward would you say it was to sign up for the energy audit?

____ Rating *[IF RATING IS > 5 SKIP TO A7]*
98 Don't know *[SKIP TO A7]*
99 Refused *[SKIP TO A7]*

A6. What was difficult about signing up for the program? *[DO NOT READ, MARK ALL THAT APPLY]*

1 I was put on a waiting list
2 National Grid took too long to call back
3 Contractor took too long to call back
4 Difficult to get an appointment time that was convenient for me
5 Wanted to use a different (non program contractor)
6 Other *[SPECIFY]* _____
98 Don't know
99 Other

[IF MEASURES = 0, SKIP TO A9]
A7. Our records indicate that the contractor installed *[INSERT LIST OF MEASURES]*. Does this sound correct to you?

1 Yes *[SKIP TO A9*]
2 No

98 Don't know *[SKIP TO QUESTION A9]*
99 Refused *[SKIP TO QUESTION A9]*

A8. What is your recollection of the improvements installed? *[READ IF PROMPTING NEEDED, MULTIPLE ANSWERS ALLOWED]*

1 Install CFLs Number _____
2 Install new lighting fixtures Number _____
3 Install water saving devices (aerators, low-flow faucets or showerheads) Number_____
4 Replace refrigerator
5 Replace freezer
6 Added insulation to walls, basement, floors or ceiling
7 Seal cracks 10 Added duct or pipe insulation or sealing 11 Added ventilation
12 Tune-up heating system
13 Installed programmable thermostats
14 Added AC timer
15 Other _____
98 Don't know
99 Refused

[CORRECT MEASURES LIST USING INFORMATION FROM A8]

A9. *[IF GAS AUDIT CUSTOMER = YES or ELECTRIC AUDIT CUSTOMER = YES, ELSE SKIP TO A10]* Our records indicate that you did not install the [INSERT LIST OF AUDIT MEASURES HERE] as recommended by the Contractor. May I know why?
[MARK ALL THAT APPLY, SEE BELOW FOR REASON CODES]

1 CFLs ____*[REASON CODE]*
2 New lighting fixtures ____*[REASON CODE]*
3 Water saving devices (aerators, low flow faucets or showerheads) ____*[REASON CODE]*
4 Refrigerator ____*[REASON CODE]*
5 Freezer ____*[REASON CODE]*
6 Insulation to building envelope____*[REASON CODE]*
7 Seal cracks ____*[REASON CODE]*
8 Duct or pipe insulation or sealing ___*[REASON CODE]*
9 Ventilation ____*[REASON CODE]*
10 Tune-up heating system ____*[REASON CODE]*
11 Programmable thermostats ____*[REASON CODE]*
12 AC timer ____*[REASON CODE]*
13 Other *[SPECIFY]*_____ ____*[REASON CODE]*
98 Don't know
99 Refused

[REASON CODES: MULTIPLE RESPONSES ALLOWED]

1 I didn't want to spend the money required to install the measure
2 I was unable to schedule the installation
3 I don't know what to do next to make the arrangements
4 I don't want that measure installed in my home *[WHY]*? _____
5 Other *[SPECIFY]*_____
98 Don't know
99 Refused

[IF NO MEASURES WERE INSTALLED SKIP TO A34]
[IF MEASURE = CFL, READ A12, ELSE SKIP TO A16]

A10. On a scale of 0 to 10, with 0 being not at all satisfied and 10 being very satisfied, how satisfied are you with the CFLs that were installed through the energy audit.

____ Rating *[IF RATING IS > 5 SKIP TO A12]*
98 Don't know *[SKIP TO A12]*
99 Refused *[SKIP TO A12]*

A11. What was unsatisfactory about the CFLs installed? *[DO NOT READ, MARK ALL THAT APPLY]*

1 I don't like the color of the light
2 The light is too bright
3 The light is too dim
4 They flicker
5 They take too long to light up
6 They don't fit well in my fixtures
7 They don't look nice in my fixtures
8 They burn out quickly
9 Other *[SPECIFY]* _____
98 Don't know
99 Other

A12. How many *CFLs]* were installed by the contractor?

1 _____ *[ENTER # of CFL's]*

98 Don't know*]*
99 Refused

A13. Are all the CFL's still installed in your home?

1 Yes *[SKIP TO QUESTION A15]*

2 No
98 Don't know *[SKIP TO QUESTION A15]*
99 Refused *[SKIP TO QUESTION A15]*

A14. Why were the CFLs removed? *[DON'T READ, MULTIPLE ANSWERS OKAY]*

1 Didn't like the color
2 It took too long to start up
3 It wasn't bright enough
4 Didn't like the way it looked
5 It didn't fit
6 It made noise/buzzed
7 It didn't work in a dimmer switch
8 It wasn't available in 3-way
9 It burned out
10 Other *[SPECIFY]* _____
98 Don't know
99 Refused

A15. *[IF MEASURE=FIXTURE, READ A15, ELSE SKIP TO A17]*
On a scale of 0 to 10, how well do you like the new lighting fixture(s) installed through the energy audit program?

____ Rating *[IF RATING IS > 5 SKIP TO A17]*
98 Don't know *[SKIP TO A17]*
99 Refused *[SKIP TO A17]*

A16. What was unsatisfactory about the new lighting fixture(s) installed? *[DO NOT READ, MARK ALL THAT APPLY]*

1 I don't like the way it looks
2 I don't like the color
3 It is too small/large
4 It stopped working
5 Other *[SPECIFY]* _____
98 Don't know
99 Other

A17. *[IF MEASURE=WATER, READ A17, ELSE SKIP TO A19]*
On a scale of 0 to 10, how well do you like the new water savings device(s) *[IF NOT SURE PROMPT WITH FAUCET AERATORS, LOW FLOW FAUCETS OR LOW FLOW SHOWER HEADS]* installed through the energy audit program?

