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1. Executive Summary

1.1 Program Overview

The OPower-administered Residential Building Practices and Demonstration (RBPD) Program utilizes a social marketing campaign, with normative messaging techniques, to encourage responsible energy behavior and choices. The campaign provides home energy reports (HERs) to households in National Grid-NY’s combined gas and electric service territories in upstate New York. The HERs provide recipients with feedback on their household energy use including a comparison of the recipient household’s energy usage with that of neighboring homes, thereby introducing a subtle form of peer pressure (often referred to as “social norming”) among households to achieve energy savings. Each HER report provides the following:

- Information on home’s energy use
- Progress tracking on home’s energy use over time and compared to neighbors
- Ideas on Energy Efficiency

The NYS Public Service Commission (PSC) issued an Order on December 3, 2010, approving the RBPD program. The RBPD program was launched in upstate-NY, during April, 2011. OPower randomly selected households to receive HERs (referred to throughout the report “participants” or “participating households”) or to be placed in a control group that did not receive HERs. This program design facilitates direct comparisons between the energy consumption of both participant and control groups to assess program effects.

1.2 Evaluation Overview

National Grid hired DNV KEMA to evaluate the effects of the RBPD program. Our analyses sought to answer the following questions:

- How well did the randomization match participating and control households?
- What energy savings resulted from the program?
- What savings can be expected during a year with “normal” weather?
- Did the program increase participation in other rebate programs?
- What behaviors and non-incented measures contributed to savings?
- How did participating households react to the HERs?
We completed an analysis of billing data for participating and control households that employed multiple statistical approaches to estimate the energy savings attributable to the RBPD program. These included the following:

- A pooled time-series/cross-sectional analysis of changes in average daily billed energy use, on an overall and monthly basis, using a multiple regression analysis framework.
- The addition of weather-related variables (heating degree days and cooling degree days) to allow us to model program savings for a typical meteorological year (TMY).
- Modeling savings from participation in other available National Grid energy efficiency programs with savings starting to accrue at the (approximate) time of installation and aggregating according to daily load shapes for the measure through each measure’s life.

In addition to the billing analysis, DNV KEMA also completed a survey of participating and control households (about 800 each) to assess participation in NYSERDA’s upstream lighting program, differences in purchases of non-incented energy saving equipment and energy saving behaviors, and participant reactions to the HERs. We tested differences between the participant and control groups with proportion tests of independent populations for yes/no questions and t-tests for questions with continuous numeric answers.

### 1.3 Summary of Findings

National Grid reported ex ante savings estimates of 14,580,000 kWh and 1,164,780 therms for the period January through December 2012 as they appear in the PSC Order that authorized the RBPD program. DNV KEMA’s ex post savings calculations (after removing joint savings) for the same period were 28,618,739 kWh (1.96 realization rate) and 669,933 therms (0.58 realization rate). Table 1 shows details of DNV KEMA’s estimates of RBPD program savings.
Table 1. Estimates of Adjusted RBPD Program Savings

<table>
<thead>
<tr>
<th>Adjusted Savings</th>
<th>Electric Only (kWh)</th>
<th>Dual Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Electric (kWh)</td>
</tr>
<tr>
<td>Program Year 1 Energy Savings ^1</td>
<td>10,495,117</td>
<td>14,403,356</td>
</tr>
<tr>
<td>(May 2011- Apr 2012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calendar Year Energy Savings ^1</td>
<td>12,126,450</td>
<td>16,492,289</td>
</tr>
<tr>
<td>(Jan 2012 – Dec 2012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Energy Savings ^1</td>
<td>18,699,228</td>
<td>26,144,870</td>
</tr>
<tr>
<td>(May 2011 – Dec 2012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per Household (% Total Post Use) ^1</td>
<td>2.43%</td>
<td>1.63%</td>
</tr>
<tr>
<td>(May 2011 – Dec 2012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weather Normalized Per HH (% Total Post Use) ^1</td>
<td>2.30%</td>
<td>1.52%</td>
</tr>
<tr>
<td>(May 2011 – Dec 2012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weather Normalized Estimated Energy Savings</td>
<td>11,513,205</td>
<td>15,358,357</td>
</tr>
<tr>
<td>(Jan 2012 – Dec 2012)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^1 Joint savings have been removed from these estimates.

In addition, we found evidence to support the following conclusions:

- Our analysis of pre-program billing data (Section 4.1) revealed that the control group randomly selected by OPower was well-matched to the participant group. Participating and control households had similar pre-program energy use, income, education, number of occupants, changes in number of occupants, home tenure, home ownership, home types, heating fuels, and water heating fuels. This increases confidence that the energy savings we found are due to the HERs.
- We found evidence that the program slightly increased participation rates in other available National Grid energy efficiency programs, and the joint energy savings were very modest. We therefore conclude that almost all of the current savings from the RBPD program are from sources other than increased participation in other incentive programs.
  - Based on incentive program tracking data provided by National Grid, RBPD participating households increased their participation in other National Grid incentive programs at a greater rate than the control households. Participation among RBPD households increased by about 3.3 percent while controls increased by about 2.9 percent; this difference was statistically significant.
  - Based on survey responses, energy savings from purchases of upstream rebated CFLs were slightly higher for electric-only participants than electric-only controls. We did not find differences between dual fuel RBPD participating and control households in NYSERDA upstream CFL rebate program participation.
None of our estimates of the energy savings from participation in other National Grid or NYSERDA energy efficiency programs significantly differed from zero. However, we used the convention of removing point estimates of joint savings (when greater than zero) from the savings credited to the RBPD program.

Note, according to conversations with National Grid staff, the HERs did not aggressively market the other available energy efficiency programs because those programs were already well-subscribed.

- Analysis of the survey results revealed that low- or no-cost behavior changes are the likely mechanism through which electric savings accrue, particularly for electric-only households. The participating households reported turning off lights, turning off electronics, and reduced cooling when nobody is home more often than the control households.
- The relative magnitude of summer (0.5 therms per household per month) and winter (0.7 therms per household per month) gas savings suggests that water heating and cooking are the main end uses where participating households reduced gas use. However, the surveys did not produce conclusive evidence to confirm or disconfirm this hypothesis.
- Participant recall of receiving the HERs was high. Almost all participants (95%) remembered receiving the HERs. The majority (64%) of respondents said they read every report. About half of the participants (51%) reported spending four or more minutes reading each HERs, and about one third (36%) of the participants said the reports were useful (4 or 5 on a five-point scale). About eight percent reported spending over 10 minutes reading each report. The components participants found most useful varied by education level.
- The electric and gas results for dual fuel households are similar to the results of published evaluations of other OPower programs. Conversely, the electric-only savings were unusually high. This may be due to the unusually high level of pre-program usage in those households (about 18,000 annual kWh).

1.4 Implications

DNV KEMA’s evaluation results confirm that OPower’s random assignment of households to participant and control groups was well-balanced, OPower’s periodic estimates of per household savings were accurate, and the program is achieving measurable electricity and gas savings. However, the evaluation
did not confirm the ex ante estimates documented in the PSC Order that approved the RBPD program. Ex ante electricity estimates were too low, and ex ante gas estimates were too high.¹

Most of the findings from DNV KEMA’s evaluation of the RBPD program were within the expected range. When using the same monthly counts of active accounts, DNV KEMA and OPower’s savings estimates are very similar. In addition, the per household savings expressed as a percent of pre-program household use were within the typical observed range for similar programs. There was one exception, in the direction of higher than expected savings. The per household electric savings for electric-only households were on the high end of the range typically seen for OPower programs. The pre-program electricity usage for these households was also relatively high, which may have contributed to the greater savings.

This was an impact evaluation, but we found an important process-related issue. While reviewing early drafts of this report, we discovered that there was no process in place for National Grid to provide OPower with inactive/finaled accounts on a monthly basis. In the case of National Grid, due to technical reasons, Opower did not receive an automated feed of inactive dates for accounts. National Grid provided a manual data extract of the number of active customer in each month from May 2011 to September 2013, and will periodically provide updated manual extracts in the future.

This discovery highlighted the need to decide how to treat finaled accounts in energy savings estimates. Our choice was constrained because we had billing records only for the accounts that were still active as of March 2013 – we did not have records for the finaled accounts. Without billing data, we had to make an assumption about the energy savings from finaled accounts. We could either assume zero savings from the finaled accounts, or that the finaled accounts would have the same monthly savings as the active accounts, until their last month of service. We chose the latter assumption. The final savings estimates are somewhat sensitive to the choice of how to treat finaled accounts, particularly for gas. Savings estimates using the other two practical methods of treating finaled accounts were lower but still within the 90% confidence intervals of those reported in Table 1.

One of the evaluation goals was to explain where the savings come from. Our study utilized a relatively extensive battery of questions related to self-reported behavioral and equipment changes, and we had enough statistical power to detect differences as small as four percent. We found relatively few differences between the participant and control households. Thus, we make the same conclusion as most previous evaluations of similar programs – the evidence suggests that the home energy reports produce

¹ The ex ante estimates documented in the PSC Order were inaccurate because they were based on a few early evaluations of OPower programs. Based on the current and much larger body of OPower evaluations, the estimates reported in the early evaluations were not typical.
savings by slightly increasing a variety of energy saving behaviors. Our findings on the use of the home energy reports suggest that they may create behavioral changes by raising the salience of energy efficiency in the participating households.

Residential gas use is less variable than electricity use, so comparison of gas savings during summer months and winter months can indicate how much of the savings come from space heating or other gas uses (primarily water heating and cooking). In the case of the RBPD program, a comparison of the summer and winter month savings indicates that most of the gas savings are from water heating and cooking (0.5 therms/month/household) rather than space heating (0.2 therms/month/household).

The evaluation results indicate that despite increased participation in other National Grid energy efficiency programs, the resulting energy savings from that participation does not yet account for a statistically significant amount of the reported program savings. Electricity savings from participation in other programs are trending upwards, so it is possible that these savings will become significant in the future. We also found that savings were sensitive to year-to-year weather variations, but atypical weather accounted for only a small fraction of the savings.

Our evaluation of the use of the HERs indicates that almost all participants noticed them, about two-thirds read them, and about a half engaged deeply with them (read them for over four minutes). Usefulness of the reports varied based on participant education. We found some evidence that the self-referential portions of the reports may be more important than the current psychological theory underpinning the reports indicates.

1.5 Recommendations

DNV KEMA offers the following high, medium, and low priority recommendations for National Grid based on this evaluation.

**Recommendation 1:** (HIGH) For claimed savings, use monthly, quarterly, or annual savings estimates provided by OPower based on comparisons to a control group and actual billing data (ex post estimates), and periodically verify and true up those savings using a third party evaluator. The billing analysis conducted by DNV KEMA revealed the following:

- Ex ante savings documented in the PSC Order that approved the RBPD program were not confirmed by the evaluation. The ex ante estimates were based on early OPower evaluations and were too low for electricity and too high for gas.
- When using the same number of accounts, DNV KEMA’s and OPower’s ex post estimates were very similar.
- Regularly timed ex post estimates comparing a participant and control group are the most accurate way to calculate savings. In particular, regularly timed ex post estimates using control groups automatically factor in population characteristics (e.g. average energy use), weather (e.g. unusually warm/cool weather), and savings persistence which can reduce the accuracy of ex ante estimates.

Thus we recommend that the program use OPower’s ex post savings estimates as the program’s official savings claims. OPower reports savings to National Grid on a monthly basis using ex post estimates that do not rely on forecasting. In addition, to help detect and correct computation issues, we further recommend that a third party evaluator periodically review the savings estimates for accuracy. Official savings claims could be adjusted or trued up based on the third party results. This practice is likely to produce more accurate savings claims than ex ante estimates.

**Recommendation 2: (HIGH) Decide in advance how to handle finaled accounts, document this decision, and share the documentation with relevant parties.** Customers are going to move out of their homes and close their accounts. National Grid should work with OPower to determine a method to identify this customer attrition. Additionally, overall savings estimates are somewhat sensitive to how savings for closed accounts are calculated. Therefore, National Grid and OPower should decide and document how to calculate savings with regard to closed accounts. Any future process evaluations should include an investigation of this procedure.

**Recommendation 3: (MEDIUM) Consider using future evaluations to investigate researchable questions beyond ex post savings, such as persistence of savings.** While the national body of evidence from evaluations of first-year savings for OPower programs is consistent, that evidence is no longer completely relevant to future RBPD evaluations because the program is currently in its third year and will be in at least its fourth year before another evaluation occurs. Thus, third party validation of ex post savings estimates provided by OPower would still be prudent. However, evaluation of a more mature OPower program presents an opportunity to investigate additional unresolved questions such as savings persistence and longer term weather effects. National Grid should consider investigating some of these outstanding questions with future evaluation efforts, budgets permitting.

**Recommendation 4: (MEDIUM) Future evaluations should consider using techniques to improve survey response rates, such as advance letters, rewards, and shortening the surveys.** Advanced letters could increase the likelihood that respondents answer the phone when surveyors call. If used, advance letters should include National Grid logos and/or be printed on National Grid letterhead to maximize the likelihood of being read. They should state that the household will receive a phone call and include the originating name and number that will show on caller id. Rewards could increase the chance that a respondent who answers the phone agrees to complete the survey. In both cases, the evaluation
team and National Grid should make sure they understand the legal requirements of the area where the program participants live. The evaluators should shorten surveys as much as possible because respondents are more likely to complete shorter surveys.

**Recommendation 5: (MEDIUM) To gather better data about behavior and equipment purchase changes caused by the HERs, National Grid and future evaluators should consider data collection strategies that occur during the course of the time period under evaluation.** The accuracy of the current evaluation’s survey responses depends on respondents’ memory of what they did two years ago. The surveys took place in 2013 and asked respondents what they did during 2011. Surveying a sample of the participants and controls more frequently during the period being evaluated could yield more proximal and accurate data than two year retrospectives.

**Recommendation 6: (LOW) Use the HERs to more prominently advertise the other energy efficiency programs available to participants.** Program administrators at National Grid reported that the HERs did not aggressively promote the other energy efficiency programs because those programs were already well-subscribed. (Note: National Grid customer service representatives did direct callers to National Grid and NYSERDA programs if customers asked how to save energy.) Participation in the other programs might be slightly increased by more prominent advertising through the HERs. This practice would increase the likelihood of producing joint savings. Evaluations of other similar programs usually produce joint savings estimates of less than one percent. While these are relatively modest savings, the wide distribution of the HERs could still result in substantial overall savings.

**Recommendation 7: (LOW) National Grid and OPower could work together to implement a variation of the HERs that tests whether the comparisons to neighbors or comparisons to recipients’ own household are more important.** OPower’s program theory is that the comparisons to neighbors activate social norms in participating households which cause them to reduce their energy use. Our evaluation found some evidence to suggest that participants may be paying more attention to the comparisons to their own household. OPower could test the relative impact of each part of the HERS by adding a second type of HER that omitted the social comparisons and retained the self-comparisons. The effects of each type of HER relative to the control group would help answer which part of the HERs is more important.
2. Introduction

2.1 Residential Building Practices and Demonstration Program

The OPower-administered Residential Building Practices and Demonstration (RBPD) Program utilizes a social marketing campaign, with normative messaging techniques, to encourage responsible energy behavior and choices. The campaign provides home energy reports (HERs) to households in National Grid-NY’s combined gas and electric service territories in upstate New York. The HERs provide recipients with feedback on their household energy use including a comparison of the recipient household’s energy usage with that of neighboring homes, thereby introducing a subtle form of peer pressure (often referred to as “social norming”) among households to achieve energy savings. To-date, about 110 thousand residential customers in upstate-NY are enrolled in HERs. The current program serves dual fuel and electric-only, single family households. Each HERs report provides the following (see Appendix C for example):

- **Information on home's energy use:** Recipients are able to see their home’s energy use in the context of the energy use of other homes that are nearby and similar in size.
- **Progress tracking:** Track changes in a home's energy use over time and across seasons.
- **Ideas on Energy Efficiency:** Practical, low cost tips on how to reduce energy consumption through behavioral changes and information about other National Grid-NY residential energy efficiency (EE) programs.²

The RBPD program is unusual among energy efficiency (EE) programs through its use of randomized customer assignments to either a participant or non-participant (control) groupings, or what is often called program participation on an opt-out basis. The selection process conducted by OPower began with forming the eligible population based on a number of technical eligibility criteria such as ensuring that the home did not have multiple meters for a given fuel and that the household had adequate billing history. Following the selection process, OPower randomly assigned the selected population into the treatment and control groups using simple randomization. Compared to the opt-in nature of most EE programs, the opt-out program design has important implications for program evaluation.

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² The HERs tips focused on best practices rather than strong promotion of other energy efficiency programs. Along with best practices, they mentioned rebates for high efficiency furnaces, water heaters, and ENERGY STAR thermostats. The HERs did not advertise available NYSERDA programs. However, DNV KEMA learned during conversations with National Grid staff that the customer service phone center would provide information about NYSERDA programs to customers who inquired about ways to save energy.
This opt-out program design comes very close to achieving a Randomized Controlled Trial (RCT), a program/experimental designs in which participants (the treatment group) and non-participants (control group) are randomly assigned to the program. (This should not be confused with random sampling.)

RCT, when properly designed and administered, effectively mitigates the problem(s) of self-selection bias – one of the more pernicious and difficult problems to address in statistical impact evaluation studies of opt-in EE programs. OPower claims the program design for the HERs meets the requirements for RCT, through random assignment of customers to receive (participant) or not receive (controls) HERs. The RCT design produces a high level of internal validity for evaluations of these programs. That is, evaluators and program administrators can have a high degree of confidence that the observed effects are due to the RBPD program.

The NYS Public Service Commission (PSC) issued an Order on December 3, 2010, approving the RBPD program. The RBPD program launched in upstate-NY during April, 2011. About 130,000 National Grid electric and gas heat customers were automatically enrolled across upstate-NY as follows:

- 58,000 in the Capital District covering Albany and surrounding areas,
- 58,000 in central NY (covering Utica-Rome through Greater Syracuse) and,
- 14,000 in western NYS, including Buffalo and surrounding areas.

From conversations with National Grid personnel and analysis of customer billing records, DNV KEMA learned that the HERs recipients (and control group) were drawn from households with greater than median energy consumption and with uninterrupted service going back to early 2009. These selection criteria do not affect DNV KEMA’s analysis, but they do affect the generalizability of the results. Results from rolling out a similar program to a population that includes low-usage households could vary from those we report.

### 2.2 DNV KEMA Evaluation

National Grid hired DNV KEMA to evaluate the effects of the RBPD program. Our analyses sought to answer the following questions:

- How well did the randomization match participating and control households?
- What energy savings resulted from the program?
- What savings can be expected during a year with “normal” weather?

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- Did the program increase participation in other rebate programs?
- What behaviors and non-incented measures contributed to savings?
- How did participating households react to the HERs?

DNV KEMA completed a billing analysis that employed multiple statistical approaches to estimate the energy savings attributable to the RBPD program. These included the following:

- A pooled time-series/cross-sectional analysis of changes in average daily billed energy use, on an overall and monthly basis, using a multiple regression analysis framework.
- The addition of weather-related variables (heating degree days and cooling degree days) to allow us to model program savings for a meteorologically typical year.
- Modeling savings from participation in other energy efficiency programs with savings starting to accrue at the (approximate) time of installation and aggregating according to daily load shapes for the measure through each measure’s life.

The following factors were taken into consideration in choosing to apply multiple statistical analysis methods:

- When viewed on a percentage of energy use basis, OPower programs typically result in average energy savings of about 1.5% to 2.5% per household, including impacts already claimed by other EE programs.
- Each measurement approach differs in data requirements and statistical complexity, and alternative representations of program impacts from HERs.
- Statistical methods have different strengths and weaknesses, that must be traded-off against the data requirements (and costs) of each.
- Using multiple methods provides a sensitivity analysis of how savings estimates vary by measurement method(s).
- Variations in weather conditions over time represents a potential confounding influence in isolating and quantifying energy impacts attributable to HERs, even with a properly selected control group. Our evaluation included statistical models that took weather into account to estimate the savings that could be expected during a “typical” meteorological year.

