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Home Energy Reports Program
PY6 Evaluation Report

Final

Energy Efficiency/Demand Response Plan:
Plan Year 6
(6/1/2013-5/31/2014)

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Executive Summary

This report presents a summary of Navigant Consulting, Inc.'s (Navigant's) findings and results from the impact evaluation of the sixth program year (PY6) [1] of Commonwealth Edison Company's (ComEd's) Home Energy Report (HER) behavioral program. ComEd designed the program to generate energy savings by providing residential customers with sets of information about customer energy use and energy conservation. Program participants receive information in the form of home energy reports that give customers various types of information, including the following:

- Assessment of how their recent energy use compares to their energy use in the past
- Tips on how to reduce energy consumption, some of which are tailored to the customer's circumstances (e.g., customers with pools receive information on how to reduce energy use of pools)Information on how their energy use compares to that of neighbors with similar homes.

Other studies have shown that this set of information can induce customers to reduce their energy use, creating average energy savings in the one to three percent range.

The design of the program did not change in PY6, but the enrollment configuration did. In particular, it included three modifications. First, as part of a persistence study, ComEd targeted approximately 10,000 customers each in program Waves 1 and 3 for termination of their reports in autumn 2012, but due to an implementer error their reports restarted in autumn 2013. Throughout this report these customer groups are referred to as lapsed report (LR) groups. Second, ComEd targeted approximately 10,000 customers each in program Waves 1, 3, and 5 non advanced metering infrastructure (non-AMI) for termination of reports in autumn 2013, with the termination lasting throughout PY6. These customer groups are referred to as terminated report (TR) groups. Third, ComEd added a new wave (Wave 6 in this report) with approximately 100,000 customers in June 2013. Additionally, PY6 is the first year that Navigant estimated savings from the AMI pilot group (Wave 5 AMI in this report), which began in July 2012.[2]

E.1 Program Savings

Table E-1 summarizes the estimated electricity savings from the HER program. The PY6 planning target for this program was 100,000 MWh. The PY6 program ex ante savings were 110,582 MWh. Verified savings, prior to uplift were 129,244 MWh, resulting in a verified realization rate of 117 percent. Verified savings were 129,063 MWh when including the uplift adjustment of 181 MWh. As described in Section 3.2, 181 MWh came from uplift in other energy efficiency programs, resulting in final verified savings of

[1] PY6 began June 1, 2013, and ended May 31, 2014.

[2] Although Wave 5 AMI officially started in July 2012, most of the customers in this group were rolled in from a previous wave that was dissolved when this wave began. The earlier wave was dissolved because ComEd had a very limited pool of AMI customers to draw from. Therefore, many of the customers in Wave 5 AMI started receiving reports as early as May 2010. Throughout this report we use May 2009 to April 2010 as the pre-program year for this wave. Some of the Wave 5 Non-AMI customers also came from this dissolved wave, but because this was a very small portion of that wave's participants (0.3 percent) we left these customers out of the Wave 5 Non-AMI analysis to ensure consistency with previous reports.

129,063 MWh for PY6. As indicated in Section 4, a key feature of the RCT design of the HER program is that the analysis inherently estimates net savings because there are no participants who otherwise might have received the individualized reports in the absence of the program. Thus, there is no free ridership and no NTGR is applied for this program.

Table E-1. PY6 Total HER Program Electric Savings

Savings Category	Energy Savings (MWh)
Ex Ante Savings	110,582
Verified Savings, Prior to Uplift Adjustment	129,244
Verified Realization Rate	117%
Uplift Adjustment	181
Final Verified Savings	129,063

Source: Navigant analysis of ComEd billing data and implementation contractor data

E.2 Program Savings by Participant Wave

For the purposes of this report, Navigant characterizes the ComEd HER program as having been rolled out for PY6 in the following six waves:

1. A pilot program targeting 50,000 residential customers initiated in July 2009 (Wave 1);
2. A wave of about 3,000 customers (Wave 2) targeted for program enrollment in September 2010 to "fill-in" for Wave 1 dropouts;
3. A major expansion targeting 200,000 customers began in May 2011 (Wave 3);
4. Another fill-in wave of 20,000 customers in January 2012 (Wave 4);
5. A third fill-in wave of 20,000 customers in July 2012 (Wave 5 Non-AMI) and a pilot group of 60,000 AMI customers started at the same time (Wave 5 AMI) but evaluated for the first time in PY6[3]; and
6. A fourth fill-in of 10,000 customers and a major expansion targeting 90,000 customers begun in June 2013 (Wave 6).