____ Rating *[IF RATING IS > 5 SKIP TO A19]*

98 Don't know *[SKIP TO A19]*
99 Refused *[SKIP TO A19]*

A18. What was unsatisfactory about the new water savings device(s) installed? *[DO NOT READ, MARK ALL THAT APPLY]*

1 Water pressure is too low
2 Water pressure is too high
3 It is too noisy
4 It stopped working
5 Other *[SPECIFY]* _____
98 Don't know
99 Other

[IF MEASURE=REFRIGERATOR OR FREEZER, READ A19, ELSE SKIP TO A21]
A19. On a scale of 0 to 10, how well do you like the new refrigerator(s) or freezer installed through the energy audit program?

____ Rating *[IF RATING IS > 5 SKIP TO A21]*
98 Don't know *[SKIP TO A21]*
99 Refused *[SKIP TO A21]*

A20. What was unsatisfactory about the new refrigerator(s) installed? *[DO NOT READ, MARK ALL THAT APPLY]*

1 I don't like the way it looks
2 I don't like the color
3 The refrigerator or freezer is too small/large
4 It doesn't keep the food at the right temperature
5 It stopped working
6 Other *[SPECIFY]* _____
98 Don't know
99 Other

[IF MEASURE=INSULATION, READ A21, OTHERWISE SKIP TO A23]
A21. On a scale of 0 to 10, how satisfied are you with the additional insulation installed through the energy audit program?

____ Rating *[IF RATING IS > 5 SKIP TO A23]*
98 Don't know *[SKIP TO A23]*
99 Refused *[SKIP TO A23]*

A22. What was unsatisfactory about installation of insulation? *[DO NOT READ, MARK ALL THAT APPLY]*

1 It wasn't enough
2 It was too much
3 It didn't help keep the house more comfortable
4 The contractor didn't finish
5 The contractor left a mess
6 Other [SPECIFY] _____
98 Don't know
99 Other

A23. *[IF MEASURE=DUCT SYSTEMS READ A23, ELSE SKIP TO A25]* On a scale of 0 to 10, how satisfied are you with the duct system work performed by the contractor through the energy audit program?

____ Rating *[IF RATING IS > 5 SKIP TO A25]*
98 Don't know *[SKIP TO A25]*
99 Refused *[SKIP TO A25]*

A24. What was unsatisfactory about the duct system work? *[DO NOT READ, MARK ALL THAT APPLY]*

1 It didn't help keep the house more comfortable
2 The contractor didn't finish
3 The contractor left a mess
4 It didn't save any energy
5 Other *[SPECIFY]* _____
98 Don't know
100 Refused

A25. *[IF MEASURE=SEALING CRACKS READ A25, ELSE SKIP TO A27]* On a scale of 0 to 10, how satisfied are you with the crack sealing work performed by the contractor through the energy audit program?

____ Rating *[IF RATING IS > 5 SKIP TO A27]*
98 Don't know *[SKIP TO A27]*
99 Refused *[SKIP TO A27]*

A26. What was unsatisfactory about the crack sealing work? *[DO NOT READ, MARK ALL THAT APPLY]*

1 It didn't help keep the house more comfortable
2 It wasn't enough sealing
3 It was too much sealing
4 The contractor didn't finish
5 The contractor left a mess

6 It didn't save any energy
7 Other *[SPECIFY]* _____
98 Don't know
99 Refused

A27. *[IF MEASURE=HEATING SYSTEM TUNE-UP, READ A27, ELSE SKIP TO A29]* On a scale of 0 to 10, how satisfied are you with the heating system tune-up performed by the contractor through the energy audit program?

____ Rating *[IF RATING IS > 5 SKIP TO A29]*
98 Don't know *[SKIP TO A2932]*
99 Refused *[SKIP TO A29]*

A28. What was unsatisfactory about the heating system tune-up? *[DO NOT READ, MARK ALL THAT APPLY]*

1 It didn't change anything
2 The heat pump doesn't work as well as before
3 It didn't help keep the house more comfortable
4 The contractor left a mess
5 Other *[SPECIFY]* _____
98 Don't know
99 Other

A29. *[IF MEASURE=THERMOSTAT, READ A29, ELSE SKIP TO A31]* On a scale of 0 to 10, how satisfied are you with the programmable thermostat installed through the energy audit program?

____ Rating *[IF RATING IS > 5 SKIP TO A31]*
98 Don't know *[SKIP TO A31]*
99 Refused *[SKIP TO A31]*

A30. What was unsatisfactory about programmable thermostat? *[DO NOT READ, MARK ALL THAT APPLY]*

1 It didn't change anything
2 The house is less comfortable
3 I don't know how to use the thermostat
4 The thermostat doesn't stay programmed
5 It doesn't work
6 Other *[SPECIFY]* _____
98 Don't know
99 Other

A31. *[IF MEASURE=AC TIMER, READ A31, ELSE SKIP TO A33]* On a scale of 0 to 10, how satisfied are you with the air conditioner timer installed through the energy audit program?