In addition to the billing analysis, DNV KEMA also completed a survey of participating and control households (about 800 each) to assess participation in NYSERDA’s upstream lighting program, differences in purchases of non-incented energy saving equipment and energy saving behaviors, and participant reactions to the HERs. Survey analyses consisted of proportion tests of independent populations for yes/no questions and t-tests for questions with continuous numeric answers. The next section details DNV KEMA’s evaluation methods.
3. Methods

3.1 Billing Analysis

This section provides an overview of DNV KEMA’s methods for estimating the savings attributable to the first year of the RBPD program. After preparing the data, DNV KEMA performed the following analyses:

- Basic Difference of Differences Model
- Remove “Joint” Savings
- Weather Normalize Savings

3.1.1 Data Preparation

According to National Grid records, the RBPD program started with 131,303 participating households and 65,646 control households in January of 2011. These households were selected in January, and HERs began going out in April. National Grid provided DNV KEMA with billing records for the still active households as of March 2013: electric billing records for 109,567 participant and 54,769 control households and gas billing records for 84,471 participant and 42,203 control households. Changes from January 2011 to March 2013 were for participating and control households that no longer had active accounts with National Grid, most likely because they moved out of their residence. Participant households that opted out of receiving the HERs, but which still had active accounts with National Grid, were included in the participant group for our analyses.4

During the review period of an early draft of this report, we discovered that there was no process in place for National Grid to provide OPower with inactive/finaled accounts on a monthly basis. National Grid promptly corrected the oversight.

This discovery highlighted the need to decide how to treat finaled accounts in estimates of the program’s energy savings. We considered three methods of estimating the savings of the finaled accounts.

1. Assign zero savings to the finaled accounts. This choice assumes the finaled accounts did nothing in response to the HERs before closing their accounts.

4 This is often referred to as an “intent to treat” design. This design eliminates self-selection effects and increases the confidence that the resulting savings are due only to the decision to put a household into the participating group.
2. Use the still-active accounts to represent the finaled accounts. This choice assumes the finaled accounts did the same things as the still-active accounts up until their last month of service.

3. Count savings for the finaled accounts up until their last month of activity. This choice requires full data for the finaled accounts. It also results in pre-program energy use estimates that include the finaled and still-active accounts.

Our choice was constrained to the first two methods because we had billing records only for the accounts that were still active as of March 2013 – we did not have records for the finaled accounts. Without billing data, we had to make an assumption about the energy savings from finaled accounts. We could either assume zero savings from the finaled accounts (method #1), or that the finaled accounts would have the same monthly savings as the active accounts, until their last month of service (method #2). We chose to use method #2.\(^5\)

In addition to billing data, National Grid also provided us with the monthly counts of still-active accounts through 2012 (Table 2). As will be described in greater detail later in the Methods section, DNV KEMA used the billing data we received for our statistical models to estimate monthly per household savings. We multiplied monthly per household savings by the monthly counts of active households shown in Table 2 to compute total savings attributable to the program.

\(^5\) OPower had access to the full data for closed accounts and used method #3 as their primary estimate of program savings. Care should be taken when comparing estimates from method #3 with those from methods #1 and #2 because of the differences in the accounts used for the pre-program energy estimates. Method #3 uses all accounts in the pre-program estimates while methods #1 and #2 do not. The use of different populations for pre-program estimates has the potential to greatly affect difference-of-difference savings estimates.
Table 2. Remaining Active Accounts - Participants

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Electric Accounts</th>
<th>Gas Accounts</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>1</td>
<td>131,292</td>
<td>101,602</td>
</tr>
<tr>
<td>2011</td>
<td>2</td>
<td>131,177</td>
<td>101,516</td>
</tr>
<tr>
<td>2011</td>
<td>3</td>
<td>130,550</td>
<td>101,062</td>
</tr>
<tr>
<td>2011</td>
<td>4</td>
<td>129,670</td>
<td>100,408</td>
</tr>
<tr>
<td>2011</td>
<td>5</td>
<td>128,414</td>
<td>99,454</td>
</tr>
<tr>
<td>2011</td>
<td>6</td>
<td>126,889</td>
<td>98,245</td>
</tr>
<tr>
<td>2011</td>
<td>7</td>
<td>125,503</td>
<td>97,140</td>
</tr>
<tr>
<td>2011</td>
<td>8</td>
<td>124,105</td>
<td>96,032</td>
</tr>
<tr>
<td>2011</td>
<td>9</td>
<td>122,966</td>
<td>95,147</td>
</tr>
<tr>
<td>2011</td>
<td>10</td>
<td>121,883</td>
<td>94,295</td>
</tr>
<tr>
<td>2011</td>
<td>11</td>
<td>121,022</td>
<td>93,606</td>
</tr>
<tr>
<td>2011</td>
<td>12</td>
<td>120,289</td>
<td>93,027</td>
</tr>
<tr>
<td>2012</td>
<td>1</td>
<td>119,717</td>
<td>92,607</td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
<td>119,114</td>
<td>92,129</td>
</tr>
<tr>
<td>2012</td>
<td>3</td>
<td>118,483</td>
<td>91,655</td>
</tr>
<tr>
<td>2012</td>
<td>4</td>
<td>117,816</td>
<td>91,136</td>
</tr>
<tr>
<td>2012</td>
<td>5</td>
<td>116,944</td>
<td>90,479</td>
</tr>
<tr>
<td>2012</td>
<td>6</td>
<td>116,078</td>
<td>89,800</td>
</tr>
<tr>
<td>2012</td>
<td>7</td>
<td>115,151</td>
<td>89,082</td>
</tr>
<tr>
<td>2012</td>
<td>8</td>
<td>114,227</td>
<td>88,355</td>
</tr>
<tr>
<td>2012</td>
<td>9</td>
<td>113,529</td>
<td>87,800</td>
</tr>
<tr>
<td>2012</td>
<td>10</td>
<td>112,759</td>
<td>87,200</td>
</tr>
<tr>
<td>2012</td>
<td>11</td>
<td>112,143</td>
<td>86,733</td>
</tr>
<tr>
<td>2012</td>
<td>12</td>
<td>111,625</td>
<td>86,337</td>
</tr>
</tbody>
</table>

For the billing analysis, DNV KEMA further restricted the billing data to accounts with 35 to 37 bills between January 1, 2010 and December 31, 2012. This resulted in the loss of another 4,021 electric and 3,545 gas accounts. We performed this step because our analysis methods calculated savings on a monthly basis, and any meter reads that represent more or less than a month throw off the monthly averages. Given the number of records available to us, we decided to drop these anomalous cases from the analysis.
Table 3. Data Cleaning Impact on Number of Records

<table>
<thead>
<tr>
<th>Type of Record</th>
<th>Electric N</th>
<th></th>
<th>Gas N</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Participant</td>
<td>Control</td>
<td>Participant</td>
<td>Control</td>
</tr>
<tr>
<td>Original Participant Group (Jan 2011)</td>
<td>131,303</td>
<td>65,646</td>
<td>101,004</td>
<td>50,499</td>
</tr>
<tr>
<td>Active Accounts (Mar 2013)</td>
<td>109,567</td>
<td>54,769</td>
<td>84,471</td>
<td>42,203</td>
</tr>
<tr>
<td>Had 35-37 Bills from Jan 2010 to Dec 2012</td>
<td>106,889</td>
<td>54,749</td>
<td>82,120</td>
<td>42,197</td>
</tr>
<tr>
<td>Used in DNV KEMA's Billing Analysis</td>
<td>106,889</td>
<td>53,406</td>
<td>82,120</td>
<td>40,984</td>
</tr>
</tbody>
</table>

3.1.1.1 Weather Data

DNV KEMA acquired weather data for use in the weather-normalized models. Participating households and controls in our analysis samples were first mapped into weather zones for the purpose of linking monthly billed energy consumption to weather data and conditions in similar geographical locations. While the National Grid service area covers most of upstate-NY, weather conditions can vary significantly from the western part of the state (Buffalo), through the Finger Lakes region in central New York (Syracuse), to the eastern part of the state, the Capital District (Albany-Schenectady-Troy), and the north country (Plattsburg). Customers in our samples were mapped to the closest weather station listed below.

- KALB (Albany)
- KBGM (Binghamton)
- KBUF (Buffalo)
- KMSS (Massena)
- KPOU (Poughkeepsie)
- KSYR (Syracuse)

After mapping to one of these weather stations, we retrieved typical meteorological year (TMY) weather from National Renewable Energy Laboratory (NREL).6 We then calculated actual and typical heating degree days (HDD) from a reference point of 60 degrees Fahrenheit and cooling degree days (CDD) from 70 degrees.

3.1.2 Basic Model

DNV KEMA’s basic savings estimate involves a “difference of differences” (DiD) approach. The basic approach is to compare the pre-program and post-program energy use of participating households to those

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of the control households. OPower randomly assigned households to the participant and control groups, and as described later in the Results section, DNV KEMA confirmed that there were no preexisting energy use differences between the treatment and control groups. Thus, the control group represents all the factors other than the HERs that could have affected energy usage (e.g.: the economy). Thus, subtracting out the control group’s pre-post difference removes all those effects, and we are left with the effects due to receiving the HERs.

The basic billing analysis used the standard fixed effect, difference of difference regression model, without weather variables, that captured program savings for the specific time period. The average daily use (calculated by monthly use ÷ number of days in month) was regressed with fixed effects across customers and across all billing periods. To calculate savings estimates in the post period, an interaction between treatment and post period billing months (i.e. is the billing period in the post period) was included. These parameter estimates indicate the marginal effect that being in the treatment group in billing period \( t \) has on average daily use. Equation (1) summarizes the basic model.

\[
E_{it} = \mu_i + \lambda_t + \beta_2 POST_t + \sum_{k=2}^{K} \beta_{k}(P_{kt}) + \epsilon_{it}
\]  

Where:
- \( E_{it} \) = Average daily usage of customer \( i \) during period \( t \)
- \( P_{it} \) = Interaction term denoting a treatment participant in post period \( t \)
- \( \lambda_t \) = Month/year dummy or fixed effect
- \( \mu_i \) = Account level fixed effect
- \( \epsilon_{it} \) = Regression residual.

We used April 2010 through March 2011 as the pre-program period, and May 2011 (one month after HERs began going out to ensure we captured a full program month) through December 2012 as the post-program period. To calculate total monthly program savings estimates for the full treatment group in a given month, we multiplied the parameter estimate (the \( \beta_2, \beta_k \)’s in Equation (1)) by the average number of days in a month (30.4) and then by the number of still active participant households. To calculate total program savings for a given period (first program year or calendar year) we added the total monthly savings for the months included in each period. For example, for the first program year savings, we summed the savings for May 2011 through April 2012.
3.1.3 Weather Normalization

DNV KEMA also performed an analysis where we applied weather normalization to the savings data. The use of a control group that experienced the same weather conditions provides some assurance that the savings accrued by the participating households were not due to differing weather conditions during the evaluation period. However, the application of weather normalization to the results provides National Grid and system administrators with a more robust prediction of the savings that may accrue during a meteorologically “normal” year.

The weather normalized approach starts from a model that is identical to the standard monthly model (Equation (1)) above except that it measures a treatment effect averaged across all of the post-period months. This aggregation of the treatment effect is necessary to support the estimation of the weather effects. The aggregate base model is specified in Equation (2):

\[ E_{it} = \mu_t + \lambda_{st} + \beta_1 \text{POST}_t + \beta_2 \text{P}_i + \epsilon_{it} \]  

Where:
- \( E_{it} \) = Average daily energy consumption for account \( i \) during month \( t \)
- \( \text{POST}_t \) = 1 if month \( t \) is in the post-treatment period, 0 otherwise
- \( \text{P}_i \) = 1 for households in the treatment group in the post-treatment period, 0 otherwise
- \( \lambda_{st} \) = Month/year dummy or fixed effect
- \( \mu_t \) = Account level fixed effect
- \( \epsilon_{it} \) = Regression residual.

Explicitly controlling for the variation in energy consumption directly due to weather can be done by adding a weather component to Equation (2) specified above. To explain exactly how a pooled approach can incorporate the weather related component of consumption, we introduce the following notation:

- \( H_{it}(\tau_H)H_{it}(\tau_H) \) = The heating-degree days of account \( i \), in period \( m \), calculated from heating degree day base \( \tau_H \).
- \( C_{it}(\tau_C)C_{it}(\tau_C) \) = The cooling-degree days of account \( i \), in period \( m \), calculated from cooling degree day base \( \tau_C \).

These weather variables are calculated as proxies for the prevailing conditions at the time of measurement. Adding these variables (and variables for the interactions with treatment condition and
post-period variables) to the model allows us to estimate how much energy use can be explained by weather conditions.

The full, (explicit) pooled model becomes:

\[
E_{it} = \mu_i + \lambda_t + \beta_2 POST_t + \beta_3 P_t + \beta_{H,2} H_{it} + \beta_{H,3} (H_{it} \times POST_t) + \beta_{C,2} (C_{it} \times POST_t) + \beta_{C,3} (C_{it} \times P_t) + \varepsilon_{it}
\]

This result facilitates the calculation of weather normalized savings un-calibrated. The Program effect is estimated not as a single average effect, but as a combination of an average effect and heating and cooling effect. The resulting coefficient estimates from fitting Equation (3), allows us to estimate the marginal impact that actual weather conditions had upon average daily usage.

By comparing the resulting savings estimates based on actual weather, versus savings during a so-called typical weather year, the impacts of year-to-year weather differences can be isolated and measured directly. Specifically, the estimate of savings becomes

\[
\frac{\partial E_{it}}{\partial P_{it}} = \hat{S}_t = \hat{\beta}_2 + \hat{\beta}_{H,2} (H_{it}) + \hat{\beta}_{C,2} (C_{it})
\]

Finally, the manner in which savings estimates are weather-adjusted to reflect typical or so-called normal weather conditions is represented in Equation (5), below:

\[
\bar{S}_{WN} = \hat{\beta}_2 + \bar{\beta}_{H,2} (H_{\text{normal,tm}}) + \bar{\beta}_{C,2} (C_{\text{normal,tm}})
\]

Equation (5) provides program related savings estimates, but where weather is indicative of a typical year. We then calculated weather normalized annual savings by multiplying the parameter \(\hat{\beta}_2\) by 365, and by multiplying \(\bar{\beta}_{H,2}\) and \(\bar{\beta}_{C,2}\) by the average TMY HDD and CDD respectively.

### 3.1.4 Joint Savings

According to the RBPD implementation plan, the program does not offer any direct financial incentives, but does promote and encourage customers to take advantage of incentives from National Grid’s other energy efficiency programs. Thus, a possible source of RBPD program savings is from increased activity in other energy efficiency programs administered by National Grid and Niagara Mohawk. To test this possibility, we compared whether RBPD participating households increased their rate of participation in the other programs after receiving HERs, relative to the control groups (program uplift). Next, we compared the average savings from tracked, incented measures for the participant and control groups. An
increase in RBPD participant incentive program savings represents savings caused by both the RBPD Program and the incentive program (joint savings).

Conceptually, both the RBPD program and incentive program(s) deserve credit for joint savings. However, attributing the full savings to both programs would result in double counting. In cases where there are measurable joint savings, it is usually easier to remove those savings from the OPower program because the incentive program(s) usually have already claimed them.

Our approach for calculating joint savings captures individual incentive program savings, and includes:

- Accepted deemed savings values
- Accruing savings from the time of installation
- Projection forward on a load-shape-weighted basis
- Maintaining the load-shape-weighted savings over the life of the measure

Savings for each installed measure start to accrue at the time of installation (or removal for refrigerator recycling). We did not have actual installed date available in the incentive program tracking databases. The closest date we had was incentive mailed date, so we used it as a proxy for the date of installation in the joint savings analyses. This was probably not completely accurate, but it was the best variable we had.

We calculated average monthly household incentive program savings for the treatment and control groups including zeroes for the majority of households that did not take part in any incentive program. An increase in average per household tracked program savings among the treatment group versus the control group would indicate joint savings.

The goal was to estimate joint savings per household with an appropriate standard error with which to determine statistical significance. National Grid provided a census list of energy efficiency (EE) program participants so that we could identify anyone in either the participant or control groups who did any EE program installations. We spread out incentive program deemed savings by starting from the day of installation, weighted across days of the year by the measure load shape and carrying forward through to measure life. Given this, we generated incentive program savings stream through time for each household. If they had yet to participate, their savings stream through time was zero. This allowed us to sum up to monthly or annual estimates of joint savings with a statistically appropriate standard error. We could then calculate average per household joint savings to facilitate a true comparison participating to control household participation.

When joint savings were greater than zero, we subtracted them from the savings credited to the RBPD program. When joint savings were less than zero, we considered them zero rather than adding credit back into the RBPD program. This practice creates the most conservative estimates of RBPD effects.
3.1.4.1 Upstream Lighting Program Participation

National Grid provided DNV KEMA with tracking data from the incentive programs they administer. NYSERDA also concurrently ran several energy efficiency programs, and the one of most relevance to the evaluation population was a point-of-purchase rebate program for open-spiral (standard) CFLs and specialty CFLs (XFLs) during 2011 and 2012 (referred to as the “upstream lighting program” for the rest of this report). It was difficult to estimate participation in the upstream lighting program because individual participant identities were not tracked. Therefore, DNV KEMA had to use survey responses to estimate participation.

An additional complication was that survey respondents may not have been aware that they participated in the upstream lighting program, so we could not directly ask them about it. Our indirect approach of estimating participation was based on the average price respondents paid for the CFLs they purchased. If that average price fell at or below a certain threshold, we considered the CFLs or XFLs to have been purchased through the upstream lighting program.

Based on NYSERDA documentation\(^7\), the minimum per-lamp price for upstream lighting program CFL was $0.99. DNV KEMA’s survey asked about the average per lamp price for all the CFLs purchased by the respondent households during the study period. Some lamps could have been purchased through the upstream program and some not, but DNV KEMA only had a single per lamp price. If respondents purchased lamps outside the upstream program, then the average per lamp price could be significantly higher than $0.99 even if the majority of the household’s purchases were within the upstream program. Therefore, we multiplied the threshold price of $0.99 by 150% (to $1.50) to use as our threshold. We then determined that if the respondent said their average per lamp price was at or below this threshold, then we would consider all of their CFL purchases as going through the upstream program.

We used a similar calculation for XFLs. In this case, DNV KEMA could not locate a minimum price for XFLs in the NYSERDA documentation. However the maximum per-lamp rebate was listed as 120% of the rebate for CFLs. Applying this percent to the DNV KEMA threshold price for regular CFLs would result in a DNV KEMA threshold of $1.80. However, considering the additional variation in XFLs, we decided to round this threshold up to $2.00. Thus, if the respondent indicated a per XFL price of $2.00 or less we considered all of their XFL purchases as going through the upstream program.

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This method of determining upstream rebate participation is admittedly inexact. However, the random assignment of households to participating or control conditions helps ameliorate the lack of precision. We applied the same rules to determine upstream participation for both the RBPD participating and control households before testing the difference. We assume that applying the same rules to both groups before comparing helped balance out any systematic under- or over-estimation of upstream participation inherent in our method.