The rollout of the six waves is summarized in Table E-2. As shown in the rightmost column, daily electricity usage varies widely across the different waves. Wave 5 AMI had the lowest usage at 20 kWh per day and Wave 5 non-AMI had the highest at 61 kWh per day.

[3] See footnote 2.

Table E-2. Synopsis of the HER program

Wave	Persistence Group Indicator	Month of First Report*	Month of Last Report	Month of Restarted Report	Targeted Number of Participants**	Targeted Number of Controls**	Average Daily Usage in PY6 (kWh)
1	CR	July 2009	-	-	50,000	50,000	41
1	LR	July 2009	August 2012	August 2013	10,000	50,000	40
1	TR	July 2009	September 2013	-	10,000	50,000	41
2	-	September 2010	-	-	3,000	3,000	38
3	CR	May 2011	-	-	200,000	50,000	52
3	LR	May 2011	August 2012	August 2013	10,000	50,000	52
3	TR	May 2011	September 2013	-	10,000	50,000	52
4	-	January 2012	-	-	20,000	20,000	34
5 AMI	-	July 2012[4]	-	-	60,000	30,000	20
5 Non-AMI	CR	July 2012	-	-	20,000	20,000	61
5 Non-AMI	TR	July 2012	September 2013	-	10,000	20,000	62
6	-	June 2013	-	-	100,000	30,000	47

*This is the month of the "first generated date" in the Opower dataset when a wave is initiated. Participants likely received their first report approximately one month later than this date.
**These numbers are the targeted numbers for each wave. The actual number of participants and control customers at the start of PY6 is used in the evaluation.
Source: Navigant analysis

To examine persistence of savings, the reports for 10,000 customers within both Waves 1 and 3 were terminated beginning in October 2012. Unfortunately, the implementer mistakenly began sending reports to these terminated customers again in August 2013. ComEd made the decision to continue to send reports to these customers as a test of the effect of an extended lapse in report delivery (these customers comprise the Wave 1 and 3 LR groups). In October 2013, ComEd chose 10,000 new customers each in Waves 1, 3, and 5 Non-AMI for HER termination for the remainder of PY6 (the customers comprise the Wave 1, 3, and 5 Non-AMI TR groups). Overall, there are three subgroups in Waves 1 and 3: a TR group, an LR group (which is the terminated report group from the PY5 report), and a continued report (CR) group; and two subgroups in Wave 5 Non-AMI: a TR group and a CR group.

Table E-3 summarizes estimated program savings by participant wave. The number of participants represents the number of customers assigned to each participant group, while the sample size indicates the number of customers with sufficient data for inclusion in the regression analysis. Across all waves, there were 446,587 participants for which savings were applied. Navigant estimated separate savings for each wave and subgroup (for example, Wave 1 CR) using regression analysis as described in Section 2.4. The weighted average per customer savings estimate was 1.94 percent (289.40 kWh) in PY6.

[4] See footnote 6.

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Table E-3. PY6 HER Program Results, by Wave