____ Rating *[IF RATING IS > 5 SKIP TO A33]*
98 Don't know *[SKIP TO A33]*
99 Refused *[SKIP TO A33]*

A32. What was unsatisfactory about the air conditioner timer? *[DO NOT READ, MARK ALL THAT APPLY]*

1 It didn't change anything
2 The house gets too hot in between cycles
3 Its too noisy when the AC turns off and on
4 It doesn't work
3 It made the air conditioner not work
4 I don't know how to use it
6 Other *[SPECIFY]* _____
98 Don't know
99 Other

A33. Using a scale of 0 through 10 with 0 meaning not at all well and 10 meaning extremely well, how smoothly would you say the energy audit (and the installations) went [*ONLY ASK ABOUT INSTALLATIONS IF MEASURES WERE INSTALLED]*?

____ Rating *[IF >5 SKIP TO A35]*
98 Don't know *[SKIP TO A35]*
99 Refused *[SKIP TO A35]*

A34. What did not go smoothly about the audit and installations? *[DO NOT READ, MARK ALL THAT APPLY]*

1 The contractor was late.
2 The contractor didn't show.
3 The work was sloppy
4 The installation didn't work
5 I didn't like the products installed
6 Other *[SPECIFY]* _____
98 Don't know
99 Other

A35. Did you receive a Home Energy Action Plan?

1 Yes
2 No *[SKIP TO A38]*

98 Don't know *[SAY IT WAS A TYPED DOCUMENT SUMMARIZING WHAT WAS INSTALLED, RECOMMENDED, WITH LOW COST SUGGESTIONS TO HELP YOU SAVE – IF STILL DON'T KNOW SKIP TO QUESTION A41]*
99 Refused *[SKIP TO QUESTION A38]*

A36. Using a scale of 0 through 10 with 0 meaning not at all helpful and 10 meaning extremely helpful, how helpful would you say the Home Energy Action Plan was??

____ Rating *[IF >5 SKIP TO A38]*
98 Don't know *[SKIP TO A38]*
99 Refused *[SKIP TO A38]*

A37. Why was the Action Plan not very helpful to you? *[DO NOT READ, MARK ALL THAT APPLY]*

1 I didn't agree with the suggestions.
2 No one followed up with me to make the installations
3 I didn't like the work done by the contractor
4 Other *[SPECIFY]* _____
98 Don't know
99 Other

A38. Did the contractor provide you any information or tips on how you could reduce your energy consumption?

1 Yes
2 No *[PROMPT WITH LIST OF TIPS FROM A39, IF STILL NO SKIP TO QUESTION A46]*
98 Don't know *[PROMPT WITH LIST OF TIPS FROM A39, IF STILL DON'T KNOW, SKIP TO A39*]
99 Refused *[SKIP TO QUESTION A44]*

A39. Which tips do you remember the contractor telling you?
1 Air dry dishes instead of using the dishwasher's drying cycle
2 Don't rinse dishes before loading in dishwasher
3 Turn off computer and monitor when not in use
4 Plug home electronics into power strips and turn off power strips when not in use
5 Lower hot water thermostat to 120F
6 Take short showers instead of baths
7 Repair leaky faucets
8 Turn off water while shaving, brushing teeth or doing the dishes
7 Wash only full loads of dishes and clothes
8 Set thermostats high in summer and low in winter

9 Use ceiling fans, window fans, or table fans instead of air conditioners
10 Use open windows with fans to cross ventilate on cool nights instead of air conditioners
11 Close windows, doors, shades and drapes during the day to keep the sun's heat out
12 Plant leafy green trees on the sunny side of your home
13 Clean cooling coils and filters on your air conditioners monthly in the summer
14 Use the recirculate setting so your air conditioner doesn't have to work as hard
15 Plant trees to shade air conditioners but not block air flow
16 Use cold water when possible
17 Avoid running hot water needlessly
18 Wash and rinse clothes in cold water
19 Clean dryer lint screens after each load
20 Vent dryer to outdoors
21 Unplug second refrigerator or freezer
22 Use 37 to 40 degrees F for fresh food and 0 for the freezer
23 Vacuum condenser coils on refrigerators and freezers
24 Make sure your refrigerator door seals are tight
25 Position your refrigerator or freezer away from heat sources
26 Turn off lights or install timers when not in use
27 Use task lighting instead of room lighting
28 Turn off TV when not in use
29 Use a microwave, toaster oven or crockpot before conventional oven
30 Avoid preheating the oven
31 Use smallest pan necessary for cooking
32 Defrost frozen foods in refrigerator
33 Heat water for beverages in the microwave oven
34 Clean inside surfaces of microwave
35 Change furnace filters every two months
36 Set thermostat fan setting on "auto" instead of continuous
98 Don't know
99 Refused

A40. Using a scale of 0 though 10 with 0 meaning not at all satisfied and 10 meaning extremely satisfied, how satisfied are you with the tips provided by the contractor?

____ Rating *[IF RATING > 5 SKIP TO A42]*
98 Don't know *[SKIP TO A42]*
99 Refused *[SKIP TO A42]*

A41. What was unsatisfactory about the tips? *[DO NOT READ, MARK ALL THAT APPLY]*

1 They didn't make sense/couldn't understand
2 They wouldn't work for my lifestyle

3 I didn't get anything written so I could remember them
4 I didn't notice any savings by implementing them
5 They were too difficult to keep up
6 It made the house uncomfortable
7 I couldn't get clothes or dishes clean
8 Ran out of hot water sooner
9 Too inconvenient
10 We already do all of them
11 Other *[SPECIFY]* _____
98 Don't know
99 Other

A42. Have you implemented any of these tips?