We based savings estimates for upstream CFLs and XFLs on the savings calculation for CFLs in the New York Technical Reference Manual\(^8\). This method assumes annual savings of 2.53 watts times the CFL lamp’s nominal wattage, multiplied by 3 hours per day and 365 days per year, divided by 1,000 to convert to kWh. We assumed the average CFL was 16 watts (14 watts for XFLs), we assigned annual savings of 47 kWh for CFLs (41 kWh for XFLs). To compute monthly upstream joint savings estimates, we divided the annual savings by 12 and multiplied by the monthly number of remaining participant households.\(^9\)

### 3.2 Survey

DNV KEMA developed and conducted a survey of participating and control households to accomplish the following three objectives:

- Estimate participation in NYSERDA’s upstream lighting program,
- Collect data to identify (non-incented) equipment purchases and energy saving behaviors that could explain energy savings for OPower participants, and
- Assess participant utilization and reactions to HERs.

The survey was structured to ask respondents about various energy efficiency measures and learn about any potential changes to peripheral systems, maintenance, and usage behaviors for each measure. The survey addressed the following key topics:

- Energy efficiency equipment purchases including: CFLs, LEDs, heating and cooling system purchases, water heating systems, insulation, appliances, and electronic equipment
- Energy saving behaviors in the areas of home heating, air conditioning, lighting, hot water, appliances, and electronics


\(^9\) This potentially overestimates the savings by giving CFLs installed in a later month a full year’s worth of savings. This is the most conservative and simplest approach for converting annual savings estimates to a monthly level.
Responses to the Home Energy Reports

In the case of the energy efficiency equipment purchases and energy savings behaviors (collectively referred to as “measures” throughout the rest of this report), we asked respondents about the period between April 2011 and March 2012. We called this the “study period.” In total, the survey contained questions about changes to over 80 measures during the study period.

3.2.1 Sample Selection

This section details the survey sample design. Our proposed sample design included 1,600 selected households, 800 from treatment group and 800 from control group. Samples of this size provide enough statistical power to make differences between the participant and control groups as small as 4 percent statistically significant.

We further subdivided each treatment and control group into electric program participants only or dual program participants (electric and gas). Each of these four sampling measure categories (treatment electric, treatment dual, control electric, and control dual) were then stratified by size in terms of Btu usage. DNV KEMA used Btus so that kWh and therm data from the tracking database could be combined. Conversion from kWh to Btu is multiplied by 3 to account for plant efficiency. DNV KEMA used kWh and therm values for program year 2011.

\[ t_{\text{Btu}} = 3 \times 3,412 \times 2011_{\text{KWh}} + 99,976 \times 2011_{\text{Therm}} \]  

Stratification of sampling measures by size in terms of Btu savings allowed us to target a higher ratio of relatively high energy using households than low energy users. DNV KEMA has found in past studies that high users account for a disproportionately large amount of energy savings. Therefore, we sought to over-sample these groups to improve our overall precisions for the same number of total survey completes. A drawback of this approach is that we were limited to sampling households for which we had billing data, which only included the households still active as of March 2013. This drawback is minimal, however, because of the large number of households remaining in the population, and considering that we only wanted to survey households that were still in the population (i.e.: the address had not turned over to new owners) as of our survey period.

The sample design used a model based statistical sampling method is shown below in Table 4. Even with conservative estimates, using this sample design, our relative precision for the overall program is +/-10% at the 90% confidence interval.
Table 4. Survey Sample Design

<table>
<thead>
<tr>
<th>Sampling Measure Category</th>
<th>Size (Btu) Stratum</th>
<th>Maximum Btu (Btu)</th>
<th>Population Households</th>
<th>Percent 2011 Energy Usage (Btu)</th>
<th>Target Survey Completes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control – Dual Fuel</td>
<td>1</td>
<td>181,231,904</td>
<td>10,959</td>
<td>5%</td>
<td>110</td>
</tr>
<tr>
<td>Control – Dual Fuel</td>
<td>2</td>
<td>206,806,332</td>
<td>9,315</td>
<td>5%</td>
<td>110</td>
</tr>
<tr>
<td>Control – Dual Fuel</td>
<td>3</td>
<td>235,160,368</td>
<td>8,417</td>
<td>5%</td>
<td>110</td>
</tr>
<tr>
<td>Control – Dual Fuel</td>
<td>4</td>
<td>278,122,736</td>
<td>7,511</td>
<td>5%</td>
<td>110</td>
</tr>
<tr>
<td>Control – Dual Fuel</td>
<td>5</td>
<td>1,108,585,472</td>
<td>5,994</td>
<td>6%</td>
<td>110</td>
</tr>
<tr>
<td>Control - Electric Only</td>
<td>1</td>
<td>153,181,740</td>
<td>3,179</td>
<td>1%</td>
<td>50</td>
</tr>
<tr>
<td>Control - Electric Only</td>
<td>2</td>
<td>170,930,964</td>
<td>2,797</td>
<td>1%</td>
<td>50</td>
</tr>
<tr>
<td>Control - Electric Only</td>
<td>3</td>
<td>192,068,304</td>
<td>2,562</td>
<td>1%</td>
<td>50</td>
</tr>
<tr>
<td>Control - Electric Only</td>
<td>4</td>
<td>230,995,812</td>
<td>2,283</td>
<td>1%</td>
<td>50</td>
</tr>
<tr>
<td>Control - Electric Only</td>
<td>5</td>
<td>833,599,368</td>
<td>1,752</td>
<td>1%</td>
<td>50</td>
</tr>
<tr>
<td>Treatment – Dual Fuel</td>
<td>1</td>
<td>180,290,952</td>
<td>21,893</td>
<td>10%</td>
<td>110</td>
</tr>
<tr>
<td>Treatment – Dual Fuel</td>
<td>2</td>
<td>205,995,436</td>
<td>18,647</td>
<td>10%</td>
<td>110</td>
</tr>
<tr>
<td>Treatment – Dual Fuel</td>
<td>3</td>
<td>234,066,312</td>
<td>16,848</td>
<td>11%</td>
<td>110</td>
</tr>
<tr>
<td>Treatment – Dual Fuel</td>
<td>4</td>
<td>276,730,944</td>
<td>15,029</td>
<td>11%</td>
<td>110</td>
</tr>
<tr>
<td>Treatment – Dual Fuel</td>
<td>5</td>
<td>1,565,897,512</td>
<td>12,010</td>
<td>12%</td>
<td>110</td>
</tr>
<tr>
<td>Treatment - Electric Only</td>
<td>1</td>
<td>151,533,744</td>
<td>6,360</td>
<td>2%</td>
<td>50</td>
</tr>
<tr>
<td>Treatment - Electric Only</td>
<td>2</td>
<td>168,801,876</td>
<td>5,592</td>
<td>3%</td>
<td>50</td>
</tr>
<tr>
<td>Treatment - Electric Only</td>
<td>3</td>
<td>190,072,284</td>
<td>5,118</td>
<td>3%</td>
<td>50</td>
</tr>
<tr>
<td>Treatment - Electric Only</td>
<td>4</td>
<td>226,727,400</td>
<td>4,572</td>
<td>3%</td>
<td>50</td>
</tr>
<tr>
<td>Treatment - Electric Only</td>
<td>5</td>
<td>866,651,412</td>
<td>3,498</td>
<td>3%</td>
<td>50</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td></td>
<td><strong>7,657,450,872</strong></td>
<td><strong>164,336</strong></td>
<td><strong>100%</strong></td>
<td><strong>1,600</strong></td>
</tr>
</tbody>
</table>

3.2.2 Survey Fielding and Dispositions

DNV KEMA conducted a Computer Aided Telephone Interview (CATI) survey to collect data used in the analysis energy efficiency purchases and behaviors associated with the OPower HER program. We selected a random sample of 31,406 households from the HER treatment and control groups for possible interview. Most (28,191) of the sample was dialed. The remaining 3,215 numbers were not dialed because we already achieved the interview target in their respective strata. We completed total of 1,624 interviews (814 treatment and 810 control) with a net effective incidence rate of 66% and a final response rate\(^1\) of

\(^1\) Response rate used is Response Rate 3 (RR3) as defined by AAPOR.
about 6 percent. All respondents were called six to eight times over the survey period\(^\text{11}\), before being considered unreachable. Table 5 below is a summarized disposition report for the survey. The average length of time taken to complete the survey was about 25 minutes.

Table 5. Survey Dispositions

<table>
<thead>
<tr>
<th>Disposition</th>
<th>Sample n</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ineligible(^\text{12})</td>
<td>2,937</td>
<td>10%</td>
</tr>
<tr>
<td>Unknown Eligibility, No Interview(^\text{13})</td>
<td>9,803</td>
<td>35%</td>
</tr>
<tr>
<td>Eligible, No Interview(^\text{14})</td>
<td>13,827</td>
<td>49%</td>
</tr>
<tr>
<td>Eligible, Complete</td>
<td>1,624</td>
<td>6%</td>
</tr>
<tr>
<td><strong>Total(^\text{15})</strong></td>
<td>28,191</td>
<td>100%</td>
</tr>
</tbody>
</table>

A six percent response rate is less than ideal. However, according to the American Association of Public Opinion Research (AAPOR), it is unclear how survey data are affected by low response rates.\(^\text{16}\) Sending advanced letters that provided caller id information and offering participation incentives might have increased our response rate.

### 3.2.3 Analysis of Survey Responses

DNV KEMA weighted all survey data to represent the population households listed in Table 4.

We utilized two methods for analyzing survey results. In the case of yes/no questions (e.g.: Did your household purchase regular CFLs during the study period?), we first converted no, don’t know, and refused responses to not-yes. Then we used the test of proportions of independent populations to determine statistically significant differences in the yes response between the participating and control households.

---

\(^{11}\) The National Grid OPower Evaluation Residential Customer CATI survey ran from July 2, 2013 through July 30, 2013 and was conducted by Discovery Research Group on behalf of DNV KEMA

\(^{12}\) Ineligible - includes non-working numbers, government/business numbers, screened-out numbers, and over quotas

\(^{13}\) Unknown eligibility, no interview – includes refusals

\(^{14}\) Eligible, no interview – includes scheduled callbacks, callbacks (non-specific), early terminations, language deaf, busy, no answer, and answering machine contacts.

\(^{15}\) 28,191 numbers were attempted in the course of the study and 3,215 numbers were unused out of the total 31,406 numbers in the sample.

\(^{16}\) [http://www.aapor.org/Response_Rates_An_Overview1.htm](http://www.aapor.org/Response_Rates_An_Overview1.htm)
For questions with continuous responses (e.g. “How many regular CFLs did you purchase during the study period?”) we used simple t-tests to assess differences between the participating and control households.
4. Findings

DNV KEMA’s analyses sought to answer the following questions:

- How well did the randomization match participating and control households?
- What energy savings resulted from the program?
- What savings can be expected during a year with “normal” weather?
- Did the program increase participation in other rebate programs?
- What behaviors and non-incented measures contributed to savings?
- How did participating households react to the HERs?

4.1 How well did the randomization match participating and control households?

We compared the pre-period billing records for the participant and control households, separately for electric-only and dual fuel customers. For the latter group, we compared both electricity and gas use. Table 6 shows the pre and post usage statistics for the electric-only customers; Table 7 shows pre and post usage for the dual fuel customers. Our baseline analysis revealed the following:

- The participant and control households were well-matched on pre-program usage. The average monthly kWh and therm usage for the participant and control samples are almost identical.
- Electric-only households had relatively high annual usage – about 18,000 kWh per year. This held for both the participating and control households.
- The sampling proportions in terms of electric-only versus dual fuel are nearly identical (23% vs. 77%) across each sample. A large discrepancy between participant and control groups in proportions of customer type could skew the results.
- There are about half as many customer accounts in the control group as participants (~53k versus 106k). A large discrepancy in the size of the treatment and control groups can skew results in smaller samples. However, it is not a major concern in this study because of the large sample sizes.
Table 6. Summary of Households Evaluated – Electric Only

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th></th>
<th>Post</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Participant</td>
<td>Control</td>
<td>Participant</td>
<td>Control</td>
</tr>
<tr>
<td>Number of Unique Customers</td>
<td>24,655</td>
<td>12,313</td>
<td>24,655</td>
<td>12,313</td>
</tr>
<tr>
<td>Average Billing Periods</td>
<td>13</td>
<td>13</td>
<td>19.99</td>
<td>19.98</td>
</tr>
<tr>
<td>Average Bill Usage / Customer</td>
<td>1,526.45</td>
<td>1,526.32</td>
<td>1,410.6</td>
<td>1,445.92</td>
</tr>
<tr>
<td>Average Daily Usage per Customer / Year</td>
<td>50.38</td>
<td>50.38</td>
<td>46.22</td>
<td>47.37</td>
</tr>
</tbody>
</table>

Table 7. Summary of Households Evaluated – Dual Fuel

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th></th>
<th>Post</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Participant</td>
<td>Control</td>
<td>Participant</td>
<td>Control</td>
</tr>
<tr>
<td>Number of Unique Customers</td>
<td>82,234</td>
<td>41,093</td>
<td>82,234</td>
<td>41,093</td>
</tr>
<tr>
<td>Average Billing Periods</td>
<td>13</td>
<td>13</td>
<td>19.98</td>
<td>19.98</td>
</tr>
<tr>
<td>Average Bill Usage / Customer</td>
<td>870.93</td>
<td>871.15</td>
<td>865.64</td>
<td>880.23</td>
</tr>
<tr>
<td>Average Daily Usage per Customer / Year</td>
<td>28.74</td>
<td>28.75</td>
<td>28.38</td>
<td>28.86</td>
</tr>
<tr>
<td>Standard Deviation of Daily Usage</td>
<td>14.86</td>
<td>14.88</td>
<td>15.28</td>
<td>15.55</td>
</tr>
</tbody>
</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Unique Customers</td>
<td>82,120</td>
<td>40,984</td>
</tr>
<tr>
<td>Average Billing Periods</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Average Bill Usage / Customer</td>
<td>98.38</td>
<td>97.96</td>
</tr>
<tr>
<td>Average Daily Usage per Customer / Year</td>
<td>3.25</td>
<td>3.23</td>
</tr>
<tr>
<td>Standard Deviation of Daily Usage</td>
<td>2.91</td>
<td>2.89</td>
</tr>
</tbody>
</table>

The customer surveys contained a battery of demographics questions. Participating and control households had similar profiles for every demographic variable measured: income, education, number of occupants, changes in number of occupants, home tenure, home ownership, and home type.

Next, we compared the survey responses for heating fuel mixes for the electric-only and dual fuel households. Table 8 shows the heating fuel mixes for participating and control households. There were no statistically significant differences between the participating and control groups. However, several important differences based on service type did emerge.

- Electric-only customers were slightly more likely than dual fuel customers to heat with electricity.
- Electric-only customers were much more likely than dual fuel customers to heat with a fuel other than natural gas or electricity. Open-ended responses indicated wood-burning stoves are a major alternative heating method.
- Dual fuel customers were much more likely to heat with natural gas than electric-only customers.
Table 8. Heating Fuel

<table>
<thead>
<tr>
<th>Heating Fuel</th>
<th>Electric only</th>
<th>Dual Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Participants</td>
<td>Control</td>
</tr>
<tr>
<td>Natural gas</td>
<td>35%</td>
<td>38%</td>
</tr>
<tr>
<td>Electricity</td>
<td>11%</td>
<td>10%</td>
</tr>
<tr>
<td>Other</td>
<td>53%</td>
<td>52%</td>
</tr>
<tr>
<td>Don't know</td>
<td>1%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Finally, we compared the survey responses for water heating fuel mixes for the electric-only and dual fuel households. Table 9 shows the water heating fuel mixes for participating and control households. There were no statistically significant differences between the participating and control groups. However, several important differences based on service type did emerge.

- Dual fuel customers were much more likely to heat with natural gas than electric-only customers.
- Electric-only customers were much more likely to heat with electricity than dual fuel customers.
- Electric-only customers were much more likely than dual fuel customers to heat with a fuel other than natural gas or electricity.

Table 9. Water Heating Fuel

<table>
<thead>
<tr>
<th>Water Heating Fuel</th>
<th>Electric only</th>
<th>Dual Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Participants</td>
<td>Control</td>
</tr>
<tr>
<td></td>
<td>(n=245)</td>
<td>(n=234)</td>
</tr>
<tr>
<td>Natural gas</td>
<td>31%</td>
<td>34%</td>
</tr>
<tr>
<td>Electricity</td>
<td>51%</td>
<td>44%</td>
</tr>
<tr>
<td>Other</td>
<td>17%</td>
<td>20%</td>
</tr>
<tr>
<td>Don't know</td>
<td>1%</td>
<td>2%</td>
</tr>
</tbody>
</table>

An implication of the heating and water heating differences between the dual fuel and electric-only customers is that we would expect to see higher electricity use and savings for the electric-only group. Because of this implication, we examined dual fuel and electric-only households separately for analyses that involved electricity use. We would also expect to see higher gas use and savings for the dual fuel group, but this hypothesis was impossible to test because we did not have gas consumption data for the electric-only group.

In addition to verifying the success of the randomization, this section provides DNV KEMA’s estimates of first program year (April 2011 to March 2012) and calendar year 2011 and 2012 electric and gas savings. We first present the monthly electric and gas results, then the overall savings.
4.1.1 Monthly Electricity

Figure 1 provides a graph of monthly electric savings for the electric-only households. Savings quickly reached about 40 kWh per month after the first report. This increase is likely due to a combination of a ramping up of savings as households initially reacted to the HERs and the concurrent onset of warm summer weather creating more opportunity for savings from air conditioning use. Savings remained between 30 and 40 kWh through 2012. The fluctuations illustrate the seasonal sensitivity of the savings. Downward fluctuations in Octobers and Aprils of 2011 and 2012 are likely due to moderate autumn and spring weather. Upticks in December are probably due to a combination of increased winter lighting loads (fewer daylight hours) and the relatively high rate of electric heating in electric-only households.

Figure 1. Monthly Electric Savings, Electric-Only Customers

Figure 2 provides a graph of monthly electric savings for the dual fuel households. The shape is similar to the electric-only households, but with a lesser magnitude. Savings quickly reached about 20 kWh per
month after the first report and remained between 10 and 20 kWh for through 2012. Fluctuations are similar, though not as pronounced, as the electric-only customers.