Type of Statistic	Wave 1 CR	Wave 1 LR	Wave 1 TR	Wave 2	Wave 3 CR	Wave 3 LR	Wave 3 TR	Wave 4	Wave 5 AMI	Wave 5 Non-AMI CR	Wave 5 Non-AMI TR	Wave 6	Total
Number of Participants	28,806	8,781	8,722	2,973	176,826	9,694	9,682	20,378	60,389	9,116	9,043	102,177	446,587
Sample Size, Treatment	22,974	7,054	6,989	2,397	152,006	8,280	8,286	18,422	37,188	5,696	5,663	87,312	-
Sample Size, Control	34,759			2,403	41,719			18,509	18,307	7,181		26,467	-
Percentage Savings	2.57%	2.59%	2.52%	2.99%	2.46%	2.69%	2.36%	2.02%	0.95%	1.75%	1.43%	1.24%	1.94%
	0.23%	*0.36%*	*0.36%*	*0.78%*	*0.13%*	*0.28%*	*0.28%*	*0.21%*	*0.30%*	*0.42%*	*0.42%*	*0.13%*	-
kWh Savings per Customer	307.32	310.25	302.88	345.99	416.82	455.1	396.74	227.25	58.88	320.33	263.43	181.54	289.40
	26.93	*41.75*	*44.32*	*88.21*	*21.65*	*46.11*	*45.64*	*23.41*	*18.35*	*84.34*	*70.91*	*18.3*	-
Verified Gross Savings, Prior to Uplift Adjustment, MWh*	8,853	2,724	2,642	1,029	73,704	4,412	3,841	4,631	3,556	2,920	2,382	18,550	129,244
	775.69	*366.58*	*372.51*	*262.25*	*3828.98*	*447.03*	*441.04*	*476.96*	*1108*	*768.85*	*641.28*	*1869.71*	-
Savings Uplift in Other EE Programs, MWh**	-3	7	9	-9	-2	9	4	-10	78	20	-17	95	181
Verified Gross Savings, MWh***	8,856	2,717	2,633	1,038	73,706	4,403	3,837	4,641	3,478	2,900	2,399	18,455	129,063

Note: The table provides standard errors in gray italics.

Source: Navigant analysis

* Total savings are pro-rated for participants that closed their accounts during PY6.

** Negative double counted savings indicate that the participation rate in the EE program is higher for the control group than the treatment group. This lowers the baseline and underestimates HER program savings.

*** Gross savings adjusted for savings uplift are equal to gross savings less the uplift of savings in other EE programs.

E.3 Key Findings and Recommendations

Key findings and recommendations include the following:

- **Verified Program Savings**
  - **Finding 1.** Overall, the program continues to generate savings at the level expected. The PY6 planning target for this program was 100,000 MWh. The program reported ex ante savings of 110,582 MWh for PY6. Verified savings, prior to uplift, were 129,244 MWh in PY6, resulting in a verified realization rate of 117 percent. Of that total, 181 MWh was due to uplift in other energy efficiency programs, resulting in final verified savings of 129,063 MWh for PY6. The double counting of savings with other ComEd EE programs *is not a significant issue* for the HER program.
  - **Finding 2.** The final verified savings of 129,063 MWh for PY6 corresponds to a weighted average across the six waves of a 1.94 percent reduction in usage for program participants. Of the four waves in PY6 that included at least a second full year of participation in the program (i.e. Waves 1-4), estimated energy savings were over two percent.
  - **Finding 3.** Compared to report savings in PY5, estimated savings for all waves increased in PY6, however not all of the differences were statistically significant. The increases were only significant for the CR group in Wave 3 and for Wave 4. This suggests that the savings for the two longest running waves (Waves 1 and 2) have levelled out. The largest increase in estimated savings occurred for Wave 4, where estimated savings increased by 0.58 percentage points; this increase was likely driven by ramp-up, as Wave 4 started in January 2012 and PY6 was their first full year of reported savings.
  - **Finding 4.** The average estimated savings for the Wave 5 AMI group were 0.95 percent. On a percentage basis, this is the lowest savings per customer of all the waves. Wave 5 AMI is made up of very low usage customers (their average consumption in the year before they began receiving reports was 20.02 kWh per day compared to an average of 37.69 kWh per day for the other waves) so it is not surprising that they have low savings.
  - **Finding 5.** Wave 5 Non-AMI enrolled in July 2012 and had estimated savings of 1.59 percent. Wave 6 enrolled in June 2013 and had estimated savings of 1.24 percent. Navigant's experience in evaluating the first year of this program for Waves 1-4, and for the same program for other utilities, is that the ramp-up phase is typically eight to 13 months. Both Wave 5 Non-AMI and Wave 6 would have been in a ramp-up phase for at least several months of PY6.
- **Persistence Findings**
  - **Finding 6.** The LR customers in Waves 1 and 3 whose reports were terminated in October 2012 and then restarted in August 2013 generated estimated savings in PY6 at least as high as their counterparts who continued to receive reports, although the differences are not statistically significant. It is unlikely that this result reflects that program effects increase when reports are stopped for 10 months. Rather, this difference in program effect could be due to differences between the lapsed group and the continued group; in PY5 Navigant found the assignment of customers into the lapsed