1 Yes
2 No *[SKIP TO A44]*
98 Don't know *[SKIP TO A44]*
99 Refused *[SKIP TO A44]*

A43. Which tips? *[DO NOT READ, MARK ALL THAT RESPONDENT RECALLS]*
1 Air dry dishes instead of using the dishwasher's drying cycle
2 Don't rinse dishes before loading in dishwasher
3 Turn off computer and monitor when not in use
4 Plug home electronics into power strips and turn off power strips when not in use
5 Lower hot water thermostat to 120F
6 Take short showers instead of baths
7 Repair leaky faucets
8 Turn off water while shaving, brushing teeth or doing the dishes
9 Wash only full loads of dishes and clothes
10 Set thermostats high in summer and low in winter
11 Use ceiling fans, window fans, or table fans instead of air conditioners
12 Use open windows with fans to cross ventilate on cool nights instead of air conditioners
13 Close windows, doors, shades and drapes during the day to keep the sun's heat out
14 Plant leafy green trees on the sunny side of your home
15 Clean cooling coils and filters on your air conditioners monthly in the summer
16 Use the recirculate setting so your air conditioner doesn't have to work as hard
17 Plant trees to shade air conditioners but not block air flow
18 Use cold water when possible
19 Avoid running hot water needlessly
20 Wash and rinse clothes in cold water
21 Clean dryer lint screens after each load
22 Vent dryer to outdoors
23 Unplug second refrigerator or freezer
24 Use 37 to 40 degrees F for fresh food and 0 for the freezer

25 Vacuum condenser coils on refrigerators and freezers
26 Make sure your refrigerator door seals are tight
27 Position your refrigerator or freezer away from heat sources
28 Turn off lights or install timers when not in use
29 Use task lighting instead of room lighting
30 Turn off TV when not in use
31 Use a microwave, toaster oven or crockpot before conventional oven
32 Avoid preheating the oven
33 Use smallest pan necessary for cooking
34 Defrost frozen foods in refrigerator
35 Heat water for beverages in the microwave oven
36 Clean inside surfaces of microwave
37 Change furnace filters every two months
38 Set thermostat fan setting on "auto" instead of continuous
98 Don't know *[PROMPT WITH LIST]*
99 Refused

[IF CUSTOMER = GAS CUSTOMER ASK QUESTION A44, ELSE SKIP TO A46]
A44. Did the contractor talk to you about how to save both gas and electricity?

1 Yes
2 No *[GO TO QUESTION A 46]*
98 Don't know *[SKIP TO QUESTION A46]*
99 Refused *[SKIP TO QUESTION A46]*

A45. Thinking back, which fuel, gas or electricity, did the contractor spend more time discussing the opportunities for savings, was it….

1 much more time on electricity saving ideas
2 much more time on gas saving ideas
3 a little more time on electricity saving ideas
4 a little more time on gas saving ideas
5 about the same amount of time on both fuels
98 Don't know
99 Refused

A46. Using a scale of 0 though 10 with 0 meaning no savings and 10 meaning high savings, how would you rate the level of energy savings you have seen from the program?

____ Rating
98 Don't know
99 Refused

B. OVERALL PROGRAM SATISFACTION

"Earlier I asked you about the sign up process, the audit, and the installations. Now, I'd like to ask about your overall satisfaction with the program".

B1. On a scale of 0 to 10, with 0 being not satisfied and 10 being very satisfied, how satisfied are you overall with the energy audit program?

____ Rating *[IF RATING IS > 5, SKIP TO B3]*
98 Don't know *[SKIP TO B3]*
99 Refused *[SKIP TO B3]*

B2. What was unsatisfactory about the energy audit program? *[DO NOT READ, MARK ALL THAT APPLY]*

1 Co-payments were too expensive
2 National Grid took too long to call back
3 Contractor took too long or never called back
4 Contractor never showed up/showed up late
5 Contractor was unreliable/unprofessional
6 Difficult to get an appointment time that was convenient for me
7 Wanted to use a different (non-program) contractor
8 Didn't like the new equipment installed
9 House is not as comfortable as before
10 Other *[SPECIFY]* _____
98 Don't know
99 Refused

B3. On a scale of 0 – 10 where 0 is not at all likely and 10 is very likely, how likely are you to recommend the National Grid energy audit program to friends and family members?

____ Rating
98 Don't know
99 Refused

B4. What do you think is the greatest benefit of having the energy audit? *[RECORD RESPONSE]* _____

B5. Do you have any suggestions to improve the energy audit Program? *[RECORD VERBATIM]* _____
_____

IF NO MEASURES WERE INSTALLED GO TO D1.

C. FREERIDERSHIP

"Now I'm going to ask you a few questions about your decision to sign up for National Grid's energy audit program."

C1. Please think back to the time when you were deciding to sign up for the energy audit program, perhaps recalling things that occurred in your household shortly before and after *[INSERT PARTICIPATION DATE]*. What factors motivated you to sign up for the energy audit? *[DO NOT READ; INDICATE ALL THAT APPLY; ONCE THEY RESPONDENT HAS FINISHED, PROBE*: Are there any other factors?]

1 Old equipment didn't work
2 Old equipment working poorly
3 The program incentive
4 The program technical assistance
5 Wanted to save energy
6 Wanted to reduce energy costs
7 Wanted to improve comfort levels in my home
8 The information provided by the Program
9 Past experience with this program
10 Because of past experience with another National Grid program
11 Recommendation from other utility program [*PROBE: WHAT PROGRAM*? _____]
12 Recommendation of dealer/retailer
13 Recommendation of someone else [*PROBE: WHO*?_____]
14 Advertisement in newspaper [*PROBE: FOR WHAT PROGRAM?* _____]
15 Radio advertisement [*PROBE: FOR WHAT PROGRAM*? _____]
16 Other *[SPECIFY]* _____
17 Environmental concerns
18 Global warming
19 Keeping up with the latest trends and fashions
98 Don't know
99 Refused

[IF MEASURE = REFRIGERATOR OR FREEZER, READ C2, ELSE SKIP TO C15]
C2. How old was the refrigerator or freezer you replaced? *[READ CATEGORIES IF NEEDED]*

1 Less than 5 years old
2 5 to less than 10 years old
3 10 to less than 20 years old

4 20 years to less than 30 years old
5 30 or more years old
98 Don't Know
99 Refused

C3. Was the old refrigerator or freezer working or not working?