**Figure 2. Monthly Electric Savings, Dual Fuel Customers**

Table 10 and Table 11 provide the monthly electric savings for electric-only and dual fuel households, respectively, in tabular form along with the count of treatment group households for that month. In combination, these numbers generate the total monthly estimated electric savings for the RBPD Program. May 2011 was the first full program month. The relatively low savings for the first month are typical for this type of program and demonstrate how savings initially ramp up. Totals at the bottom of the table provide the total and annual savings along with confidence intervals for the aggregate numbers. For
electric only customers, the relative precision of the total savings estimate is 16.3%, at 95% confidence. For dual fuel electric customers it is 12.1% at 95% confidence.\textsuperscript{17}

\textsuperscript{17} A 90% confidence interval would provide a narrower bracketing of the series of month estimates.
### Table 10. Participant Electric Savings – Electric-Only

<table>
<thead>
<tr>
<th>Month</th>
<th>Unadjusted Savings per Household (kWh)</th>
<th>Count of Treatment group Participants</th>
<th>Program Unadjusted Savings (MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May-11</td>
<td>3.63</td>
<td>28,960</td>
<td>105</td>
</tr>
<tr>
<td>Jun-11</td>
<td>20.12</td>
<td>28,644</td>
<td>576</td>
</tr>
<tr>
<td>Jul-11</td>
<td>30.87</td>
<td>28,363</td>
<td>876</td>
</tr>
<tr>
<td>Aug-11</td>
<td>40.71</td>
<td>28,073</td>
<td>1,143</td>
</tr>
<tr>
<td>Sep-11</td>
<td>40.65</td>
<td>27,819</td>
<td>1,131</td>
</tr>
<tr>
<td>Oct-11</td>
<td>31.58</td>
<td>27,588</td>
<td>871</td>
</tr>
<tr>
<td>Nov-11</td>
<td>32.02</td>
<td>27,416</td>
<td>878</td>
</tr>
<tr>
<td>Dec-11</td>
<td>37.55</td>
<td>27,262</td>
<td>1,024</td>
</tr>
<tr>
<td>Jan-12</td>
<td>37.55</td>
<td>27,110</td>
<td>1,018</td>
</tr>
<tr>
<td>Feb-12</td>
<td>37.35</td>
<td>26,985</td>
<td>1,008</td>
</tr>
<tr>
<td>Mar-12</td>
<td>38.31</td>
<td>26,828</td>
<td>1,028</td>
</tr>
<tr>
<td>Apr-12</td>
<td>33.27</td>
<td>26,680</td>
<td>888</td>
</tr>
<tr>
<td>May-12</td>
<td>35.76</td>
<td>26,465</td>
<td>946</td>
</tr>
<tr>
<td>Jun-12</td>
<td>36.45</td>
<td>26,278</td>
<td>956</td>
</tr>
<tr>
<td>Jul-12</td>
<td>43.33</td>
<td>26,069</td>
<td>1,130</td>
</tr>
<tr>
<td>Aug-12</td>
<td>43.37</td>
<td>25,872</td>
<td>1,122</td>
</tr>
<tr>
<td>Sep-12</td>
<td>42.13</td>
<td>25,729</td>
<td>1,084</td>
</tr>
<tr>
<td>Oct-12</td>
<td>33.99</td>
<td>25,559</td>
<td>869</td>
</tr>
<tr>
<td>Nov-12</td>
<td>39.21</td>
<td>25,410</td>
<td>996</td>
</tr>
<tr>
<td>Dec-12</td>
<td>46.19</td>
<td>25,288</td>
<td>1,168</td>
</tr>
</tbody>
</table>

Total Savings: 18,818 +/- 16.3%

Program Year Savings (May 2011 – Apr 2012): 10,545 +/- 16.2%

2011 Savings: 6,603 +/- 22.1%

2012 Savings: 12,214 +/- 16.2%
Table 11. Participant Electric Savings – Dual Fuel

<table>
<thead>
<tr>
<th>Month</th>
<th>Unadjusted Savings per Household (kWh)</th>
<th>Count of Treatment group Participants</th>
<th>Program Unadjusted Savings (MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May-11</td>
<td>0.91</td>
<td>99,454</td>
<td>90</td>
</tr>
<tr>
<td>Jun-11</td>
<td>10.06</td>
<td>98,245</td>
<td>988</td>
</tr>
<tr>
<td>Jul-11</td>
<td>17.73</td>
<td>97,140</td>
<td>1,723</td>
</tr>
<tr>
<td>Aug-11</td>
<td>20.87</td>
<td>96,032</td>
<td>2,004</td>
</tr>
<tr>
<td>Sep-11</td>
<td>15.50</td>
<td>95,147</td>
<td>1,475</td>
</tr>
<tr>
<td>Oct-11</td>
<td>10.89</td>
<td>94,295</td>
<td>1,027</td>
</tr>
<tr>
<td>Nov-11</td>
<td>11.13</td>
<td>93,606</td>
<td>1,042</td>
</tr>
<tr>
<td>Dec-11</td>
<td>14.12</td>
<td>93,027</td>
<td>1,314</td>
</tr>
<tr>
<td>Jan-12</td>
<td>14.41</td>
<td>92,607</td>
<td>1,334</td>
</tr>
<tr>
<td>Feb-12</td>
<td>13.20</td>
<td>92,129</td>
<td>1,216</td>
</tr>
<tr>
<td>Mar-12</td>
<td>12.87</td>
<td>91,655</td>
<td>1,179</td>
</tr>
<tr>
<td>Apr-12</td>
<td>11.37</td>
<td>91,136</td>
<td>1,036</td>
</tr>
<tr>
<td>May-12</td>
<td>12.83</td>
<td>90,479</td>
<td>1,160</td>
</tr>
<tr>
<td>Jun-12</td>
<td>17.45</td>
<td>89,800</td>
<td>1,567</td>
</tr>
<tr>
<td>Jul-12</td>
<td>24.56</td>
<td>89,082</td>
<td>2,188</td>
</tr>
<tr>
<td>Aug-12</td>
<td>23.93</td>
<td>88,355</td>
<td>2,114</td>
</tr>
<tr>
<td>Sep-12</td>
<td>19.50</td>
<td>87,800</td>
<td>1,712</td>
</tr>
<tr>
<td>Oct-12</td>
<td>11.78</td>
<td>87,200</td>
<td>1,027</td>
</tr>
<tr>
<td>Nov-12</td>
<td>11.60</td>
<td>86,733</td>
<td>1,006</td>
</tr>
<tr>
<td>Dec-12</td>
<td>11.94</td>
<td>86,337</td>
<td>1,031</td>
</tr>
</tbody>
</table>

Total Savings: 26,232 +/- 12.1% (23,058, 29,406)

Program Year Savings (May 2011 – Apr 2012): 14,427 +/- 12.3% (12,652, 16,201)

2011 Savings: 9,661 +/- 14.7% (8,241, 11,082)

2012 Savings: 16,571 +/- 12.8% (14,450, 18,692)
4.1.2 Monthly Gas

Figure 3 provides a graph of monthly gas savings for the dual fuel households. Savings slowly increase to about 0.7 therms during the first winter, drop a little during summer of 2012, and then increases in the winter of 2012. Similar to electric savings, the fluctuations illustrate the seasonal (temperature) sensitivity of the savings. This sensitivity is particularly evident in the spike for April 2012. April was about one degree cooler than normal while March 2012 was nine degrees warmer than normal.

This graphic also provides some clues as to where the gas savings originate. Residential gas use is less variable than electricity use, and mostly consists of space heating, water heating, and cooking. Space heating only occurs in the winter months while water heating and cooking loads are relatively constant throughout the year. An inspection of gas savings during the summer and winter months can indicate how much of the gas savings come from space heating or other uses of gas. Average per household savings
During the summer months, gas usage is around 0.5 therms and goes up to about 0.7 therms in winter months. This suggests that the majority of gas savings comes from water heating and cooking rather than space heating.
Table 12. Participant Gas Savings – Dual Fuel

<table>
<thead>
<tr>
<th>Month</th>
<th>Unadjusted Savings per Household (Therms)</th>
<th>Count of Treatment group Participants</th>
<th>Program Unadjusted Savings (,000s Therms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May-11</td>
<td>0.20</td>
<td>99,454</td>
<td>20.3</td>
</tr>
<tr>
<td>Jun-11</td>
<td>0.46</td>
<td>98,245</td>
<td>44.9</td>
</tr>
<tr>
<td>Jul-11</td>
<td>0.50</td>
<td>97,140</td>
<td>48.3</td>
</tr>
<tr>
<td>Aug-11</td>
<td>0.51</td>
<td>96,032</td>
<td>48.5</td>
</tr>
<tr>
<td>Sep-11</td>
<td>0.41</td>
<td>95,147</td>
<td>38.7</td>
</tr>
<tr>
<td>Oct-11</td>
<td>0.58</td>
<td>94,295</td>
<td>55.0</td>
</tr>
<tr>
<td>Nov-11</td>
<td>0.59</td>
<td>93,606</td>
<td>55.6</td>
</tr>
<tr>
<td>Dec-11</td>
<td>0.72</td>
<td>93,027</td>
<td>66.7</td>
</tr>
<tr>
<td>Jan-12</td>
<td>0.71</td>
<td>92,607</td>
<td>65.5</td>
</tr>
<tr>
<td>Feb-12</td>
<td>0.61</td>
<td>92,129</td>
<td>56.2</td>
</tr>
<tr>
<td>Mar-12</td>
<td>0.55</td>
<td>91,655</td>
<td>50.0</td>
</tr>
<tr>
<td>Apr-12</td>
<td>0.83</td>
<td>91,136</td>
<td>75.7</td>
</tr>
<tr>
<td>May-12</td>
<td>0.70</td>
<td>90,479</td>
<td>63.3</td>
</tr>
<tr>
<td>Jun-12</td>
<td>0.48</td>
<td>89,800</td>
<td>43.5</td>
</tr>
<tr>
<td>Jul-12</td>
<td>0.44</td>
<td>89,082</td>
<td>39.0</td>
</tr>
<tr>
<td>Aug-12</td>
<td>0.57</td>
<td>88,355</td>
<td>50.3</td>
</tr>
<tr>
<td>Sep-12</td>
<td>0.60</td>
<td>87,800</td>
<td>52.7</td>
</tr>
<tr>
<td>Oct-12</td>
<td>0.66</td>
<td>87,200</td>
<td>57.6</td>
</tr>
<tr>
<td>Nov-12</td>
<td>0.76</td>
<td>86,733</td>
<td>65.7</td>
</tr>
<tr>
<td>Dec-12</td>
<td>0.61</td>
<td>86,337</td>
<td>52.5</td>
</tr>
</tbody>
</table>

| Total Savings | 1,050 +/- 30.3% |
|               | (732, 1368)     |
| Program Year Savings (May 2011 – Apr 2012) | 625 +/- 25.8% |
|               | (464, 787)      |
| 2011 Savings  | 378 +/- 50.2%   |
|               | (188, 568)      |
| 2012 Savings  | 672 +/- 24.3%   |
|               | (509, 835)      |

Table 12 provides the monthly gas savings for dual fuel households in tabular form along with the count of treatment group households for that month. In combination, these numbers generate the total monthly estimated gas savings for the RBPD Program. May 2011 was the first full program month. Like the
electric savings, the relatively low savings for the first month are typical for this type of program and demonstrate how savings initially ramp up. Totals at the bottom of the table provide the total and annual savings along with confidence intervals for the aggregate numbers. For the total savings, the relative precision is 30% at 95% confidence.  

4.1.3 Overall Savings

Table 13 presents the overall energy savings for the RBPD program and the average per participant savings estimates by fuel type and program/calendar year as estimated using the Basic Model described above. These results were obtained by converting the savings parameter estimates to percent savings relative to the control group’s average daily usage.

National Grid reported ex ante savings estimates of 14,580,000 kWh and 1,164,780 therms for the period January through December 2012. DNV KEMA’s ex post savings calculations for the same period were 28,784,867 kWh (1.97 realization rate) and 671,932 therms (0.58 realization rate).

| Table 13. Estimates of RBPD Program Savings
Prior to Removal of Joint Savings |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unadjusted Savings</td>
<td>Electric Only (kWh)</td>
<td>Dual Fuel Gas (Therms)</td>
<td></td>
</tr>
<tr>
<td>Program Year 1 Energy Savings (May 2011- Apr 2012)</td>
<td>10,544,793</td>
<td>14,426,591</td>
<td>625,352</td>
</tr>
<tr>
<td>Calendar Year Energy Savings (Jan 2012 – Dec 2012)</td>
<td>12,214,008</td>
<td>16,570,859</td>
<td>671,932</td>
</tr>
<tr>
<td>Total Energy Savings (May 2011- Dec 2012)</td>
<td>18,817,545</td>
<td>26,232,177</td>
<td>1,049,976</td>
</tr>
<tr>
<td>Changes in Energy Use (% Total Post Use) (May 2011 – Dec 2012)</td>
<td>2.44%</td>
<td>1.64%</td>
<td>0.82%</td>
</tr>
</tbody>
</table>

The final savings estimates were somewhat sensitive to the choice of how to treat finaled accounts, particularly for gas. As described in the Methods section, the estimates in Table 13 are based on an assumption that finaled accounts have the same energy savings as still-active accounts up until their last month of service (method #2). Savings estimates using the other two methods of treating finaled accounts were lower but still within the 90% confidence intervals of those in Table 13.

---

18 A 90% confidence interval would provide a narrower bracketing of the series of month estimates.
4.2 What savings can be expected during a year with “normal” weather?

Table 14 below presents the expected savings for a year with “normal” weather. Comparing the estimates below to those in the table above, one can see that the savings are slightly lower, suggesting that during the evaluation period the heating and cooling load were greater than those seen in a year with typical temperatures.

Table 14. Weather Normalized Estimates Savings

<table>
<thead>
<tr>
<th>Changes in Energy Use (% Total Post Use) (May 2011 – Dec 2012)</th>
<th>Electric Only (kWh)</th>
<th>Dual Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.30%</td>
<td>1.52%</td>
</tr>
</tbody>
</table>

4.3 Did the program increase participation in other energy efficiency programs?

DNV KEMA analyzed the increase in participation in other energy efficiency programs during the same time period as the RBPD program two different ways. First, we examined National Grid program tracking data to determine whether RBPD participating households participated in other rebate programs more often than the control households (program uptake). Next, we calculated the energy savings expected from participation using hourly load shapes to compare the effects of participation in the other programs at an energy usage level (joint savings).

National Grid staff reported that the HERs did not actively or aggressively promote these other programs because those programs were already well-subscribed. Therefore, we expected low uptake and joint savings estimates. We completed these analyses for the sake of completeness and to explore a potential causal mechanism for RBPD savings.

4.3.1 Tracked Incentive Program Uptake

National Grid tracked participation in energy efficiency programs that included incentives for the following measures:
- High efficiency furnaces,
- Programmable thermostats,
- Refrigerator bounties,
- Freezer recycling,
- High efficiency windows,
- Air sealing,
- High efficiency boilers,
- Insulation,
- Domestic water heaters,
- Boiler control resets, and
- Duct insulation and sealing.

DNV KEMA analyzed the participation rates for each of these measures for the RBPD participating households and control group. We examined the participation rates before and after the HERs started going out, and compared the difference of differences. Because of the very high number of RBPD participants and controls and very low rates of participation, the statistical test DNV KEMA used (difference of population proportions) is a very strong test. Therefore, DNV KEMA used a confidence level of 99% for statistical significance.

RBPD participants appeared to have increased their participation in boilers, insulation, water heaters, and overall relative to the control households. While the control households appear to have increased their relative participation in freezer recycling during this time (Table 15).
Table 15. Rebate Program Participation Rates

<table>
<thead>
<tr>
<th>Measure Category</th>
<th>RBPD Participants (n=131,303)</th>
<th>Control Households (n=65,646)</th>
<th>Difference of Differences</th>
<th>Statistical Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>After HERs</td>
<td>Before HERs</td>
<td>Difference</td>
<td>After HERs</td>
</tr>
<tr>
<td>Air Sealing</td>
<td>0.2%</td>
<td>0.0%</td>
<td>0.2%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Boiler</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Boiler Reset</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Duct &amp; Leakage Sealing</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Furnace</td>
<td>1.4%</td>
<td>0.5%</td>
<td>0.8%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Freezer Recycling</td>
<td>0.5%</td>
<td>0.1%</td>
<td>0.3%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Insulation</td>
<td>0.1%</td>
<td>0.0%</td>
<td>0.1%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Refrigerator Bounty</td>
<td>1.3%</td>
<td>0.2%</td>
<td>1.1%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Thermostats</td>
<td>1.3%</td>
<td>0.5%</td>
<td>0.8%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Water Heater - indirect</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Windows</td>
<td>0.1%</td>
<td>0.3%</td>
<td>-0.2%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Total</td>
<td>5.1%</td>
<td>1.8%</td>
<td>3.3%</td>
<td>4.8%</td>
</tr>
</tbody>
</table>

* Difference of difference between RBPD participants and controls statistically significant at 99% confidence level.

4.3.2 Joint Savings - Energy

Based on incentive program tracking data provided by National Grid, we found minimal joint savings at an energy level. This is consistent with the small observed increase in efficiency program uptake. Figure 4 shows the monthly electric joint savings for the electric-only and dual fuel customers (participants less controls). Joint electric savings for dual fuel households are smaller in magnitude, but have much the same shape as the electric-only joint savings. Electric savings steadily increase from the program start through the summer of 2012 before flattening out. Figure 5

Figure 5. Monthly Joint Savings, Dual Fuel, Gas
(Participants less Controls)
illustrates the gas joint savings for dual fuel customers. The seasonality of gas savings is apparent in the shape of the joint savings line in Figure 5. Additionally, we estimated that during the winter of 2012, control households actually had greater savings from participation in National Grid rebate programs than the RBPD participating households. However, the magnitude of this difference is actually very small (about 0.05 therms per household per month).
Figure 4. Monthly Joint Savings, Electric
(Participants less Controls)
4.3.3 Upstream Lighting Uptake

We found little evidence of increased upstream lighting program uptake among the RBPD participants. There was no participation tracking database available to determine increased participation in NYSERDA’s upstream CFL rebate program. Therefore DNV KEMA estimated program participation based on survey responses, as described in the Methods section. The results are presented in Table 16. Upstream Lighting Program Uptake below. None of the differences shown in the table achieved statistical significance (at the 90% confidence level). Even if they were significant, most of the differences indicate slightly higher participation among the control households.
Table 16. Upstream Lighting Program Uptake

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Electric Only</th>
<th>Dual Fuel</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Participants</td>
<td>Controls</td>
<td>Participants</td>
</tr>
<tr>
<td>Participation Rate</td>
<td>47%</td>
<td>45%</td>
<td>44%</td>
</tr>
<tr>
<td>CFLs purchased (mean)</td>
<td>5.3</td>
<td>4.5</td>
<td>4.1</td>
</tr>
<tr>
<td>XFLs purchased (mean)</td>
<td>1.3</td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Annual Savings (mean kWh per household)</td>
<td>5.0</td>
<td>3.8</td>
<td>3.9</td>
</tr>
</tbody>
</table>

4.3.4 Credited Savings

Most previous evaluations of OPower programs remove the point estimates of joint savings from credited program savings, and we follow that convention in this evaluation. Error! Reference source not found. There were two instances where we computed negative joint savings – dual fuel upstream electricity and dual fuel traditional therms. In both cases, we opted to consider negative savings as zero. This decision was the most conservative one from the sense of avoiding overestimating OPower program savings. It is also conceptually difficult to justify giving the OPower program credit for negative joint savings. Table 17 shows the resulting adjusted savings after removing joint savings.

Table 17. Adjusted Savings

<table>
<thead>
<tr>
<th>Customer Type</th>
<th>Savings Type</th>
<th>Calendar Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2011</td>
</tr>
<tr>
<td>Electric Only (MWh)</td>
<td>Gross Savings</td>
<td>6,603</td>
</tr>
<tr>
<td></td>
<td>Joint Savings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Traditional</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Upstream</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td><strong>Adjusted Savings</strong></td>
<td><strong>6,573</strong></td>
</tr>
<tr>
<td>Dual Fuel (MWh)</td>
<td>Gross Savings</td>
<td>9,661</td>
</tr>
<tr>
<td></td>
<td>Joint Savings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Traditional</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Upstream¹</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>Adjusted Savings</strong></td>
<td><strong>9,653</strong></td>
</tr>
<tr>
<td>Dual Fuel (.000 therms)</td>
<td>Gross Savings</td>
<td>378</td>
</tr>
<tr>
<td></td>
<td>Joint Savings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Traditional²</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Upstream</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td><strong>Adjusted Savings</strong></td>
<td><strong>378</strong></td>
</tr>
</tbody>
</table>

¹ Negative joint savings were counted as 0. Upstream electricity joint savings for dual fuel customers were slightly negative: -13 MWh in 2011 and -18 MWh in 2012.
² Negative joint savings were counted as 0. Therms savings from traditional programs were slightly negative: -9,000 therms in 2011 and another -9,000 therms in 2012.
4.4 What behaviors and non-incented measures contributed to savings?

The survey asked respondents about over 80 specific measures (including non-incented equipment and behaviors) they may have installed or performed during the first year of receiving HERs (April 2011 through March 2012). We broke these measures down into ones that would result in electric savings and ones that would result in gas savings. We compared the results for the RBPD participating and control households on each measure. In the following sections, we present the measures for which we found statistically significant (90% or greater confidence level) differences between the participating and control households. The full survey results are reported in Appendix A.