groups for Waves 1 and 3 (referred to as terminated groups in the PY5 report) was not consistent with a randomized controlled trial (RCT).

- **Finding 7.** The estimated savings for all three groups of TR customers were lower than their CR counterparts, but in all three cases the differences were not statistically significant. Estimated savings decreased 0.05 percentage points (2 percent) for Wave 1 customers (who had been in the program four years before termination), 0.01 percentage points (0.4 percent) for Wave 3 customers (who had been in the program two years), and 0.32 percentage points (18 percent) for Wave 5 Non-AMI customers (who had been in the program one year). It is problematic to draw conclusions about the relationship between program participation time and the persistence of savings for three reasons. First, none of the TR groups' savings estimates were statistically different than their CR counterparts. Second, the groups are not the same in terms of their pre-program energy use; usage in the relevant pre-program year was 42.94 kWh per day for Wave 1, 57.24 kWh per day for Wave 3, and 62.31 kWh per day for Wave 5 Non-AMI. Third, the groups could be different in other, unobservable ways.
- **Recommendation 1.** Given the small decay in estimated savings after report termination, Navigant recommends that ComEd continue the persistence study with TR customers continuing not to receive reports. In the future, Navigant will be able to explore whether savings continue to decay through time or whether the decay levels out.
- **Recommendation 2.** In order to find statistically significant decreases from termination, which might allow further analysis of the differences between Waves 1, 3, and 5 Non-AMI, larger sample sizes are needed. Using the results of the PY6 analysis, Navigant could conduct a power analysis to determine the TR group sample size necessary to find statistically significant decreases from termination for each wave.

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1 Introduction

1.1 Program Description

This report presents a summary of Navigant Consulting, Inc.'s (Navigant's) findings and results from the impact evaluation of the sixth program year (PY6) [5] of Commonwealth Edison Company's (ComEd's) Home Energy Report (HER) behavioral program. The program is designed to generate energy savings by providing residential customers with sets of information about their specific energy use and related energy conservation suggestions and tips. Program participants receive information in the form of home energy reports that give customers various types of information, including the following:

- Assessment of how their recent energy use compares to their energy use in the past
- Tips on how to reduce energy consumption, some of which are tailored to the customer's circumstances
- Information on how their energy use compares to that of neighbors with similar homes

Currently, participating households receive the reports bimonthly. Other studies have shown that this set of information can stimulate customers to reduce their energy use, creating average energy savings in the one percent to three percent range, depending on local energy use patterns.

An important feature of the HER program is that it is a randomized controlled trial (RCT). Customers in the feasible set of customers (that is, those customers meeting program criteria) are randomly assigned to a treatment (participant) group and a control (non-participant) group, for the purpose of estimating changes in energy use due to the program.

ComEd rolled out the HER program in PY6 in the following six waves:

1. A pilot program targeting 50,000 residential customers began in July 2009 (Wave 1).
2. A wave of about 3,000 customers (Wave 2) began in September 2010 to "fill-in" for Wave 1 dropouts.
3. A major expansion targeting 200,000 customers began in May 2011 (Wave 3).
4. Another fill-in wave of about 20,000 customers began in January 2012 (Wave 4).
5. A third fill-in wave of 20,000 customers began in July 2012 (Wave 5 Non-advanced metering infrastructure [AMI]) and a pilot group of 60,000 AMI customers started at the same time (Wave 5 AMI).[6]
6. A fourth fill-in of 10,000 customers and a major expansion targeting 90,000 customers began in June 2013 (Wave 6).