1 Working
2 Not working *[SKIP TO C5]*
98 Don't Know *[SKIP TO C5]*
99 Refused *[SKIP TO C5]*

C4. Was the old refrigerator or freezer in good, fair, or poor working condition?

1 Good
2 Fair
3 Poor
98 Don't Know
99 Refused

C5. At the time you first heard about the energy audit program from National Grid had you….? *[READ LIST]*

1 Already been thinking about purchasing a new refrigerator or freezer?
2 Already begun collecting information about refrigerators or freezers?
3 Already selected the refrigerator or freezer you were going to get?
4 *[DON'T READ]* Other: _____
98 Don't know
99 Refused

C6. Just to be sure I understand, did you have specific plans to install a new refrigerator or freezer before learning about the incentives available through the energy audit program?

1 Yes
2 No *[SKIP TO C10]*
98 Don't know *[SKIP TO C10]*
99 Refused *[SKIP TO C10]*

C7. Did you have to make any changes to your existing plans in order to receive this assistance through the energy audit program?

1 Yes
2 No
98 Don't Know
99 Refused

C8. *[REPEAT AS NEEDED FOR C8 PARTS A – D]* If the assistance from the energy audit program had not been available,

C8A. would you still have purchased a refrigerator?

1 Yes
2 No *[SKIP TO C9]*
98 Don't know
99 Refused

C8B. would you still have purchased the refrigerator at the same time as you did?

1 Yes *[SKIP TO C8C]*
2 No
98 Don't Know *[SKIP TO C8C]*
99 Refused *[SKIP TO C8C]*

C8B1. Would you have bought the refrigerator earlier than you did, or later?

1 Earlier
2 Same Time *[REPEAT QUESTION C8B]*
3 Later
98 Don't know *[SKIP TO C8C]*
99 Refused *[SKIP TO C8C]*

C8B2. *[IF C8B1=1, SHOW EARLIER, IF C8B1=3, SHOW LATER]* How much **[earlier/later]** would you have bought the refrigerator?

_____ Years *[AND/OR]* _____Months
98 Don't know
99 Refused

C8C. If the assistance from the energy audit program had not been available, would you have done anything else differently?

1 Yes
2 No *[SKIP TO C9]*
98 Don't know *[SKIP TO C9]*
99 Refused *[SKIP TO C9]*

C8D. What would you have done differently?

[RECORD RESPONSE]: _____

C9. On a 0 to 10 scale, with 0 being not at all likely and 10 being very likely, how likely is it that you would have bought the same refrigerator if you had not received any assistance from the program?

____ RATING
98 Don't Know
99 Refused

C10. Our records indicate you received about *$200* from National Grid either directly or at the time of purchase to offset the cost of the refrigerator. Does this amount sound about right?

1 Yes *[SKIP TO C12]*
2 No
98 Don't know *[SKIP TO C12]*
99 Refused *[SKIP TO C12]*

C11. What would you estimate to be the actual amount?

[RECORD RESPONSE] _____ *[SET = NEW AMOUNT OF PROGRAM INCENTIVE/SUBSIDY – IF $0 SKIP TO C13]*
98 Don't know
99 Refused

C12. On a scale of 0 to 10, where 0 is strongly disagree and 10 is strongly agree, how much do you agree with the following statement? If I had not had any assistance from the program, I would have paid the additional amount to buy the refrigerator on my own.

[*RECORD RESPONSE (0-10)]* _____
98 Don't know
99 Refused

C13. *[CHECK FOR INCONSISTENT RESPONSES ON QUESTIONS C6, C8a, C9, & C12 – RESPONSES SHOULD EITHER BE C6=1, C8A=1, C9 >5, and C12 >5 OR C6=2, C8a=2, C9<5, and C12<5], ASK THIS QUESTION:]* Let me make sure I understand you. Earlier, you said **[fill with inconsistency 1]**, but that differs from some of your other responses. Please tell me in your own words what influence,

if any, the program had on your decision to purchase and install the refrigerator at the time you did? [RECORD VERBATIM RESPONSE BELOW]

_____
_____
_____

C14. **[fill with wording and response categories to the one question which was inconsistent]** *[INTERVIEWER; BASED ON VERBATIM RESPONSE TO C13, PLEASE RECORD NEW RESPONSE]*

C15*. [IF INSULATION FLAG=1 OR A8=6, ELSE GO TO D1]* Our records indicated that insulation was installed through the energy audit in your home. Was this insulation installed in areas where no prior insulation existed?

1 YeS
2 No
98 Don't know
99 Refused

C16. At the time you first heard about the energy audit program from National Grid had you….? *[READ LIST]*

1 Already been thinking about adding new insulation to your home?
2 Already begun collecting information about insulation?
3 Already selected the insulation you were going to purchase?
4 Other: _____
98 Don't know
99 Refused

C17. Just to be sure I understand, did you have specific plans to install new insulation before learning about the incentives available through the energy audit program?

1 Yes
2 No *[SKIP TO C19]*
98 Don't know
99 Refused

C18. Did you have to make any changes to your existing plans in order to receive the insulation through the energy audit program?