4.4.1 Participant and Control Household Differences

Dual fuel and electric-only customers had different levels of electricity savings and different heating and water heating profiles. Therefore, we analyzed the electricity results separately for each group. The dual fuel group was the only group with gas savings. Of the three analyses - electric-only electricity saving measures, dual fuel electricity saving measures, and dual fuel gas saving measures – we found statistically significant differences between participant and control households only for electric-only electricity saving measures. We did not find significant behavioral differences between participating and control households in the dual fuel group for either electricity or gas saving measures.

Figure 6 shows the measures for which there were uptake differences between the participating and control households, and for which the differences would indicate electricity savings for the participating electric-only households. Among electric-only households, RBPD participants reported turning off lights more often, cooling less when nobody was home, putting computers or TVs on standby mode, installing programmable thermostats, and reducing their dryer use more often than controls. For the most part, these are no-cost behavioral measures.
4.4.2 Participant Household Open-ended Responses

The survey included two questions that directly asked participants what they did in response to the HERs. The purpose of these questions was to gather additional data to determine what causes RBPD program savings. We could not compare participant and control households on these questions because only the participants answered them.

These open-ended responses are fairly consistent with the analyses that compared the participant and control households. One notable exception is equipment purchases, where the open-ended responses suggest higher levels of equipment purchase influence than the comparative results. This inconsistency probably indicates that the HERs had a minor effect on participant equipment decision purchases. However, when considered along with all the other factors that influence such purchases (represented by the control households), the effect of the HERs on equipment purchase decisions were not detectable.
Figure 7. HERs Influenced Behaviors
(Participants Only)

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Percent of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>61%</td>
</tr>
<tr>
<td>Turn things off</td>
<td>15%</td>
</tr>
<tr>
<td>Increased awareness of temp / Used prog t-stat</td>
<td>5%</td>
</tr>
<tr>
<td>Lights/bulbs</td>
<td>7%</td>
</tr>
<tr>
<td>Unplug items not in use</td>
<td>9%</td>
</tr>
<tr>
<td>Less usage</td>
<td>5%</td>
</tr>
<tr>
<td>More consumption awareness</td>
<td>5%</td>
</tr>
<tr>
<td>Buying energy efficient equipment</td>
<td>5%</td>
</tr>
<tr>
<td>Other</td>
<td>10%</td>
</tr>
</tbody>
</table>

Total exceeds 100% because multiple responses were allowed. Other included the following, each provided by fewer than 5% of respondents: Sealing windows/doors, Added insulation, Outlets/power strips, Adjust time of day of use, Use cold water, Use window coverings, Improved home maintenance, and miscellaneous other responses.
Figure 8. HERs Influenced Equipment Purchases
(Participants Only)

Total exceeds 100% because multiple responses were allowed. Other included the following, each provided by fewer than 5% of respondents: Furnace, Energy Star/labels, Air conditioner, Dishwasher, Hot water heater, Computer/tablet, Windows/doors/seals, Appliances- not specified, Insulation, Stove, Thermostat, Power strips, Microwave, and miscellaneous other responses.

4.5 How did participating households react to the HERs?

The survey asked all respondents in the participating group a series of questions on HER use that included: recollection of receipt, whether respondents read the HERs, how much time they spent on them, and the influence, if any, of HERs on energy saving behaviors and energy efficient equipment purchases.
Overall, participants:

- demonstrated a high level of recall of receiving the HERs,
- most read every report,
- on average, spent a few minutes reading the reports, and
- found the self-comparisons and energy saving tips more useful than the social comparisons.

We also noted variation in responses based on education level. The following sections provide detailed survey findings on HER use and reactions.

### 4.5.1 Response to HERs Summary

The survey asked participant group respondents several questions which were collectively used to define respondent categories or segments based on level of use of HERs, as shown in Table 10 below. There was a drop in level of involvement with HERs as we go across the spectrum of basic awareness of receipt to reading it and high perceived usefulness of HERs (Table 18).

<table>
<thead>
<tr>
<th>Categories of HERs use</th>
<th>Percent of Participants (n=814)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recall receipt of HERs</td>
<td>95%</td>
</tr>
<tr>
<td>Recall receipt, and read every report</td>
<td>64%</td>
</tr>
<tr>
<td>Recall receipt, read HERs, and find it useful</td>
<td>36%</td>
</tr>
</tbody>
</table>

### 4.5.2 Recollection of Reports

Over three-fourths (88%) of participating households remembered receiving the HERs without additional prompting or description. Upon prompting with a follow-up question that described the HERS, an additional seven percent recalled receipt of HERs. Only five percent of the participant group respondents did not recall receiving HERs. All respondents with either aided or unaided recall of HERs receipt were asked subsequent questions regarding the use of HERs.
There was a significant difference between electric-only and dual fuel customers when recalling receipt of HERs. Electric-only customers indicating lower recall than dual fuel customers (Figure 10). This difference suggests that the electric-only customers are less likely to notice the HERs than the dual fuel customers.
Figure 10. Unaided recall of HERs receipt - by customer type

![Bar chart showing unaided recall percentages for different customer types.](chart)

### 4.5.3 Read HERs

Almost all (94%) respondents who remembered receiving the HERs indicated that they read them. Nearly two-thirds (64%) of the respondents who remembered receiving the HERs said they read every report they received (Figure 11). The results further showed that respondents with a college degree or higher (74%) were more likely than those with some college (65%) to state that they read every HER.
4.5.4  Time Spent Reading HERs

Most (51%) participants reported spending four or more minutes reading the reports, and about one tenth indicated spending 10 or more minutes on them. (Figure 12). Electric-only customers were more likely than dual fuel customers to report spending over 10 minutes reading their HERs (Figure 13). While electric-only customers were less likely to notice the HERs (Figure 10), those that did notice them engaged with them more deeply than dual fuel customers.
Figure 12. Time spent reading HERs – Overall

- Read HERs >10 mins: 8%
- Read HERs 4-10 mins: 43%
- Read HERs 1-3 mins: 47%

Percent of HERs Recipients (n = 695)
4.5.5 Perceived Usefulness of HERs

Respondents rated the usefulness of the reports on a five-point scale anchored at 1 for “not at all useful” and 5 for “very useful.” About one third (36%) of respondents said the reports were useful (4 or 5 on the five-point scale; Figure 14).
Participant group respondents were asked to rate the usefulness of several specific components of the HERs. These components consisted of: comparison to own house last year, action steps for reducing energy use, comparison to neighbors’ energy use for the last 12 months, comparison to neighbors’ energy use for the last two months, and suggestions for energy efficiency (EE) purchases. The usefulness ratings were made on three point scales: very useful, somewhat useful, and not at all useful. Comparison to the respondents’ own homes was the most useful component followed by tips to save energy and recommendations for energy efficient purchases. The comparative/social norm aspects were perceived to be relatively the least useful component of HERs.

Findings that show self-comparisons are the most helpful components and social comparison are the least useful aspects of the HERs are similar to a DNV KEMA evaluation of Puget Sound’s HERs program.19 There are several possible explanations for this pattern of findings, some of which challenge the

theoretical underpinnings of the OPower program that social norms cause participating households to reduce energy use, and some which do not:

- The desire to improve or do better than oneself in the past (sometimes called a “mastery goal” in the social psychological literature) could be a motivational mechanism.
- The question wording may not be capturing the right construct. “Useful” is not the same as “influential.”
- Respondents may be unwilling to admit to being swayed by social norms.

OPower could test the first possibility by setting up an experiment where some participating households receive only the self-referential portions of the HERs and another group receives only the social comparison portions. Evaluators could refine question wording to address the second possibility. The third possibility is difficult to test.

**Figure 15. Usefulness of HERs components - Overall**
There were statistically significant differences in the perceived usefulness of HERs components by customer type and level of education.

- **Customer type:** Dual fuel customers had a higher proportion of respondents who found the comparison to their neighbors’ gas and electricity consumption over the last 12 months “very useful” than electric only customers (23% versus 14% respectively). A similar effect was observed on the tips to save energy component with 23 percent of dual fuel customers perceiving this to be “very useful” versus just 16 percent of electric only customers.

- **Education:** The direction of differences by level of education varied with the type of component being discussed. Those with a college degree or higher found the comparison to their own household’s usage from a year before “very useful” at higher rates than those with high school or some years of college (44% versus 29% and 31% respectively). More highly educated people may be more interested in self-comparison, they may have more skepticism of how the social comparisons were computed, or they may have less willingness to admit they are swayed by social norms.

Customers with a high school level education seemed to value more action oriented components than customers with a college degree or higher.

- Tips to save energy (27% versus 17%)
- Recommendations for energy efficient purchases (23% versus 15%)
- A similar finding along this spectrum was the significantly higher perceived usefulness of recommendation for energy efficient purchases amongst those with some years of college compared to those with a college degree or more (21% versus 15% respectively).
5. **Comparison to Other OPower Programs**

DNV KEMA located the results of several other recent OPower evaluations that were publically available and contained pre-program usage and program year one savings estimates. To compare the results of the RBPD program with these other programs, we plotted average electricity (Figure 16) and gas (Figure 17) savings²⁰ by average annual usage for the year before participants started receiving the HERs (pre-program usage). For the RBPD evaluation, HERs started going out in April 2011, so pre-program usage is the average household electricity or gas use for April 2010 through March 2011. The electric and gas results for dual fuel households are similar to other programs. On the other hand, the electric-only results are unusually high. This may be due to the unusually high level of pre-program usage in those households.

---

²⁰ Specification of the removal of joint savings and weather normalization varied. Wherever possible, we tried to report first program year savings after removing joint savings (if they were calculated) and before weather normalization.
Figure 16. Other Program Comparisons - Electric

- Electric Only
- Dual Fuel

Percent Savings, Year 1 vs Avg. One Year Pre-Program Energy Use (kWh)
Table 19 and Table 20 list the data and sources used to generate Figure 16 and Figure 17.
### Table 19. Other OPower Evaluations - Electric

<table>
<thead>
<tr>
<th>Avg. One Year Pre-Program Energy Use (kWh)</th>
<th>Percent Savings, Year 1</th>
<th>Joint Savings Removed?</th>
<th>Weather Normalized?</th>
<th>Consulting Firm</th>
<th>Service Territory</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>18,389</td>
<td>2.44%</td>
<td>NA (estimated 0)</td>
<td>N</td>
<td>DNV KEMA</td>
<td>Niagara Mohawk (Electric-only)</td>
<td></td>
</tr>
<tr>
<td>10,490</td>
<td>1.64%</td>
<td>NA (estimated 0)</td>
<td>N</td>
<td>DNV KEMA</td>
<td>Niagara Mohawk (Dual Fuel)</td>
<td></td>
</tr>
</tbody>
</table>
### Table 20. Other OPower Evaluations – Gas

<table>
<thead>
<tr>
<th>Avg. One Year Pre-Program Energy Use (MMBtu)</th>
<th>Percent Savings, Year 1</th>
<th>Joint Savings Removed?</th>
<th>Weather Normalized?</th>
<th>Consulting Firm</th>
<th>Service Territory</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>139.9</td>
<td>1.21%</td>
<td>Y</td>
<td>Not Specified</td>
<td>ODC (w/ Navigant)</td>
<td>MA (NSTAR)</td>
<td></td>
</tr>
<tr>
<td>102.7</td>
<td>0.99%</td>
<td>Y</td>
<td>Not Specified</td>
<td>MA (NSTAR)</td>
<td>MN (NSTAR)</td>
<td></td>
</tr>
<tr>
<td>121.5</td>
<td>1.50%</td>
<td>Y</td>
<td>Not Specified</td>
<td>DNV KEMA</td>
<td>Niagara Mohawk (dual fuel)</td>
<td></td>
</tr>
</tbody>
</table>
A. Full Behavior and Unincented Measure Results

This section contains tables that show the overall differences between participant and control households for each of the behavior and unincented measures queried with the survey. Note, these tables show the data for all participant and control groups and do not separate out the results for electric-only or dual fuel households.

A.1 Lighting

Table 21. Measure Uptake - Lighting

| Survey Question | Measure          | Participant % | Control % | Difference | Significant?
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LI0A</td>
<td>Purchased CFLs</td>
<td>72%</td>
<td>75%</td>
<td>-3%</td>
<td>N</td>
</tr>
<tr>
<td>LI0B</td>
<td>Purchased specialty CFLs</td>
<td>33%</td>
<td>35%</td>
<td>-1%</td>
<td>N</td>
</tr>
<tr>
<td>LI0C</td>
<td>Purchased LEDs</td>
<td>18%</td>
<td>18%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>LI0D</td>
<td>Purchased incandescents</td>
<td>62%</td>
<td>59%</td>
<td>3%</td>
<td>N</td>
</tr>
<tr>
<td>LI32_1</td>
<td>Turn off lights more often</td>
<td>35%</td>
<td>33%</td>
<td>3%</td>
<td>N</td>
</tr>
<tr>
<td>LI32_2</td>
<td>Use motion sensors</td>
<td>4%</td>
<td>3%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>LI32_3</td>
<td>Use more daylight</td>
<td>2%</td>
<td>3%</td>
<td>-1%</td>
<td>N</td>
</tr>
<tr>
<td>LI32_4</td>
<td>Use task lighting</td>
<td>2%</td>
<td>2%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>LI32_5</td>
<td>Increased lighting levels</td>
<td>3%</td>
<td>3%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>LI32_6</td>
<td>Less use of holiday lights</td>
<td>1%</td>
<td>2%</td>
<td>-1%</td>
<td>N</td>
</tr>
<tr>
<td>LI32_7</td>
<td>Installed EE lighting</td>
<td>4%</td>
<td>5%</td>
<td>-1%</td>
<td>N</td>
</tr>
</tbody>
</table>

Table 22. Measure Number - Lighting

| Survey Question | Measure          | Participant Mean | Control Mean | Difference | Significant?
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LI1</td>
<td>CFLs purchased</td>
<td>7.4</td>
<td>8.3</td>
<td>-0.9</td>
<td>Y</td>
</tr>
<tr>
<td>LI4</td>
<td>CFLs installed</td>
<td>5.7</td>
<td>6.1</td>
<td>-0.4</td>
<td>N</td>
</tr>
<tr>
<td>LI11</td>
<td>Specialty CFLs purchased</td>
<td>1.9</td>
<td>1.9</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>LI14</td>
<td>Specialty CFLs installed</td>
<td>1.5</td>
<td>1.4</td>
<td>0.1</td>
<td>N</td>
</tr>
<tr>
<td>LI21</td>
<td>LEDs purchased</td>
<td>1.2</td>
<td>1.2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>LI24</td>
<td>LEDs installed</td>
<td>0.8</td>
<td>0.8</td>
<td>0</td>
<td>N</td>
</tr>
</tbody>
</table>
## A.2 Heating

Table 23. Measure Uptake - Heating

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Measure</th>
<th>Participant %</th>
<th>Control %</th>
<th>Difference</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS3, HS4</td>
<td>Heating system purchased, ENERGY STAR?</td>
<td>10%</td>
<td>9%</td>
<td>2%</td>
<td>N</td>
</tr>
<tr>
<td>HS10</td>
<td>Installed draft reducing measures</td>
<td>35%</td>
<td>35%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>HS11A</td>
<td>Installed ceiling insulation</td>
<td>11%</td>
<td>13%</td>
<td>-2%</td>
<td>N</td>
</tr>
<tr>
<td>HS11B</td>
<td>Installed wall insulation</td>
<td>10%</td>
<td>11%</td>
<td>-1%</td>
<td>N</td>
</tr>
<tr>
<td>HS11C</td>
<td>Installed ENERGY STAR windows</td>
<td>16%</td>
<td>17%</td>
<td>-2%</td>
<td>N</td>
</tr>
<tr>
<td>HS11D</td>
<td>Installed weather stripping or caulking</td>
<td>24%</td>
<td>25%</td>
<td>-1%</td>
<td>N</td>
</tr>
<tr>
<td>HS11E</td>
<td>Installed shades or curtains</td>
<td>18%</td>
<td>18%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td><strong>HS11F</strong></td>
<td>Installed plastic window coverings</td>
<td>9%</td>
<td>7%</td>
<td>2%</td>
<td>Y</td>
</tr>
<tr>
<td>HS11G</td>
<td>Installed insulated outlets</td>
<td>8%</td>
<td>10%</td>
<td>-1%</td>
<td>N</td>
</tr>
<tr>
<td>HS11H</td>
<td>Installed under-door draft reducers</td>
<td>19%</td>
<td>18%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>HS11I</td>
<td>Installed others</td>
<td>4%</td>
<td>4%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>HS13</td>
<td>Maintenance on heating system</td>
<td>60%</td>
<td>60%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>HS14A</td>
<td>Furnace tune up</td>
<td>42%</td>
<td>42%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>HS14B</td>
<td>Reset boiler water temperature</td>
<td>13%</td>
<td>11%</td>
<td>1%</td>
<td>N</td>
</tr>
<tr>
<td>HS14C</td>
<td>Sealed air ducts</td>
<td>10%</td>
<td>10%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>HS14D</td>
<td>Cleaned/replaced filters</td>
<td>51%</td>
<td>51%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>HS14E</td>
<td>Other heating maintenance</td>
<td>6%</td>
<td>5%</td>
<td>1%</td>
<td>N</td>
</tr>
</tbody>
</table>
### A.3 Cooling

**Table 24. Measure Uptake - Cooling**

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Measure</th>
<th>Participant %</th>
<th>Control %</th>
<th>Difference</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO2, CO3</td>
<td>CO2, CO3 Cooling system purchased, ENERGY STAR?</td>
<td>13%</td>
<td>15%</td>
<td>-2%</td>
<td>N</td>
</tr>
<tr>
<td>CO10</td>
<td>CO10 Central AC tuned</td>
<td>21%</td>
<td>19%</td>
<td>2%</td>
<td>N</td>
</tr>
<tr>
<td>CO11</td>
<td>CO11 Changes to heating/cooling</td>
<td>21%</td>
<td>21%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>CO12_1</td>
<td>CO12_1 New thermostat</td>
<td>2%</td>
<td>4%</td>
<td>-2%</td>
<td>Y</td>
</tr>
<tr>
<td>CO12_2</td>
<td>CO12_2 Changed settings</td>
<td>10%</td>
<td>10%</td>
<td>1%</td>
<td>N</td>
</tr>
<tr>
<td>CO12_3</td>
<td>CO12_3 New EE purchase</td>
<td>2%</td>
<td>2%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>CO12_4</td>
<td>CO12_4 Changed habits</td>
<td>5%</td>
<td>4%</td>
<td>1%</td>
<td>N</td>
</tr>
<tr>
<td>CO12_5</td>
<td>CO12_5 Supplemental heat/cool</td>
<td>1%</td>
<td>1%</td>
<td>-1%</td>
<td>N</td>
</tr>
<tr>
<td>CO12_6</td>
<td>CO12_6 Number of people in home changed</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>CO13A</td>
<td>CO13A Constant thermostat temperature</td>
<td>57%</td>
<td>63%</td>
<td>-6%</td>
<td>Y</td>
</tr>
<tr>
<td>CO13B</td>
<td>CO13B Adjust thermostat for comfort</td>
<td>49%</td>
<td>52%</td>
<td>-3%</td>
<td>N</td>
</tr>
<tr>
<td>CO13C</td>
<td>CO13C Use space heaters</td>
<td>17%</td>
<td>17%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>CO13D</td>
<td>CO13D Use fans, not AC</td>
<td>63%</td>
<td>62%</td>
<td>2%</td>
<td>N</td>
</tr>
<tr>
<td>CO13E</td>
<td>CO13E Open windows, not AC</td>
<td>80%</td>
<td>80%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>CO13F</td>
<td>CO13F Heat less at night</td>
<td>73%</td>
<td>69%</td>
<td>4%</td>
<td>Y</td>
</tr>
<tr>
<td>CO13G</td>
<td>CO13G Cool less at night</td>
<td>53%</td>
<td>51%</td>
<td>2%</td>
<td>N</td>
</tr>
<tr>
<td>CO13H</td>
<td>CO13H Heat less when not home</td>
<td>66%</td>
<td>63%</td>
<td>3%</td>
<td>N</td>
</tr>
<tr>
<td>CO13I</td>
<td>CO13I Cool less when not home</td>
<td>60%</td>
<td>58%</td>
<td>2%</td>
<td>N</td>
</tr>
<tr>
<td>CO13J</td>
<td>CO13J Other heat related changes</td>
<td>7%</td>
<td>5%</td>
<td>2%</td>
<td>N</td>
</tr>
<tr>
<td>CO13J_1</td>
<td>CO13J_1 Use fireplace</td>
<td>2.7%</td>
<td>1.3%</td>
<td>1%</td>
<td>Y</td>
</tr>
<tr>
<td>CO13J_2</td>
<td>CO13J_2 Supplemental heat</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>N</td>
</tr>
<tr>
<td>CO13J_6</td>
<td>CO13J_6 Use fans</td>
<td>0%</td>
<td>0.4%</td>
<td>-0.4%</td>
<td>Y</td>
</tr>
<tr>
<td>CO13J_20</td>
<td>CO13J_20 Programmable thermostat</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
<td>Y</td>
</tr>
<tr>
<td>CO13J_21</td>
<td>CO13J_21 Adjust settings</td>
<td>0%</td>
<td>1%</td>
<td>-1%</td>
<td>Y</td>
</tr>
<tr>
<td>CO13J_22</td>
<td>CO13J_22 Window coverings</td>
<td>0%</td>
<td>0.2%</td>
<td>-0.2%</td>
<td>Y</td>
</tr>
<tr>
<td>CO13J_23</td>
<td>CO13J_23 Energy efficient habits</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>CO13K</td>
<td>CO13K Other cool related changes</td>
<td>3%</td>
<td>3%</td>
<td>0%</td>
<td>N</td>
</tr>
</tbody>
</table>
Table 25. Measure Number - Cooling