[5] PY6 began June 1, 2013, and ended May 31, 2014.

[6] Although Wave 5 AMI officially started in July 2012, most of the customers in this group were rolled in from a previous wave that was dissolved when this wave began. The earlier wave was dissolved because ComEd had a very limited pool of AMI customers to draw from. Therefore, many of the customers in Wave 5 AMI started receiving reports as early as May 2010. Throughout this report we use May 2009 to April 2010 as the pre-program year for this wave. Some of the Wave 5 Non-AMI customers also came from this dissolved wave; however, because this was a very small portion of that wave's participants (0.3 percent), we left these customers out of the Wave 5 Non-AMI analysis to ensure consistency with previous reports.

The Wave 5 Non-AMI group was to compensate for the approximately 10,000 customers in each of Waves 1 and 3 (total of 20,000 customers) for whom reports were terminated in October 2012 as part of an experiment to examine how the termination of reports affects energy savings (the Persistence Group Indicator in Table 1-1). Unfortunately, the implementer mistakenly began sending reports to these terminated customers again in August 2013. ComEd decided to continue to send reports to these customers as a test of the effect of an extended lapse in report delivery. We refer to these customers as "lapsed report" (LR) customers, corresponding to those labelled as terminated report (TR) customers in the PY5 report. ComEd initiated the persistence experiment again in October 2013 with a new set of 10,000 randomly chosen customers from each of Waves 1, 3, and 5 Non-AMI. We refer to these customers as TR customers. Net savings are reported by wave and, for Waves 1, 3, and 5 Non-AMI, by LR, TR, and continued report (CR) groups. As LR customers stopped receiving reports in October 2012 and started receiving them again in August 2013, their energy savings in PY6 represent energy savings associated with having no reports sent in June/July 2013, followed by bimonthly reports from August 2013 through May 2014. Since TR customers stopped receiving reports in October 2013, their energy savings in PY6 represents energy savings associated with receiving reports through September 2013, followed by a termination period from October 2013 through May 2014.

The rollout of the six waves is summarized in Table 1-1. As shown in the rightmost column, daily electricity usage varies widely across the different waves. Wave 5 AMI had the lowest usage at 20 kilowatt-hours (kWh) per day and Wave 5 non-AMI had the highest at 61 kWh per day.

Table 1-1. Synopsis of the HER Program

Wave	Persistence Group Indicator	Month of First Report*	Month of Last Report	Month of Restarted Report	Targeted Number of Participants**	Targeted Number of Controls**	Average Daily Usage in PY6 (kWh)
1	CR	July 2009	-	-	50,000	50,000	41
1	LR	July 2009	August 2012	August 2013	10,000	50,000	40
1	TR	July 2009	September 2013	-	10,000	50,000	41
2	-	September 2010	-	-	3,000	3,000	38
3	CR	May 2011	-	-	200,000	50,000	52
3	LR	May 2011	August 2012	August 2013	10,000	50,000	52
3	TR	May 2011	September 2013	-	10,000	50,000	52
4	-	January 2012	-	-	20,000	20,000	34
5 AMI	-	July 2012[7]	-	-	60,000	30,000	20
5 Non-AMI	CR	July 2012	-	-	20,000	20,000	61
5 Non-AMI	TR	July 2012	September 2013	-	10,000	20,000	62
6	-	June 2013	-	-	100,000	30,000	47

*This is the month of the "first generated date" in the Opower dataset when a wave is initiated. Participants likely received their first report approximately one month later than this date.
**These numbers are the targeted numbers for each wave. The actual number of participants and control customers at the start of PY6 is used in the evaluation.
Source: Navigant analysis

1.2 Evaluation Objectives

The primary objective of the analysis in this report is to determine the extent to which participants in each wave of the HER program reduced their energy consumption in PY6 due to the program. Two secondary objectives are the following:

- Evaluate how program savings change over time
- Assess the effect of lapsed and terminated reports on program savings

[7] See footnote 6.

2 Evaluation Approach

The evaluation approach is consistent with that of the evaluations in previous years, relying on statistical analysis appropriate for RCTs.