1 Yes
2 No
98 Don't Know
99 Refused

C19. If the insulation were not available through the energy audit program, would you still have purchased any insulation?

1 Yes
2 No *[SKIP TO C24]*
98 Don't Know
99 Refused

C20. If the insulation were not available through the energy audit program, would you have purchased the insulation at the same time as you did?

1 Yes *[SKIP TO C23]*
2 No
98 Don't Know
99 Refused

C21. If the insulation weren't available through the energy audit program, would you have purchased it earlier than you did or later?

1 Earlier
2 Same time *[REPEAT QUESTION C20]*
3 Later
98 Don't know *[SKIP TO C24]*
99 Refused *[SKIP TO C24]*

C22. How much *[EARLIER/LATER – USE ANSWER FROM C21]* would you have purchased the insulation?

____ Years *[AND/OR]* ____ Months
98 Don't know
99 Refused

C23. Without the program, would you have purchased the same R value of insulation?

1 Yes
2 No
98 Don't know
99 Refused

C24. If the energy audit program would not have been available would you have done anything else differently?

1 Yes
2 No *[SKIP TO C26]*
98 Don't know *[SKIP TO C26]*
99 Refused *[SKIP TO C26]*

C25. What would you have done differently?

[RECORD RESPONSE] _____

C26. On a scale of 0 to 10 scale, with 0 being not at all likely and 10 being very likely, how likely is it that you would have bought the same insulation if you had not received it from the energy audit program?

_____ *[RECORD RESPONSE (0-10)]*
98 Don't know
99 Refused

C27. Our records indicate you received a 50% subsidy from National Grid to offset the cost of the insulation. Does this amount sound about right?

1 Yes *[SKIP TO C29]*
2 No
98 Don't Know *[SKIP TO C29]*
99 Refused *[SKIP TO C29]*

C28. What would you estimate to be the actual percentage?

____ *[RECORD RESPONSE] [SET = NEW AMOUNT OF SUBSIDY]*
98 Don't know
99 Refused

I'm going to read several statements about how you came to choose your insulation. On a scale of 0 to 10, where 0 is strongly disagree and 10 is strongly agree, how much do you agree with each statement?

C29. If I had not received any assistance from the program, I would have paid the additional *[PROGRAM SUBSIDY]* to buy the insulation on my own.

_____ *[RECORD RESPONSE]*
98 Don't know
99 Refused

C30. There may have been several reasons for my purchase decision. But the assistance from National Grid was a critical factor in my decision to purchase the insulation.

_____ *[RECORD RESPONSE]*
98 Don't know
99 Refused

C31. I would have bought insulation within a year of when I did even without the incentives from National Grid.

____ *[RECORD RESPONSE]*
98 Don't know
99 Refused

C32. *[CHECK FOR INCONSISTENT RESPONSES ON QUESTIONS C17, C19, C26 & C29 – RESPONSES SHOULD EITHER BE C17=1, C19=1, C26 >5, and C29 >5 OR C17=2, C19=2, C26>5, and C29>5], ASK THIS QUESTION:* Let me make sure I understand you. Earlier, you said **[fill with inconsistency 1]**, but that differs from some of your other responses. Please tell me in your own words what influence, if any, the program had on your decision to purchase and install the insulation at the time you did? *[RECORD VERBATIM RESPONSE BELOW]*

_____
_____

C33. **[fill with wording and response categories to the one question which was inconsistent]** *[INTERVIEWER; BASED ON VERBATIM RESPONSE TO C32, PLEASE RECORD NEW RESPONSE]*

D. SPILLOVER

D1. Since deciding to have an energy audit did you make any other energy efficiency improvements or purchases on your own without any assistance from a utility or other energy company *[EXCLUDES MANUFACTURERS REBATES]*?

1 Yes
2 No *[SKIP TO E1]*
98 Don't know *[SKIP TO E1]*
99 Refused *[SKIP TO E1]*

D2. What did you purchase or install?

1 Energy efficient appliance *[WHICH APPLIANCE?]*_____
2 *CFLs*
3 Upgraded heating or cooling unit
4 Additional insulation
5 Other *[SPECIFY]* _____
98 Don't know
99 Refused

D3. *[ASK FOR EACH TYPE OF EQUIPMENT IN D2]* How do you know that this equipment is high efficiency? *[PROBE: WAS IT ENERGY STAR® RATED?]*

Type 1: _____
Type 2: _____
Type 3: _____

D4. *[ASK FOR EACH TYPE OF EQUIPMENT IN D2]*I'm going to read a statement about the *[INSERT EQUIPMENT FROM D2]* equipment that you purchased on your own. On a scale from 0-10 with 0 indicating you strongly disagree and 10 indicating that you strongly agree, please rate the following statement: "My experience with the energy audit influenced my decision to install different types of high efficiency equipment on my own".

_____*[RECORD RESPONSE (0-10)]*
98 Don't Know
99 Refused

D5. *[ASK FOR EACH TYPE OF EQUIPMENT IN D2]* Why did you purchase this high efficiency equipment without going through a National Grid or other utility program? *[DO NOT READ; INDICATE ALL THAT APPLY]*

1 Too much paperwork
2 Takes too long to get approval
3 No time to participate, needed equipment immediately
4 The program had ended
5 The equipment would not qualify *[PROBE: WHY NOT?]* _____
6 The amount of the rebate wasn't important enough
7 Did not know program was available
8 There was no program available
9 Other *[SPECIFY]* _____
98 Don't Know
99 Refused

E. DEMOGRAPHICS

E1. What is the approximate age of your home?

____ years
98 Don't know
99 Refused

E2. Excluding your garage and/or patio, about how large is your home in square feet?