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Measure</th>
<th>Participant Mean</th>
<th>Control Mean</th>
<th>Difference</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO14</td>
<td>Temperature thermostat set in winter</td>
<td>68.3</td>
<td>68.9</td>
<td>-0.6</td>
<td>Y</td>
</tr>
<tr>
<td>CO15</td>
<td>Temperature thermostat set in summer</td>
<td>73.0</td>
<td>72.7</td>
<td>-0.3</td>
<td>N</td>
</tr>
</tbody>
</table>

A.4 Water Heating

Table 26. Measure Uptake – Water Heating

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Measure</th>
<th>Participant %</th>
<th>Control %</th>
<th>Difference</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>WH2, WH3</td>
<td>Water heater purchased, ENERGY STAR?</td>
<td>14%</td>
<td>13%</td>
<td>1%</td>
<td>N</td>
</tr>
<tr>
<td>WH11</td>
<td>Water heater maintenance</td>
<td>15%</td>
<td>13%</td>
<td>2%</td>
<td>N</td>
</tr>
<tr>
<td>WH12</td>
<td>Installed insulating blanket</td>
<td>6%</td>
<td>5%</td>
<td>1%</td>
<td>N</td>
</tr>
<tr>
<td>WH13</td>
<td>Added pipe insulation</td>
<td>11%</td>
<td>13%</td>
<td>-2%</td>
<td>N</td>
</tr>
<tr>
<td>WH14</td>
<td>Installed low flow showerhead</td>
<td>27%</td>
<td>29%</td>
<td>-2%</td>
<td>N</td>
</tr>
<tr>
<td>WH15</td>
<td>Installed low flow shower head on secondary</td>
<td>15%</td>
<td>18%</td>
<td>-3%</td>
<td>N</td>
</tr>
<tr>
<td>WH16</td>
<td>Installed low flow faucet aerator</td>
<td>10%</td>
<td>12%</td>
<td>-2%</td>
<td>N</td>
</tr>
<tr>
<td>WH18</td>
<td>Lowered water heater temperature</td>
<td>19%</td>
<td>20%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>WH19</td>
<td>Lower water heater temp when away</td>
<td>23%</td>
<td>22%</td>
<td>1%</td>
<td>N</td>
</tr>
<tr>
<td>WH23</td>
<td>Washing machine ENERGY STAR?</td>
<td>19%</td>
<td>20%</td>
<td>-1%</td>
<td>N</td>
</tr>
<tr>
<td>WH25</td>
<td>Change washing machine use</td>
<td>24%</td>
<td>22%</td>
<td>2%</td>
<td>N</td>
</tr>
<tr>
<td>WH26_1</td>
<td>More loads per week</td>
<td>5%</td>
<td>5%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>WH26_2</td>
<td>Fewer loads per week</td>
<td>12%</td>
<td>10%</td>
<td>2%</td>
<td>N</td>
</tr>
<tr>
<td>WH26_3</td>
<td>Cold water more often</td>
<td>17%</td>
<td>14%</td>
<td>3%</td>
<td>Y</td>
</tr>
<tr>
<td>WH26_4</td>
<td>Hot water more often</td>
<td>3%</td>
<td>3%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>WH26_5</td>
<td>Avoid using rinse hold</td>
<td>6%</td>
<td>4%</td>
<td>2%</td>
<td>N</td>
</tr>
<tr>
<td>WH26_6</td>
<td>Use dryer less often</td>
<td>9%</td>
<td>8%</td>
<td>1%</td>
<td>N</td>
</tr>
<tr>
<td>WH26_7</td>
<td>Use dryer more often</td>
<td>3%</td>
<td>2%</td>
<td>1%</td>
<td>N</td>
</tr>
<tr>
<td>WH26_95</td>
<td>Other clothes washing changes</td>
<td>0%</td>
<td>1%</td>
<td>-1%</td>
<td>Y</td>
</tr>
<tr>
<td>WH32</td>
<td>Purchased non ENERGY STAR dishwasher</td>
<td>13%</td>
<td>12%</td>
<td>1%</td>
<td>N</td>
</tr>
<tr>
<td>WH32,WH33</td>
<td>Purchased ENERGY STAR dishwasher</td>
<td>13%</td>
<td>11%</td>
<td>2%</td>
<td>N</td>
</tr>
<tr>
<td>WH34</td>
<td>Changed dishwasher use</td>
<td>14%</td>
<td>15%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>WH35_1</td>
<td>Fewer dishwasher loads</td>
<td>9%</td>
<td>10%</td>
<td>-1%</td>
<td>N</td>
</tr>
<tr>
<td>WH35_2</td>
<td>More dishwasher loads</td>
<td>3%</td>
<td>1%</td>
<td>1%</td>
<td>N</td>
</tr>
<tr>
<td>WH35_3</td>
<td>Air dry dishes more</td>
<td>2%</td>
<td>3%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>WH35_95</td>
<td>Other dishwashing changes</td>
<td>2%</td>
<td>2%</td>
<td>0%</td>
<td>N</td>
</tr>
</tbody>
</table>
Table 27. Measure Number – Water Heating

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Measure</th>
<th>Participant Mean</th>
<th>Control Mean</th>
<th>Difference</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>WH14/WH15</td>
<td>Low flow showerheads installed</td>
<td>0.5</td>
<td>0.6</td>
<td>-0.1</td>
<td>Y</td>
</tr>
<tr>
<td>WH17</td>
<td>Low flow faucet aerators installed</td>
<td>0.2</td>
<td>0.2</td>
<td>0</td>
<td>N</td>
</tr>
</tbody>
</table>
## A.5 Electronics

### Table 28. Measure Uptake - Electronics

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Measure</th>
<th>Participant %</th>
<th>Control %</th>
<th>Difference</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP1</td>
<td>Installed refrigerator(s)</td>
<td>17</td>
<td>18</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>AP2</td>
<td>ENERGY STAR?</td>
<td>16</td>
<td>16</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>AP12, AP13</td>
<td>Purchased ENERGY STAR freezer</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>AP13</td>
<td>Purchased Non ENERGY STAR freezer</td>
<td>5</td>
<td>5</td>
<td>-1</td>
<td>N</td>
</tr>
<tr>
<td>EL2</td>
<td>Installed TV</td>
<td>41</td>
<td>43</td>
<td>-1</td>
<td>N</td>
</tr>
<tr>
<td>EL7</td>
<td>TV ENERGY STAR</td>
<td>32</td>
<td>35</td>
<td>-3</td>
<td>N</td>
</tr>
<tr>
<td>EL11</td>
<td>Discarded TVs</td>
<td>31</td>
<td>32</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL31</td>
<td>Changed TV viewing behavior</td>
<td>13</td>
<td>15</td>
<td>-2</td>
<td>N</td>
</tr>
<tr>
<td>EL32A</td>
<td>Increased main TV watching</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL32A</td>
<td>Decreased main TV watching</td>
<td>6</td>
<td>7</td>
<td>-1</td>
<td>N</td>
</tr>
<tr>
<td>EL32B</td>
<td>Increased secondary TV watching</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL32B</td>
<td>Decreased secondary TV watching</td>
<td>6</td>
<td>5</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL32C</td>
<td>Turn off TV more when not watching</td>
<td>8</td>
<td>8</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL32C</td>
<td>Turn off TV less when not watching</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL32D</td>
<td>Use smart strips or unplug (TV) more</td>
<td>3</td>
<td>4</td>
<td>-1</td>
<td>N</td>
</tr>
<tr>
<td><strong>EL32D</strong></td>
<td><strong>Use smart strips or unplug (TV) less</strong></td>
<td><strong>0.5%</strong></td>
<td><strong>1.4%</strong></td>
<td><strong>-0.9%</strong></td>
<td><strong>Y</strong></td>
</tr>
<tr>
<td>EL32E</td>
<td>Set TV on standby more</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL32E</td>
<td>Set TV on standby less</td>
<td>1</td>
<td>2</td>
<td>-1</td>
<td>N</td>
</tr>
<tr>
<td>EL53</td>
<td>Changed computer use</td>
<td>19</td>
<td>19</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL54A</td>
<td>Increased desktop computer use</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL54A</td>
<td>Decreased desktop computer use</td>
<td>10</td>
<td>9</td>
<td>1</td>
<td>N</td>
</tr>
<tr>
<td>EL54B</td>
<td>Increased laptop computer use</td>
<td>9</td>
<td>9</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL54B</td>
<td>Decreased laptop computer use</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>N</td>
</tr>
<tr>
<td>EL54C</td>
<td>Increased tablet use</td>
<td>9</td>
<td>8</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL54C</td>
<td>Decreased tablet use</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>N</td>
</tr>
<tr>
<td>EL54D</td>
<td>Turn off computer when not using more often</td>
<td>9</td>
<td>9</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL54D</td>
<td>Turn off computer when not using less often</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>N</td>
</tr>
<tr>
<td>EL54E</td>
<td>Use smart power strips or unplug (comp) more</td>
<td>7</td>
<td>6</td>
<td>1</td>
<td>N</td>
</tr>
<tr>
<td>EL54E</td>
<td>Use smart power strips or unplug (comp) less</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>N</td>
</tr>
<tr>
<td>EL54F</td>
<td>Set computer on standby more often</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>N</td>
</tr>
<tr>
<td>EL54F</td>
<td>Set computer on standby less often</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL63</td>
<td>Plug in devices changed</td>
<td>20</td>
<td>18</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>Survey Question</td>
<td>Measure</td>
<td>Participant %</td>
<td>Control %</td>
<td>Difference</td>
<td>Significant?</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------</td>
<td>---------------</td>
<td>-----------</td>
<td>------------</td>
<td>--------------</td>
</tr>
<tr>
<td>EL64</td>
<td>Increased plug in devices</td>
<td>18%</td>
<td>15%</td>
<td>2%</td>
<td>N</td>
</tr>
<tr>
<td>EL64</td>
<td>Decreased plug in devices</td>
<td>2%</td>
<td>2%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>EL67</td>
<td>Change in plug in device use</td>
<td>10%</td>
<td>10%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>EL68_1</td>
<td>Increased usage</td>
<td>5%</td>
<td>5%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>EL68_2</td>
<td>Decreased usage</td>
<td>2%</td>
<td>1%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>EL68_3</td>
<td>Added more devices</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>EL68_4</td>
<td>Unplug devices when not in use</td>
<td>1%</td>
<td>2%</td>
<td>-1%</td>
<td>N</td>
</tr>
<tr>
<td>EL68_5</td>
<td>Use more rechargeable batteries</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>EL68_6</td>
<td>Charge plug in elsewhere</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>EL68_7</td>
<td>Turn off devices</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>N</td>
</tr>
<tr>
<td>EL68_8</td>
<td>Energy efficient habits</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>N</td>
</tr>
</tbody>
</table>
### Table 29. Measure Number - Electronics

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Measure</th>
<th>Participant Mean</th>
<th>Control Mean</th>
<th>Difference</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP17</td>
<td>Refrigerators recycled</td>
<td>1.2</td>
<td>1.2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>AP18</td>
<td>Freezers recycled</td>
<td>1.0</td>
<td>1.1</td>
<td>-0.1</td>
<td>N</td>
</tr>
<tr>
<td>EL3</td>
<td>TVs purchased</td>
<td>1.5</td>
<td>1.6</td>
<td>-0.1</td>
<td>N</td>
</tr>
<tr>
<td>EL12</td>
<td>TVs Discarded</td>
<td>1.7</td>
<td>1.6</td>
<td>0.1</td>
<td>N</td>
</tr>
<tr>
<td><strong>EL3, EL12</strong></td>
<td><strong>TV Deltas</strong></td>
<td><strong>-0.1</strong></td>
<td><strong>0.1</strong></td>
<td><strong>-0.2</strong></td>
<td><strong>Y</strong></td>
</tr>
<tr>
<td>EL41A</td>
<td>DVRs purchased</td>
<td>0.2</td>
<td>0.2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL42A</td>
<td>DVRs discarded</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL41A, EL42A</td>
<td>DVR Deltas</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL41B</td>
<td>DVD players purchased</td>
<td>0.3</td>
<td>0.2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL42B</td>
<td>DVD players discarded</td>
<td>0.2</td>
<td>0.2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL41B, EL42B</td>
<td>DVD player Deltas</td>
<td>0.1</td>
<td>0</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL41C</td>
<td>Game consoles purchased</td>
<td>0.3</td>
<td>0.2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL42C</td>
<td>Game consoles discarded</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL41C, EL42C</td>
<td>Game console Deltas</td>
<td>0.2</td>
<td>0.2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL51A</td>
<td>Desktop computers purchased</td>
<td>0.2</td>
<td>0.2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL52A</td>
<td>Desktop computers discarded</td>
<td>0.3</td>
<td>0.3</td>
<td>0</td>
<td>N</td>
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<tr>
<td>EL51A, EL52A</td>
<td>Desktop computers deltas</td>
<td>-0.1</td>
<td>-0.1</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL51B</td>
<td>Laptop computers purchased</td>
<td>0.5</td>
<td>0.4</td>
<td>0.1</td>
<td>N</td>
</tr>
<tr>
<td>EL52B</td>
<td>Laptop computers discarded</td>
<td>0.2</td>
<td>0.2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL51B, EL52B</td>
<td>Laptop computers deltas</td>
<td>0.3</td>
<td>0.3</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL51C</td>
<td>Tablets purchased</td>
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<td>0.4</td>
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<td>N</td>
</tr>
<tr>
<td>EL52C</td>
<td>Tablets discarded</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL51C, EL52C</td>
<td>Tablets deltas</td>
<td>0.4</td>
<td>0.4</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL51D</td>
<td>Printers purchased</td>
<td>0.3</td>
<td>0.3</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL52D</td>
<td>Printers discarded</td>
<td>0.2</td>
<td>0.3</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL51D, EL52D</td>
<td>Printers deltas</td>
<td>0.1</td>
<td>0</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL51E</td>
<td>Monitors purchased</td>
<td>0.1</td>
<td>0.2</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td><strong>EL52E</strong></td>
<td><strong>Monitors discarded</strong></td>
<td><strong>0.23</strong></td>
<td><strong>0.17</strong></td>
<td><strong>0.06</strong></td>
<td><strong>Y</strong></td>
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<tr>
<td>EL51E, EL52E</td>
<td>Monitors deltas</td>
<td>0</td>
<td>-0.1</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL51F</td>
<td>Routers purchased</td>
<td>0.3</td>
<td>0.3</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL52F</td>
<td>Routers discarded</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL51F, EL52F</td>
<td>Routers deltas</td>
<td>0.2</td>
<td>0.1</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL61</td>
<td>Cell phones purchased</td>
<td>1</td>
<td>1.1</td>
<td>0.1</td>
<td>N</td>
</tr>
<tr>
<td>EL62</td>
<td>Cell phones discarded</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>N</td>
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<tr>
<td>EL61, EL62</td>
<td>Cell phones deltas</td>
<td>0</td>
<td>0.1</td>
<td>-0.1</td>
<td>N</td>
</tr>
<tr>
<td>Survey Question</td>
<td>Measure</td>
<td>Participant Mean</td>
<td>Control Mean</td>
<td>Difference</td>
<td>Significant?</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------</td>
<td>------------------</td>
<td>--------------</td>
<td>------------</td>
<td>--------------</td>
</tr>
<tr>
<td>EL65</td>
<td>Plug in devices added</td>
<td>3.3</td>
<td>3.3</td>
<td>0</td>
<td>N</td>
</tr>
<tr>
<td>EL66</td>
<td>Plug in devices discarded</td>
<td>2.1</td>
<td>2.0</td>
<td>0</td>
<td>N</td>
</tr>
</tbody>
</table>
B. Survey Instrument

B.1 National Grid OPower CATI

**SCREENER**

INTRO. Hello, my name is ________ and I am calling from Discovery Research Group on behalf of National Grid, your utility service provider. This is NOT a sales call. May I please speak with a person familiar with your energy bills and household energy use such as lighting and heating?

[IF RESPONDENT]
Discovery Research Group is conducting research of National Grid customers and we would like to ask you some questions related to your household’s energy use. National Grid is interested in what you have to say in order to improve programs offered to residential customers. We estimate that this interview will take around **20-30 minutes**.

[IF REQUIRED]
Your responses will be kept completely confidential and only be reported in the aggregate. This call may be recorded or monitored for quality purposes. To confirm the legitimacy of this study, you can call National Grid at 1.800.642.4272 or go to NationalGrid.com and choose 'Customer Support' then 'Contact Us'.

-----CELLPHONE SCREEN – ASK ALL-------------------------------------

CELL1. Before we begin, are you driving a vehicle or doing something that requires your attention?
[INTERVIEWER: IF RESPONDENT SAYS YES, READ] Due to safety reasons we will need to call you back at a more convenient time. Thank you very much.
01 [YES] [SET AS SOFT CALLBACK]
02 [NO] [GOTO PS1]
96 [Refused] [TERMINATE]
97 [Don’t know] [TERMINATE]

-----POPULATION SCREENING – ASK ALL---------------------------------

PS1. I am calling about [READ CUSTOMER ADDRESS]. Do you live at this address?
01 [YES]
02 [NO ] [TERMINATE, INELIGIBLE]
96 [Refused] [TERMINATE]
97 [Don’t know] [TERMINATE]
[THANK & TERMINATE SCRIPT]: Those are all the questions I have for you today. Thank you very much for your time.