2.1 Overview of Data Collection Activities

Navigant received tracking data and monthly billing data for all program participants and control customers from September 2008 to May 2014 from the program implementer. Table 2-1 provides details.

Table 2-1. Primary Data Collection Activities

Collection Method	Subject Data	Quantity	Net Impact	Process
Billing Data	Program participants and controls	All	X	N/A
Tracking Data	Program participants and controls	All	X	N/A
Tracking Data for Other Programs	Participants in other programs	All	X	N/A

Source: Navigant analysis

2.2 Sampling Plan

The HER program was implemented by the program implementer as an RCT, in which individuals are randomly assigned to a treatment (participant) group and a control group, for the purpose of estimating changes in energy use due to the program.[8] Data for all participants and controls are included in this impact evaluation.

Navigant conducted a statistical analysis to determine whether the assignment of customers to the new terminated groups for Waves 1, 3, and 5 Non-AMI was statistically consistent with an RCT design, and further examined whether the allocation of customers in the waves evaluated for the first time in PY6 – Waves 5 AMI and 6—was consistent with an RCT. A detailed description of this analysis appears in Section 6.Analysis results show that the allocation of customers in control and treatment groups for Waves 5 AMI and 6 and the allocation of customers into the TR groups for Waves 1, 3, and 5 Non-AMI were consistent with an RCT.

[8] In this design, treatment customers receive HERs, while control customers do not.

2.3 Data Used in Impact Analysis

In preparation for the impact analysis, Navigant combined and cleaned the data provided by the implementer. The dataset included 456,393 participants and 191,826 controls. Navigant removed the following customers and data points from the analysis:

- Customers marked to be excluded or with no first report generation date (13,515 participants, 6,179 controls)[9]
- Customers with an active account and less than 11 bills or any customer with more than 13 bills during PY6 (50,601 participants, 24,982 controls)
- Customers with less than 11 or more than 13 bills during the pre-program year (21,306 participants, 7,906 controls)
- Customers with delayed first report generation dates (6,076 participants, 2,343 controls)[10]
- Observations with less than 20 or more than 40 days in the billing cycle
- Observations missing billing usage data
- Observations outside of the 12-month pre-program period or the PY6 post-period
- Outliers, defined as observations with average daily usage more than one order of magnitude from the median usage[11]

2.4 Statistical Models Used in the Impact Evaluation

Navigant estimated program impacts using two approaches: a simple post-program regression (PPR) analysis with lagged controls and a linear fixed-effects regression (LFER) analysis applied to monthly billing data. Navigant uses PPR results for reporting total program savings for PY6. In the past, we have reported the LFER results, but we have switched this year for two reasons. One, the implementer is also using a post-only model for evaluation. Two, although both the LFER and PPR models generate unbiased estimates of program savings, as an empirical matter—based on our past analyses and those in the academic literature—estimated savings from the PPR model tend to have lower standard errors than those from the LFER model, though the differences are usually very small.[12] We ran both models as a robustness check. Although the two models are structurally very different, assuming the RCT is well balanced with respect to the drivers of energy use, in a single sample they generate very similar estimates of program savings.

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[9] This step also removes customers in Wave 5 Non-AMI who had a first generated date prior to July 2012, as discussed in footnote 6.

[10] The majority of customers within a wave have first report generation dates clustered within a few weeks. However, some customers have delayed first report generation dates, which can be delayed up to several years. Therefore, Navigant excluded all customers with a delayed first report generation date from the regression analysis in order to study a more homogeneous treatment group. Customers with a delayed first report generation date count towards total program savings, accruing savings once they have received their first report. The program implementer stated that delayed first report dates are typically caused by insufficient or erroneous data.

[11] Median usage was calculated by Wave. Chronologically, the medians were 34.97, 33.94, 47.15, 31.60, 13.55 (AMI), 53.46 (Non-AMI), and 39.84 kilowatt-hours (kWh) per day. Navigant excluded observations in the relevant wave with usage values greater than 10 times the median kWh per day or less than the median divided by 10 kWh per day from the analysis.