1 _____ square feet *[IF DON'T KNOW, USE CATEGORIES]*
2 Under 1000 square feet
3 1000 – 1500 square feet
4 1501 – 2000 square feet

5 2001 – 2500 square feet
6 2501 – 3000 square feet
7 More than 3000 square feet
98 Don't know
99 Refused

E3. How many full or half bathrooms do you have in your home *[COUNT EITHER FULL OR HALF OR ¾ AS 1]*?

___ *[ENTER # OF BATHROOMS]*
98 Don't know
99 Refused

E4. How many bedrooms do you have in your home *[IF A ONE-ROOM EFFICIENCY OR STUDIO APARTMENT, BEDROOMS = 0]*

___ *[ENTER # OF BEDROOMS]*
98 Don't know
99 Refused

[IF E4=0, SKIP TO E6]
E5. Other than bedrooms and bathrooms, how many other rooms are there in your home? Do not count laundry rooms, foyers, unfinished storage spaces, porches, hallways or garages.

___ *[ENTER # OF OTHER ROOMS]*
98 Don't know
99 Refused

E6. Is your home occupied?

1 Year round *[SKIP TO E8]*
2 Only during certain seasons
3 For vacations only
98 Don't know
99 Refused

E7. Approximately how many days per year is your home occupied?

____ *[RECORD RESPONSE – SKIP TO E9]*
98 Don't know *[SKIP TO E9]*
99 Refused *[SKIP TO E9]*

E8. How many people live in your home?

____ *[RECORD RESPONSE]*
98 Don't know
99 Refused

E9. What year were you born?

____ *[RECORD RESPONSE]*
98 Don't know
99 Refused

E10. What is the highest level of education you have completed? [DON'T READ]

1 No schooling
2 Less than high school
3 Some high school
4 High school graduate or equivalent (GED)
5 Trade or technical school
6 Some college
7 College degree
8 Some graduate school
9 Graduate Degree
10 Other *[SPECIFY]*_____
98 Don't know
99 Refused

E11. In 2008, which of the following categories best describes your total annual household income before taxes? *[READ LIST]*

1 Less than $15,000
2 $15,000 to $24,999
3 $25,000 to $34,999
4 $35,000 to $49,000
5 $50,000 to $74,999
6 $75,000 to $99,999
7 $1000,000 to $149,999
8 $150,000 or more
98 Don't know *[DO NOT READ]*
99 Refused *[DO NOT READ]*

"Thank you for your time today, that's all the questions I have".

Appendix B: Participant Survey Demographic Results

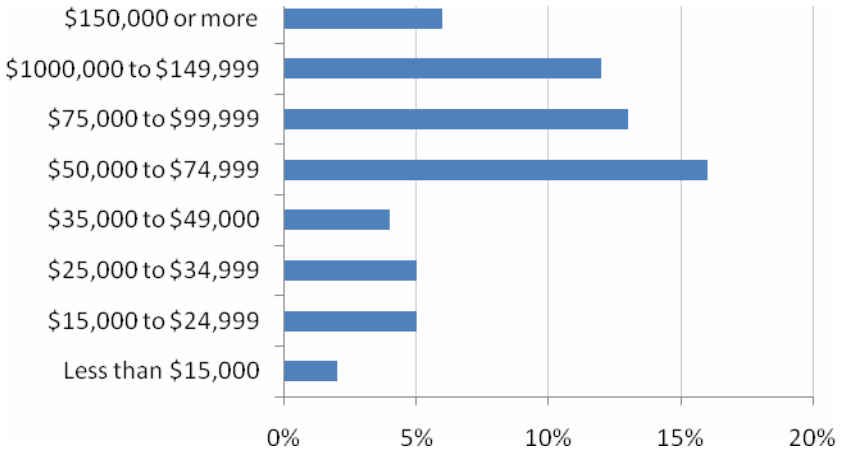
The survey included questions to assess the demographic makeup of the sample. All respondents were single-family homeowners, and their median age was 56. 0 shows the ages of participants.

Participant Age

Age range	Frequency	Percent
20-29	13	5%
30-39	24	10%
40-49	33	14%
50-59	63	26%
60-69	51	21%
70-79	28	12%
80 plus	6	3%
Refused	20	8%
Total	238	100%

A majority of participants (79%) had at least some college education. The average household size was 2.7. Household income, as shown in 0, appears to be higher than the 2008 median family income in Rhode Island, which the U.S. Census Bureau estimated at approximately $70,000[23].

Reported Participant Household Income



Note: An additional 34% of participants declined to report their household income, and 3% did not know.

The housing stock represented in our sample is made up of single-family homes, and as 0 shows, a majority of them were built over 50 years ago.

[23] http://www.census.gov/hhes/www/income/medincsizeandstate.xls. The median in our sample would fall between $75,000 and $99,999.

Approximate Age of Home in Years

Age of Home (years)	Frequency	Percent
0-19	23	10%
20-39	54	23%
40-59	78	33%
60-79	37	16%
80-99	17	7%
100+	23	10%
Don't know	2	1%
Refused	4	2%
Total	232	100%

0shows approximate square footage excluding garage and/or patio space. It is also notable that 81% of homes serviced had three or more bedrooms.

Approximate Size of Home in Square Feet

Square Footage	Frequency	Percent
Under 1000	12	5%
1000 - 1500	50	21%
1501 - 2000	54	23%
2001 - 2500	31	13%
2501 - 3000	12	5%
More than 3000	16	7%
Don't Know	60	25%
Refused	3	1%
Total	238	100%

Appendix C: Stakeholder Interview Guide

STAKEHOLDER INTERVIEW GUIDE

NATIONAL GRID ENERGY*WISE* PROGRAM 2008

Hello, my name is _____, I am calling on behalf of National Grid. We are currently evaluating the Energy*Wise* Program and would like to talk with you about your experience with the program. The purpose of our interview is to gain insight into the delivery process of the Program. This interview will take approximately 45 minutes. Thank you for your time.