D1. I would like to begin with a few basic questions on your home. Approximately what year was your home built? Would you say it was… [READ OPTIONS. CHOOSE ONE]
  01 before 1980
  02 between 1980 and 2006
  03 2007 OR LATER
  96 [Refused]
  97 [Don’t know]

D2. What is the approximate finished square footage of your home? Your best estimate is fine. [DO NOT READ]
  01 [LESS THAN 1,200 SQUARE FEET]
  02 [1,200 TO 1,799 SQUARE FEET]
  03 [1,800 TO 2,399 SQUARE FEET]
  04 [2,400 TO 2,999 SQUARE FEET]
  05 [3,000 SQUARE FEET OR MORE]
  96 [Refused]
  97 [Don’t know]

[Current Heating System] 

HS1. Now I have some questions about your home’s heating system. What type of heating system does your home currently have?
  [READ UNBRACKETED OPTIONS]
  01 Furnace [GOTO HS2]
  02 Boiler [GOTO HS2]
  03 Heat pump or air source heat pump [GOTO HS3]
  04 Geothermal or ground source heat pump [GOTO HS3]
  95 Or something else (Specify) [GOTO HS2]
  96 [REFUSED] [GOTO CO0]
  97 [Don’t know] [GOTO CO0]

HS2. What type of fuel does it use? Is it...
  [READ OPTIONS]
  01 Natural gas
  02 Electricity
  95 or something else?
  96 [REFUSED]
  97 [Don’t know]

HS3. Does your current heating system have an ENERGY STAR label? [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word.]
  01 [Yes]
  02 [No]
  96 [REFUSED]
Throughout this interview, I’m going to ask you about things that you did between April 1st 2011 and March 31st 2012. Instead of repeating those dates over and over, I am going to refer to that as the “study period.”

[NOTE TO CALLER – THROUGHOUT THE REST OF THE INTERVIEW, REPEAT “April 2011 to March 2012” AS NECESSARY.]

HS4. Did you purchase your current heating system during the study period?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>[Yes]</td>
</tr>
<tr>
<td>02</td>
<td>[No]</td>
</tr>
<tr>
<td>96</td>
<td>[Refused]</td>
</tr>
<tr>
<td>97</td>
<td>[Don’t know]</td>
</tr>
</tbody>
</table>

[Current Cooling System---------------------------------------------------------------]

CO0. Now I have a few questions about your home’s cooling system. Does your home have an air conditioner or cooling system?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Yes</td>
</tr>
<tr>
<td>02</td>
<td>No [GOTO WH0]</td>
</tr>
<tr>
<td>96</td>
<td>[Refused] [GOTO WH0]</td>
</tr>
<tr>
<td>97</td>
<td>[Don’t know] [GOTO WH0]</td>
</tr>
</tbody>
</table>

CO1. What is your main cooling system? Is it a…

[READ OPTIONS, PICK ONE]

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>A central air conditioner,</td>
</tr>
<tr>
<td>02</td>
<td>one or more room air conditioners</td>
</tr>
<tr>
<td>03</td>
<td>an air source heat pump, [OR “HEAT PUMP” OR “REGULAR HEAT PUMP”]</td>
</tr>
<tr>
<td>04</td>
<td>a geothermal heat pump,</td>
</tr>
<tr>
<td>95</td>
<td>or something else? [SPECIFY]</td>
</tr>
<tr>
<td>96</td>
<td>[Refused]</td>
</tr>
<tr>
<td>97</td>
<td>[Don’t know]</td>
</tr>
</tbody>
</table>

CO2. Does it have an ENERGY STAR label? [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word]

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Yes</td>
</tr>
<tr>
<td>02</td>
<td>No</td>
</tr>
<tr>
<td>96</td>
<td>[Refused]</td>
</tr>
<tr>
<td>97</td>
<td>[Don’t know]</td>
</tr>
</tbody>
</table>

CO3. Did you purchase your current cooling system during the study period?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>[Yes]</td>
</tr>
<tr>
<td>02</td>
<td>[No]</td>
</tr>
<tr>
<td>96</td>
<td>[Refused]</td>
</tr>
<tr>
<td>97</td>
<td>[Don’t know]</td>
</tr>
</tbody>
</table>
WH0. Next I have some questions about your water heater. What type of water heater do you have? Is it a...
  
  [READ OPTIONS, PICK ONE]
  01 storage tank water heater, [ALSO ACCEPT “REGULAR WATER HEATER”]
  02 a tankless or on-demand water heater,
  03 a heat pump water heater [GOTO WH2]
  04 a solar water heater, or [GOTO WH2]
  95 something else [SPECIFY _______] [GOTO L10]
  96 [Refused] [GOTO L10]
  97 [Don’t know] [GOTO L10]

WH1. What kind of fuel does it use?
  01 Natural gas.
  02 Electricity,
  95 or Something else
  96 [Refused]
  97 [Don’t know]

WH2. Does your current water heater have an ENERGY STAR label? [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word]
  01 Yes
  02 No
  96 [Refused]
  97 [Don’t know]

X2. Just to remind you, when I say “study period” I mean between April 1st, 2011 and March 31st, 2012.

WH3. Did you purchase your current water heater during the study period?
  01 [Yes]
  02 [No]
  96 [Refused]
  97 [Don’t know]

**LIGHTING**

LI0. Now I have some questions about lighting purchases. Did you or anyone in your household purchase any of the following lighting products during the study period? [REPEAT AS NECESSARY FOR B THROUGH D BELOW]

A. Compact fluorescent bulbs (also called CFLs) that fit in regular light sockets. These are the spiral or curly bulbs.
B. Compact fluorescent flood lights, chandelier bulbs, bathroom globes, or other special use CFL bulbs.
C. LED bulbs. These bulbs are pretty new on the market. They usually have a lot of little fins around the sides of the bulb.
D. Incandescent bulbs. These are the regular bulbs that have been available for a really long time.

01 [Yes]
02 [No]
96 [Refused]
97 [Don’t know]

[IF ALL 3 of LI0_A, LI0_B, LI0_C = some combination of DK, Ref, No then GOTO LI31]

----REGULAR CFL SUBSECTION---------------------------------------------------------------

[IF LI0_A = 1 (PURCHASED REGULAR CFLS) THEN READ LI1 TO LI5; ELSE GOTO INSTRUCTIONS BEFORE LI11]

LI1. You said that you purchased some regular compact fluorescent bulbs during the study period. How many regular CFL bulbs did you purchase in that time frame? Your best guess is fine.
01 [RECORD VERBATIM]
96 [Refused] [GOTO LI11]
97 [Don’t know] [GOTO LI11]

LI2. What was the total price of the <LI1> bulbs?
01 [RECORD VERBATIM]
96 [Refused] [GOTO LI4]
97 [Don’t know] [GOTO LI4]

LI3. So that works out to about <LI2 ÷ LI1> per bulb. Does that sound correct?
01 [Yes]
02 [No] [GOTO LI2. NOTE TO PROGRAMMER – ONLY LOOP ONCE ON 2nd TIME, GO TO LI4]
96 [Refused]
97 [Don’t know]

LI4. About how many of those <LI1 response> bulbs are currently installed in your home? [IF NECESSARY: Your best guess is fine.]
01 [RECORD VERBATIM]
02 [Zero (0)] [GOTO LI11]
96 [Refused] [GOTO LI11]
97 [Don’t know] [GOTO LI11]

LI5. How many of the <LI4> installed CFL bulbs replaced regular incandescent bulbs? [IF NECESSARY: Your best guess is fine.]
01 [All]
02 [Some] [SPECIFY NUMBER]
03 [None]
LI11. You said before that you purchased some specialty compact fluorescent bulbs during the study period. How many did you purchase in that time frame? Your best guess is fine.

01 [RECORD VERBATIM]  
02 [ZERO (0)] [GOTO LI21]  
96 [Refused] [GOTO LI21]  
97 [Don’t know] [GOTO LI21]

LI12. What was the total price of the <LI11> bulbs?

01 [RECORD VERBATIM]  
96 [Refused] [GOTO LI14]  
97 [Don’t know] [GOTO LI14]

LI13. So that works out to about <LI12 ÷ LI11> per bulb. Does that sound correct?

01 [Yes]  
02 [No] [GOTO LI12. NOTE TO PROGRAMMER – ONLY LOOP ONCE ON 2nd TIME, GO TO LI14]  
96 [Refused]  
97 [Don’t know]

LI14. About how many of those <LI11 response> bulbs are currently installed in your home? [IF NECESSARY: Your best guess is fine.]

01 [RECORD VERBATIM]  
02 [Zero (0)] [GOTO LI21]  
96 [Refused] [GOTO LI21]  
97 [Don’t know] [GOTO LI21]

LI15. How many of the <LI14> specialty CFL bulbs replaced incandescent bulbs? [IF NECESSARY: Your best guess is fine.]

01 [All]  
02 [Some] [SPECIFY NUMBER]  
03 [None]  
96 [Refused]  
97 [Don’t know]
LED SUBSECTION

[IF LI0_C = 1 (PURCHASED LEDS) THEN READ LI21 TO LI25; ELSE GOTO LI31]

LI21. You said before that you purchased some LED bulbs during the study period. How many LED bulbs did you purchase in that time frame? Your best guess is fine.
   01 [RECORD VERBATIM]
   02 [ZERO (0)] [GOTO LI31]
   96 [Refused] [GOTO LI31]
   97 [Don’t know] [GOTO LI31]

LI22. What was the total price of the <LI21> bulbs?
   01 [RECORD VERBATIM]
   96 [Refused] [GOTO LI24]
   97 [Don’t know] [GOTO LI24]

LI23. So that works out to about <LI22 ÷ LI21> per bulb. Does that sound correct?
   01 [Yes]
   02 [No] [GOTO LI22. NOTE TO PROGRAMMER – ONLY LOOP ONCE ON 2nd TIME, GO TO LI24]
   96 [Refused]
   97 [Don’t know]

LI24. About how many of those <LI21 response> bulbs are currently installed in your home? [IF NECESSARY: Your best guess is fine.]
   01 [RECORD VERBATIM]
   02 [Zero (0)] [GOTO LI31]
   96 [Refused] [GOTO LI31]
   97 [Don’t know] [GOTO LI31]

LI25. How many of the <LI24> LED bulbs replaced incandescent bulbs? [IF NECESSARY: Your best guess is fine.]
   01 [All]
   02 [Some] [SPECIFY NUMBER]
   03 [None]
   96 [Refused]
   97 [Don’t know]
LI31. Since April 2011, have you made any changes to how your home uses lighting? This includes things like turning off lights more when they are not needed, or increasing the lighting levels in your home.

01 [Yes] [GOTO NEXT SECTION]
02 [No] [GOTO NEXT SECTION]
96 [Refused] [GOTO NEXT SECTION]
97 [Don’t know] [GOTO NEXT SECTION]

LI32. What changes have you made? [DO NOT READ LIST. ACCEPT MULTIPLE]

01 [Turn off lights more often]
02 [Use motion sensors or occupancy sensors to automatically turn lights on/off]
03 [Use more daylight]
04 [Use task lighting instead of lighting whole room]
05 [Increased lighting levels in home]
06 [Decrease use of holiday lights]
07 [Installed energy efficient lighting – SPECIFY]
95 [Other – SPECIFY]
96 [REFUSED]
97 [DON’T KNOW]
HEATING

[IF HS4 = 01 ASK HS5, ELSE GO TO HS10]

HS5. You mentioned earlier that your current heating system is pretty new. What kind of heating system did you replace? Was it a… [READ OPTIONS]

01 Furnace [GOTO HS6]
02 Boiler [GOTO HS6]
03 Heat pump or air source heat pump [GOTO HS7]
04 Geothermal or ground source heat pump [GOTO HS7]
95 Or something else (Specify) [GOTO HS6]
96 [REFUSED] [GOTO HS10]
97 [Don’t know] [GOTO HS10]

HS6. What type of fuel did the old one use? Was it...
[READ OPTIONS]

01 Natural gas
02 Electricity
95 or something else?
96 [REFUSED]
97 [Don’t know]

HS7. Did your old heating system have an ENERGY STAR label? [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word.]

01 [Yes]
02 [No]
96 [REFUSED]
97 [Don’t know]

HS8. Approximately how old was it? Your best guess is fine.

01 [RECORD RESPONSE]
96 [REFUSED]
97 [Don’t know]

[HS9 DELIBERATELY MISSING]

-----END OLD SYSTEM SUBSECTION------------------------------------------

-----PERIPHERAL SYSTEM SUBSECTION----------------------------------------

HS10. Now I have some questions about things that would affect your home’s heating and cooling. During the study period of April 1st, 2011 and March 31st, 2012, did you add insulation or do anything to reduce drafts in your home? This includes things like insulation upgrades, weather stripping on doors, caulking windows, and purchasing new windows.

01 [Yes]
02 [No] [GOTO HS13]
HS11. Which of the following was installed? [READ OPTIONS, ACCEPT MULTIPLE]
A. Attic or ceiling insulation
B. Wall insulation
C. Energy Star windows
D. Weather stripping or caulking around windows and/or doors
E. Window shades, window quilts, or heavy curtains
F. Plastic or cellophane window coverings
G. Insulated outlets or light switches
H. Under-door draft reducers
I. Anything else? [SPECIFY]

01 Yes
02 No
96 [REFUSED]
97 [Don’t know]

[IF HS11C = 01 (installed Energy Star Windows)]
HS12. What type of windows did you replace? Would you say… [READ OPTIONS]
01 Single pane
02 or Double pane
96 [REFUSED]
97 [Don’t know]

-----END PERIPHERAL SYSTEM SUBSECTION-------------------------------------

HS13. Since April 2011, has any maintenance been done on your home’s primary heating system? This includes things like professional tune-ups and changing filters
01 Yes
02 No [GOTO CO4 (COOLING)]
96 [REFUSED] [GOTO CO4 (COOLING)]
97 [Don’t know] [GOTO CO4 (COOLING)]

HS14. Which of the following did you do? [CHOOSE ALL THAT APPLY]
A. Furnace tune up
B. Reset boiler water temperature
C. Sealed air ducts
D. Cleaned or replaced air filters
E. Or something else (SPECIFY)

01 Yes
02 No
96 [REFUSED]
97 [Don’t know]
COOLING

[IF CO3 = 01 ASK CO4, ELSE GOTO CO10]

CO4. You mentioned earlier that you have a fairly new cooling system. Did this cooling system replace an old one?
   01 Yes
   02 No [GOTO CO10]
   96 [Refused] [GOTO CO10]
   97 [Don’t know] [GOTO CO10]

CO5. What was the old cooling system? Was it a…
[READ OPTIONS, SELECT ONE]
   01 A central air conditioner,
   02 one or more room air conditioners
   03 an air source heat pump, [ALSO TAKE “HEAT PUMP” OR “REGULAR HEAT PUMP”]
   04 a geothermal heat pump,
   95 or something else [SPECIFY]
   96 [Refused]
   97 [Don’t know]

CO6. Approximately how old was the old cooling system? Your best guess is fine.
   01 [RECORD RESPONSE]
   96 [Refused]
   97 [Don’t know]

CO7. Did your old cooling system have an energy star label? [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word]
   01 Yes
   02 No
   96 [Refused]
   97 [Don’t know]

---- OPERATIONS & MAINTENANCE SUBSECTION------------------------------------------

[CO8-CO9 DELIBERATELY MISSING]

[IF CO0 = 01 AND CO1 = 01 (central AC), ASK CO10, ELSE GOTO CO11]

CO10. Did your central AC system receive a tune-up during the study period?
   01 Yes
   02 No
   96 [Refused]
   97 [Don’t know]
CO11. Since April 2011 have you made any changes to how you use your heating and/or cooling system?

01 Yes [GOTO CO13]
02 No [GOTO CO13]
96 [Refused] [GOTO CO13]
97 [Don’t know] [GOTO CO13]

CO12. What did you change?

01 [RECORD RESPONSE]
96 [Refused]
97 [Don’t know]

CO13. Which of the following best describes your typical heating and/cooling behaviors?

[READ LIST, CHOOSE ALL THAT APPLY]:
A. Set thermostat to a constant temperature and usually leave it there
B. Turn thermostat up or down based on comfort
C. Use space heaters
D. Use fans instead of your main cooling system
E. Open the windows instead of running the main cooling system
F. Heat less overnight
G. Cool less overnight
H. Heat less during the day when nobody is home
I. Cool less during the day when nobody is home
J. Anything else heating related [SPECIFY OTHER HEATING BEHAVIOR]
K. Anything else cooling related [SPECIFY OTHER COOLING BEHAVIOR]

01 Yes
02 No
96 [Refused]
97 [Don’t know]

CO14. About what temperature do you set your thermostat to heat your home in the winter? [IF NECESSARY: Your best guess is fine.]

01 [RECORD VERBATIM]
96 [Refused]
97 [Don’t know]

[IF CO0 = 01 AND CO1 = 01 (central AC), ASK CO15, ELSE GOTO WH4]

CO15. About what temperature do you set your thermostat to in the summer? [IF NECESSARY: Your best guess is fine.]