1. What is your role in the Program? (probe for title, responsibilities, number of staff assisting, which part of the program they focus on i.e., design, marketing, implementation)

2. How long have you held this position?

3. (RISE Only) What other services does your company offer?

4. (RISE Only) How many employees does your company have? How many are engaged in this program?

5. (RISE Only) What type of training do your employees receive prior to delivery of the Program?

6. (RISE Only) Has your company ever implemented any other energy-efficiency programs?

Program Design

7. What do you believe are the primary goals of the Energy*Wise* program?

8. Would you say the Program succeeds in meeting these goals? (probe for any metrics they might base this on)

Program Delivery

9. In very general terms, will you please walk me through how the Energy*Wise* Program is delivered to customers? (probe for marketing, contact with customers – both SF and MF, scheduling and conducting audits, supplying a household with the Home Energy Action Plan, installing measures, follow-up with participants, incentive applications)

10. Which aspects of the Program is the implementer responsible for? Which is National Grid responsible for?

11. What areas of program delivery would you say work particularly well?

12. What areas do you believe do not work well?
13. What ideas do you have for improving these areas?
14. Is there anything else, specifically, you would change about the program?
15. (NG only) How was the implementer for this program choosen? (probe for: criteria used in choosing implementer, past experience with this implementer)
16. (NG Only)How well do you feel the implementer delivers the Program? (probe for all stages of the Program, as defined in #8)
17. How are concerns or issues communicated between you and National Grid (OR the implementer)?
18. How is the program marketed to potential participants?
19. What marketing materials are used? (probe for differences between MF & SF focused materials)
20. Would you say these materials are sufficient to provide the participant enough information to make decisions on the program and installation of measures?

    If not, what else do you believe is needed?
21. How would a single-family household become engaged in the Program? How about a household living in a multifamily building?
22. How soon after a household contacts the Program are they visited by an auditor?
23. How is the audit generally carried out? (probe for: differences between MF & SF, different diagnostic tools)
24. How is the Home Energy Action plan created? How is it delivered to the participants or residents? (probe for: in-person delivery and review, and differences between MF & SF)
25. What is included in the Home Energy Action Plan for the customer? How do you (the implementer) decide which measures and behavioral actions should be included in the Action Plan? (probe for any software tools used, other references to help prompt them to include a certain recommendations)
26. Are data from the Home Energy Action Plan kept and stored anywhere? Is this information used in any way afterwards by RISE or by National Grid for any purpose?
27. How are you (the implementer) incorporating natural gas as well as electric-focus into your audits and recommendations to participants?

28. How is data collected and stored on participants and their homes or buildings? Have there been any difficulties with the data tracking?
29. How are measures installed in the participant's home?
30. Do you feel the incentive offered by National Grid is sufficient to engage participants?
31. Are there any measures that are particularly hard to convince customers to adopt? Which ones? Why? What steps do you take to convince customers to adopt recommended measures?
32. Are you satisfied with the range of equipment that is eligible for incentives?
33. How do you (the implementer) report to National Grid? How often?
34. How are you (OR the implementers) paid for completed jobs? Do you feel the amount paid per home, building, or measure is sufficient?
35. How long is it between submission of the implementer invoice and payment?
36. How long is it typically between participant request for an audit and completion of the audit and installations? Do customers seem satisfied with this timeline?

Market Feedback

37. What is the response of customers to the Program? (probe for: difference between MF/SF, and gas/electric)
38. Do you think customers are generally aware of the Program?
39. What do you see as the future of the Energy*Wise* Program?
40. Do you have any other comments or areas we did not cover which you would like to discuss?

Appendix D: Data Tracking Interview Questions

Overall Process

1. Please walk through, from the time a customer requests an audit to the completion of measure installations from an audit, the points at which you collect information from a customer and when and how the information gets input into the tracking database.
2. Please walk through, at what times additional information from National Grid (such as savings estimates) is added to the data base for each participant.
3. Please describe how it is determined what variables should be tracked for this program?

Data Collection

1. What information is required from customers when they sign up for EnergyWise?
2. How does National Grid use this information (i.e. customer verification, scheduling, tracking)?
3. What information collected at sign-up is input into the tracking system? When does it occur (i.e., as they sign up or later in batches)?
4. How are account numbers matched to a participant or verified when a participant signs up for a program?
5. How does National Grid track multifamily customers in the tracking database? How does National Grid include or differentiate by building or unit?
6. How does the evaluation team communicate with the people responsible for the data collection?
7. Who decides what savings estimates are used for this program?
8. Who sets up the fields for data input?
9. How are data definitions developed and communicated to users?

Savings

10. Who decides what savings estimates to use for each measure or project? Where do savings estimates values come from?

11. How often are these savings assumptions revisited?
12. Do different departments (evaluation, planning, implementation) use the same estimates (i.e. are the tracking estimates the same as planning estimates)?
13. What calculations are used to determine per unit insulation and sealing measure savings?

Data Provided to National Grid

1. What are the National Grid specifications to contractors for data collection? Do the contracts require contractors to provide certain fields? Which ones?
2. Does each implementation contractor manage their data separately?
3. In what form does National Grid receive the data from contractors (spreadsheet, etc.)?
4. Does National Grid perform any quality review on data provided by subcontractors?