01 [RECORD VERBATIM]
96 [Refused]
97 [Don’t know]
[IF WH3=1 ASK WH4, ELSE GOTO WH11]

WH4. You said earlier that you recently replaced your water heater. What type of water heater was the OLD one? Was it a...
[READ OPTIONS, PICK ONE]
01 storage tank water heater. [ALSO ACCEPT “REGULAR WATER HEATER”]
02 a tankless or on-demand water heater,
03 a heat pump water heater
04 a solar water heater, or
95 something else? [SPECIFY _______]
96 [Refused]
97 [Don’t know]

WH5. What fuel did the old water heater use? Was it...
[READ OPTIONS. PICK ONE]
01 Natural gas
02 Electricity,
95 or Something else (SPECIFY:____________)
96 [Refused]
97 [Don’t know]

WH6. Approximately how old was the water heater that you replaced (OPEN END, RECORD RESPONSE)?
[USE BRACKETING IF SAY DON’T KNOW] [INTERVIEWER NOTE: YOU CAN PROBE HERE WITH RANGES BEFORE ACCEPTING A DON’T KNOW RESPONSE]
01 [RECORD RESPONSE]
96 [Refused]
97 [Don’t know]

WH7. Did your old water heater have an ENERGY STAR label? [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word]
01 Yes
02 No
96 [Refused]
97 [Don’t know]

----- OPERATIONS & MAINTENANCE SUBSECTION---------------------------------------------------------------

[WH8 – WH10 DELIBERATELY MISSING]

WH11. Now I have some questions about things that would affect your home’s water heating. Did you or a professional do any maintenance on your water heater during the study period?
01 Yes
02 No
96 [Refused]
97 [Don’t know]
WH12. Did you or a professional install an insulating blanket over your water heater anytime during the study period?
01 Yes
02 No
96 [Refused]
97 [Don’t know]

WH13. Did you add insulation to your water pipes during the study period?
01 Yes
02 No
96 [Refused]
97 [Don’t know]

WH14. During the study period, did you install a low flow showerhead on your home’s primary shower?
[IF necessary: the shower that is used most often]
01 Yes
02 No
96 [Refused]
97 [Don’t know]

WH15. During the study period, how many of your home’s secondary showers did you install low flow showerheads on? (OPEN END, RECORD RESPONSE)
01 OPEN END (1-20)
02 Only installed it in the primary shower
03 We only have one shower
96 [Refused]
97 [Don’t know]

WH16. During the study period, did you install any low flow faucet aerators in your home?
01 Yes
02 No [GOTO WH18]
96 [Refused] [GOTO WH18]
97 [Don’t know] [GOTO WH18]

WH17. How many low flow faucet aerators did you install?
01 [RECORD # INSTALLED ]
96 [Refused]
97 [Don’t know]

WH18. Have you lowered the temperature on your water heater since April 2011?
01 Yes
02 No
96 [Refused]
97 [Don’t know]
WH19. Do you lower the temperature on your water heater when you are going to be away for more than a couple of days?
01 Yes
02 No
96 [Refused]
97 [Don’t know]

[WH20 DELIBERATELY MISSING]

WH21. Does your home have a clothes washing machine?
01 Yes
02 No [GOTO WH31]
96 [Refused] [GOTO WH31]
97 [Don’t know] [GOTO WH31]

WH22. Did you purchase this washing machine during the study period?
01 Yes
02 No [GOTO WH24]
96 [Refused] [GOTO WH24]
97 [Don’t know] [GOTO WH24]

WH23. Does it have an ENERGY STAR label? [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word]
01 Yes
02 No
96 [Refused]
97 [Don’t know]

WH24. What fuel does your clothes dryer use? [READ UNBRACKETED RESPONSES]
01 Electricity
02 Natural gas
03 Something else
04 [We don’t have a clothes dryer]
96 [REFUSED]
97 [DON’T KNOW]

WH25. Since April 2011, have you changed how you use your washing machine? This includes things like changing the number of loads you wash in a typical week or changing your temperature settings.
01 Yes
02 No [GOTO WH31]
96 [Refused] [GOTO WH31]
97 [Don’t know] [GOTO WH31]

WH26. I’m going to read a list of possible changes. Please tell me which, if any, you made.? [READ LIST. ACCEPT MULTIPLE]
01 Do more loads per week
02 Do fewer loads per week
03 Use cold water more often
04 Use hot or warm water more often
05 Avoid using rinse hold on washing machine
06 Use a clothes dryer less often
07 Use dryer more often
95 Or something else [SPECIFY]
96 [Refused]
97 [Don’t know]

[WH25 to WH30 DELIBERATELY MISSING]

WH31. Does your home have a dishwasher?
   01 Yes
   02 No [GOTO WH34]
   96 [Refused] [GOTO WH34]
   97 [Don’t know] [GOTO WH34]

WH32. Did you purchase this dishwasher during the study period?
   01 Yes
   02 No [GOTO WH34]
   96 [Refused] [GOTO WH34]
   97 [Don’t know] [GOTO WH34]

WH33. Does your new dishwasher have an ENERGY STAR label? [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word]
   01 Yes
   02 No
   96 [Refused]
   97 [Don’t know]

WH34. Since April 2011, have you changed how you use your dishwasher? This includes things like changing the number of loads you wash in a typical week or changing your drying settings.
   01 Yes
   02 No [GOTO AP1]
   96 [Refused] [GOTO AP1]
   97 [Don’t know] [GOTO AP1]

WH35. What changes did you make? [DO NOT READ. ACCEPT MULTIPLE]
   01 [Fewer loads / Wash by hand more]
   02 [More loads]
   03 [Air dry more]
   95 [Other – SPECIFY]
   96 [Refused]
   97 [Don’t know]
APPLIANCES & ELECTRONICS (ASK OR SKIP SECTION BASED ON MATRIX ON PAGE 1)

---- REFRIGERATOR SUBSECTION----------------------------------------------------------

AP1. Next I have some questions about refrigerators and freezers in your home. Did your household install any refrigerators during the study period?
01 Yes  
02 No  [GOTO AP11]  
96 [Refused]  [GOTO AP11]  
97 [Don’t know]  [GOTO AP11]

AP2. Does your new refrigerator have an ENERGY STAR label? [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word]
01 Yes  
02 No  
96 [Refused]  
97 [Don’t know]
AP3. Is your old refrigerator still plugged in and operating somewhere in your house?
   01 Yes [GOTO AP11]
   02 No [GOTO AP11]
   96 [Refused] [GOTO AP11]
   97 [Don’t know] [GOTO AP11]

AP4. How many years old was your previous refrigerator? [IF NECESSARY: Your best guess is fine.]
   01 [RECORD VERBATIM]
   96 [Refused]
   97 [Don’t know]

AP5. Did your old refrigerator have an ENERGY STAR label? [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word]
   01 Yes
   02 No
   96 [Refused]
   97 [Don’t know]

-----END REFRIGERATOR SUBSECTION----------------------------------------

[AP6 TO AP10 DELIBERATELY MISSING]

----- FREEZER SUBSECTION-------------------------------------------------

AP11. Do you have a standalone freezer?
   01 Yes
   02 No [GOTO AP17]
   96 [Refused] [GOTO AP17]
   97 [Don’t know] [GOTO AP17]

AP12. Does your standalone freezer have an ENERGY STAR label?
[READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word]
   01 Yes
   02 No
   96 [Refused]
   97 [Don’t know]

AP13. Did your household purchase and install any standalone freezers during the study period?
   01 Yes
   02 No [GOTO AP17]
   96 [Refused] [GOTO AP17]
   97 [Don’t know] [GOTO AP17]

AP14. Is your old freezer still plugged in and running somewhere in your house?
   01 Yes [GOTO AP17]
   02 No
AP15. How old was the old freezer? [IF NECESSARY: Your best guess is fine.]
   01 [RECORD VERBATIM]
   96 [Refused]
   97 [Don’t know]

AP16. Did your old freezer have an ENERGY STAR label? [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word]
   01 Yes
   02 No
   96 [Refused]
   97 [Don’t know]

-----END STANDALONE FREEZER SUBSECTION--------------------------

AP17. How many, if any, refrigerators did you recycle during the study period?
   00 None
   01 [RECORD NUMBER]
   96 [REFUSED]
   97 [Don’t Know]

AP18. How many, if any, standalone freezers did you recycle during the study period?
   00 None
   01 [RECORD NUMBER]
   96 [REFUSED]
   97 [Don’t Know]

[AP19 – AP20 DELIBERATELY MISSING]

ELECTRONICS SECTION

----- TELEVISION SUBSECTION--------------------------

EL1. The next section will be about electronics in your home. Do you currently own a television?
   01 Yes [GOTO EL2]
   02 No [GOTO EL11]
   96 [Refused] [GOTO EL11]
   97 [Don’t know] [GOTO EL11]

EL2. Did your household purchase and install a new television during the study period?
   01 Yes [GOTO EL3]
   02 No [GOTO EL11]
   96 [Refused] [GOTO EL11]
   97 [Don’t know] [GOTO EL11]
EL3. How many TVs did you buy?
   01 [RECORD VERBATIM]
   96 [Refused] [GOTO EL11]
   97 [Don’t know] [GOTO EL11]

EL4. [IF EL3 < 2 NEW TVs, GOTO EL5] I’m going to ask you a little more about the one you watch the most often.

EL5. What type is the new TV?
   [READ OPTIONS, CHOOSE ONE]
   01 LCD
   02 Plasma
   03 LED
   04 Projection
   05 Standard tube
   95 [OTHER-SPECIFY]
   96 [Refused]
   97 [Don’t know]

EL6. How large is the screen?
   [READ OPTIONS, CHOOSE ONE]
   01 Less than 21 inches
   02 21 to 36 inches
   03 greater than 37 inches
   96 [Refused]
   97 [Don’t know]

EL7. Does this television have an ENERGY STAR label?
   [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word]
   01 Yes
   02 No
   96 [Refused]
   97 [Don’t know]

[EL8 TO EL10 DELIBERATELY MISSING]

EL11. Did you discard any TVs between April 1, 2011 and March 31st, 2012?
   01 Yes
   02 No [GOTO EL31]
   96 [Refused] [GOTO EL31]
   97 [Don’t know] [GOTO EL31]

EL12. How many TVs did you discard?
   01 [RECORD VERBATIM]
   96 [Refused] [GOTO EL31]
   97 [Don’t know] [GOTO EL31]
EL13. [IF EL12 <2 OLD TVs, GOTO EL15] I’m going to ask you a little more about one of your discarded TV. Please tell me about the biggest one.

EL15. What type of TV was it?
   [READ OPTIONS. CHOOSE ONE]
   01 LCD
   02 Plasma
   03 LED
   04 Projection
   05 Standard tube
   95 [OTHER SPECIFY]
   96 [Refused]
   97 [Don’t know]

EL16. How large was the screen?
   [READ OPTIONS. CHOOSE ONE]
   01 Less than 21 inches
   02 21 to 36 inches
   03 greater than 37 inches
   96 [Refused]
   97 [Don’t know]

EL17. Did it have an ENERGY STAR label?
   [READ IF NECESSARY: The energy star label shows the word energy, written in script, with a star symbol at the end of the word]
   01 Yes
   02 No
   96 [Refused]
   97 [Don’t know]

[EL18 to EL30 DELIBERATELY MISSING]

EL31. Since April 2011 have you made any changes to your viewing behavior?
   01 Yes
   02 No [GOTO EL41]
   96 [Refused] [GOTO EL41]
   97 [Don’t know] [GOTO EL41]

EL32. Do you do each of the following more often, less often, or the same amount?
   [RANDOMIZE LIST, READ RESPONSE OPTIONS]

   A Watch or use your main TV
   B Watch or use secondary TVs
   C Turn off TV(s) when not actively watching
   D Use smart power strips, Switch off power strips, or unplug TV(s) when not in use
   E Set the TV(s) on a standby powersave mode timer

   01 [INCREASED / MORE OFTEN]
02 [DECREASED / LESS OFTEN]
03 [NO CHANGE / SAME AMOUNT / NOT APPLICABLE]
96 [Refused]
97 [Don’t know]

----- END TELEVISION SUBSECTION-----------------------------------------

[EL33 to EL40 DELIBERATELY MISSING]

----- DVR/DVD/GAMES SUBSECTION-----------------------------------------

EL41. Between April 1st, 2011 and March 31st, 2012, how many of each of the following did your household purchase?

A. DVRs or TIVOs
B. DVD players
C. Game Consoles (Xbox, Playstation, Wii, etc.)

01 [RECORD VERBATIM]
02 [NONE (0)]
96 [Refused]
97 [Don’t know]

EL42. Between April 1st, 2011 and March 31st, 2012, how many of each of the following did your household discard?

A. DVRs or TIVOs
B. DVD players
C. Game Consoles (Xbox, Playstation, Wii, etc.)

01 [RECORD VERBATIM]
02 [NONE (0)]
96 [Refused]
97 [Don’t know]

----- END DVR/DVD/CONSOLE SUBSECTION------------------------------------

[EL43 to EL50 DELIBERATELY MISSING]

----- CONSUMER ELECTRONICS SUBSECTION----------------------------------

EL51. Now I have some questions about computers and peripherals in your home. During the study period, how many of each of the following computer devices did your household purchase?
A. Desktops
B. Laptops
C. Tablets or iPads
D. Printers
E. Monitors
F. Routers or wireless routers

01 [RECORD VERBATIM]
02 [NONE (0)]
96 [Refused]
97 [Don’t know]

EL52. During the study period, how many of each of the following computer devices did your household discard or stop using?

A. Desktops
B. Laptops
C. Tablets or iPads
D. Printers
E. Monitors
F. Routers or wireless routers

01 [RECORD VERBATIM]
02 [NONE (0)]
96 [Refused]
97 [Don’t know]

EL53. Since April 2011, have you made any changes to your computer use?

01 Yes
02 No [GOTO EL61]
96 [Refused] [GOTO EL61]
97 [Don’t know] [GOTO EL61]

EL54. Do you do each of the following more often, less often, or the same amount?

[RANDOMIZE LIST, READ RESPONSE OPTIONS]

A Use a desktop computer
B Use a laptop computer
C Use a tablet or iPad
D Turn off computers when not actively using
E Use smart power strips, Switch off power strips, or unplug cords when not in use
F Set computers on a standby powersave mode timer

01 [INCREASED / MORE OFTEN]
02 [DECREASED / LESS OFTEN]
03 [NO CHANGE / SAME AMOUNT / NOT APPLICABLE]
96 [Refused]
EL61. During the study period, how many new cell phones did your household purchase?
   01 [RECORD VERBATIM]
   02 [NONE (0)]
   96 [Refused]
   97 [Don’t know]

EL62. During the study period, how many cell phones did your household discard or stop using?
   01 [RECORD VERBATIM]
   02 [NONE (0)]
   96 [Refused]
   97 [Don’t know]

EL63. Excluding TVs, computers, cell phones, and related equipment, has the total number of plug in or rechargeable devices in your home changed since April 2011?
   01 Yes
   02 No [GOTO EL67]
   96 [Refused] [GOTO EL67]
   97 [Don’t know] [GOTO EL67]

EL64. Has it increased or decreased?
   01 Increased [GOTO EL65]
   02 Decreased [GOTO EL66]
   03 Stayed the Same [GOTO EL67]
   96 [REFUSED] [GOTO EL67]
   97 [Don’t know] [GOTO EL67]

EL65. How many devices did you add? Your best guess is fine.
   01 [RECORD VERBATIM] [GOTO EL67]
   02 [NONE (0)] [GOTO EL67]
   96 [Refused] [GOTO EL67]
   97 [Don’t know] [GOTO EL67]

EL66. How many devices did you discard? Your best guess is fine.
   01 [RECORD VERBATIM]
   02 [NONE (0)]
   96 [Refused]
   97 [Don’t know]
EL67. Regardless of any changes to the number of plug in or rechargeable devices in your home, have you made any changes to the way you use those devices, since April 2011? [IF NECESSARY: Still excluding TVs, computers, and cell phones.]

01 Yes  [GOTO M1]
02 No    [GOTO M1]
96 [Refused] [GOTO M1]
97 [Don’t know] [GOTO M1]

EL68. What changes have you made?

01 [RECORD VERBATIM]
02 [NONE (0)]
96 [Refused]
97 [Don’t know]

---- END CONSUMER ELECTRONICS SUBSECTION-----------------------------------------------

HER REPORT USE

[IF STRATA = TX GRP READ M1, ELSE SKIP TO D3]

M1. Does your household receive a Home Energy Report from NATIONAL GRID about your in-home energy use?

01 Yes  [GOTO M3]
02 No    [GOTO M2]
96 [Refused] [GOTO D3]
97 [Don’t know] [GOTO M2]

M2. The Home Energy Report is sent by NATIONAL GRID, separate from your bill. It breaks down your energy use and your neighbors’ energy use and highlights tips about saving energy. Do you recall receiving the Home Energy Reports?

01 Yes 
02 No    [GOTO D3]
96 [Refused] [GOTO D3]
97 [Don’t know] [GOTO D3]

M3. How frequently do you receive these reports? [READ]

01 Monthly
02 Every other month
03 Quarterly, or
04 Annually?
96 [Refused] [GOTO D3]
97 [Don’t know]

M4. Did you or someone else in your household read the reports?

01 YES
M5. Would you say that someone in your household read . . . [READ]?
01 some of the reports,
02 most of the reports,
03 or every Home Energy Report that you received?
96 [Refused] [GOTO D3]
97 [Don’t know] [GOTO D3]

M6. About how much time did you or someone else in your household spend reading each report?
[READ] [DO NOT ACCEPT MULTIPLE REPLIES]
01 One to three minutes,
02 Four to ten minutes, or
03 More than 10 minutes
96 [Refused] [GOTO D3]
97 [Don’t know]

M7. On a scale of 1 to 5, where 1 is “not at all useful” and 5 is “very useful,” how useful have you found the Home Energy Reports?
01 not at all useful
02
03
04
05 very useful
96 [Refused]
97 [Don’t know]

M8. Now I’m going to ask you about how useful each of the components of the Home Energy Report is. First/Next is the <INSERT COMPONENT HERE>. Is it…[READ]?
A Last 2 Months Overall Usage Comparisons to your neighbors’ energy use
B Last 12 Months Comparison to Neighbors for Gas and Electricity
C Comparison to your Household’s Usage the Year Before
D Action Step – Tips to Save Energy
E Recommendations For Energy Efficient Purchases

01 Not at all useful
02 Somewhat useful
03 Very useful
96 [Refused]
97 [Don’t know]

M9. Did any of the energy saving tips in the Home Energy Report influence you to adopt new energy saving habits?
01 Yes
M10. What new habits did you adopt due to the home energy reports?
01 [RECORD VERBATIM]
02 [NONE (0)]
96 [Refused]
97 [Don’t know]

M11. Did the Home Energy Reports influence your purchases of energy using equipment?
01 Yes
02 No [GOTO D3]
96 [Refused] [GOTO D3]
97 [Don’t know]

M12. What equipment purchases did the reports influence? Any others?
01 [RECORD VERBATIM]
96 [Refused]
97 [Don’t know]

DEMOGRAPHICS (ASK ALL)

[READ]: I have few final questions about your household. We’re almost done.

D3. Which of the following best describes the type of home you live in? Is it a… [READ]
01 Single family, detached,
02 Single family attached, such as town house or row house,
03 Apartment in multi-unit structure of 2–4 units,
04 Apartment in multi-unit structure of 5 or more units, or
05 Mobile Home?
96 [Refused]
97 [Don’t know]

D4. Do you own or rent your home?
01 OWN
02 RENT
96 [Refused]
97 [Don’t know]

D5. How many years have you lived in your current home?
01 [RECORD VERBATIM; IF <1 YEAR, RECORD 0]
96 [Refused]
97 [Don’t know]
D6. Including yourself and children, how many people live in your home at least six months of the year?

01 [RECORD VERBATIM]
96 [Refused] [GOTO D9]
97 [Don’t know] [GOTO D9]

D7. Was this the same during the period April 2011 through March 2012?

01 Yes [GOTO D9]
02 No
96 [Refused] [GOTO D9]
97 [Don’t know] [GOTO D9]

D8. How many people lived in the household during the period April 2011 through March 2012?

[RECORD VERBATIM]
96 [Refused]
97 [Don’t know]

D9. The next two questions are for statistical purposes only. This information will be kept confidential and will only be used for characterizing respondents to this study. What is the highest level of education you have obtained? [READ LIST]

01 Some high school,
02 High school graduate, including GED,
03 Some college or an Associate’s degree,
04 Bachelor’s degree,
05 Some graduate school,
06 Graduate or professional degree,
96 [Refused]
97 [Don’t know]

D10. What was your household’s total 2012 annual income before taxes. Please stop me when I reach the category that best describes your household’s income [READ LIST]

01 Less than $25,000,
02 $25,000 to $49,999,
03 $50,000 to $74,999,
04 $75,000 to $99,999,
05 $100,000 to $124,999,
06 $125,000 to $149,999,
07 $150,000 to $199,999,
08 or more?
96 [Refused]
97 [Don’t know]

WRAP UP – ASK ALL

[READ]: Is there anything that you want me to pass on to National Grid?

01 YES [RECORD VERBATIM]
02 NO
96  [Refused]
97  [Don’t know]

Additional: Just in case my supervisor would like to validate my work, may I have your first name?

[READ] Those are all the questions I have for you. Thank you very much for your time and opinions.

RECORD GENDER
01  MALE
02  FEMALE
97  CAN’T DETERMINE
C.  Example Home Energy Report (HER)
Home Energy Report
Account number: 1234567890
Report period: 05/26/11 - 06/25/11

We are pleased to provide this personalized report to help you save energy.

The purpose of this report is to:
- Provide information
- Help you track your progress
- Share energy efficiency tips

This information and more is available at nationalgrid.com/EnergyReportsNY

Last Month Neighbor Comparison
You used 13% LESS energy than your efficient neighbors.

YOU 732 *
Efficient Neighbors 810
All Neighbors 1,103

* This energy index combines electricity (kWh) and natural gas (therms) into a single measurement.

Who are your Neighbors?
All Neighbors
Approximately 100 occupied, nearby homes that are similar in size to yours (avg 2,666 sq ft) and have both electricity and natural gas service
Efficient Neighbors
The most efficient 20 percent from the "All Neighbors" group

Last 12 Months Neighbor Comparison
You used 22% MORE energy than your neighbors.
This costs you about $404 EXTRA per year.

Electricity: 24% less electricity than your neighbors
< 2009 2010 >

Natural Gas: 69% more natural gas than your neighbors
< 2009 2010 >

Turn over for savings

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