[12] Allcott, Hunt and Todd Rogers. "The Short-Run and Long-Run Effects of Behavioral Intervention: Experimental Evidence from Energy Conservation. Forthcoming. *American Economic Review.*

The PPR model combines both cross-sectional and time-series data in a panel data set. It uses the post-program data only, with lagged energy use for the same calendar month of the pre-program period serving as a control for any small, systematic differences between the treatment and control customers. The lagged energy use term is similar to the customer fixed effect included in the LFER model explained below.

As with the PPR model, the LFER model combines both cross-sectional and time-series data in a panel data set. The regression essentially compares pre- and post-program billing data for participants and the control group to identify the effect of the program. The customer-specific fixed effect is a key feature of the LFER analysis and captures all customer-specific factors affecting electricity usage that do not change over time, including those that are unobservable. Examples include the square footage of a residence, the number of occupants, and thermostat settings. The fixed effect represents an attempt to control for any small, systematic differences between the treatment and control customers that might occur due to chance.

Section 6.2.1 of the appendix presents the PPR and LFER models used in the analysis.

2.5 Accounting for Uplift in Other Energy Efficiency Programs

The home energy reports sent to participating households include energy-saving tips, some of which encourage participants to enroll in other ComEd energy efficiency (EE) programs. If participation rates in other EE programs are the same for HER participant and control groups, the savings estimates from the regression analysis are already "net" of savings from the other programs, as this indicates the HER program had no effect on participation in the other EE programs. However, if the HER program affects participation rates in other EE programs, then savings across all programs are lower than indicated by the simple summation of savings in the HER and EE programs. For instance, if the HER program increases participation in other EE programs, the increase in savings may be allocated to either the HER program or the EE program, but cannot be allocated to both programs simultaneously.[13]

As data permitted, Navigant used a difference-in-difference (DID) statistic to estimate uplift in other EE programs. To calculate the DID statistic, Navigant subtracted the change in the participation rate in another EE program between PY6 and the pre-program year for the control group from the same change for the treatment group. For instance, if the rate of participation in an EE program during PY6 is five percent for the treatment group and three percent for the control group, and the rate of participation during the year before the start of the HER program is two percent for the treatment group and one percent for the control group, then the rate of uplift due to the HER program is one percent, as reflected the following calculation:

(PY6 treatment group participation – pre-PY treatment group participation) – (PY6 control group participation – pre-PY control group participation) = DID statistic
(5% – 2%) – (3% – 1%) = 1%

[13] It is not possible to avoid double counting of savings generated by programs for which tracking data are not available, such as upstream compact fluorescent lamp (CFL) programs.

The DID statistic generates an unbiased estimate of uplift when the baseline average rate of participation is the same for the treatment and control groups, or when they are different due only to differences between the two groups in time-invariant factors, such as the square footage of the residence.

An alternative statistic that generates an unbiased estimate of uplift when the baseline average rate of participation in the EE program is the same for the treatment and control groups is a simple difference in participation rates during PY6. Navigant uses this alternative statistic –the "post-only difference" (POD) statistic –in cases where the EE program did not exist for the entire pre-program year.

Navigant examined the uplift associated with four EE programs: Residential Fridge and Freezer Recycle Rewards (FFRR) program, Complete System Replacement (CSR) program, Multi-family Comprehensive Energy Efficiency Program (MCEEP), and Single Family Home Energy Savings (SFHES) program. In PY5, Navigant also evaluated uplift from the Clothes Washer (CW) program, but ComEd has discontinued that program. The FFRR program achieves energy savings through retirement and recycling of older, inefficient refrigerators, freezers, and room air conditioners. The SFHES program provides customers in single family homes a discounted home energy assessment and free or incentivized direct install and weatherization measure recommendations and installations. The CSR program offers education and cash incentives to ComEd's, Nicor Gas's, North Shore Gas's, and Peoples Gas's residential customers to encourage customer purchases of higher efficiency heating, ventilating, and air-conditioning (HVAC) equipment. The MCEEP offers direct installation of low-cost efficiency measures, such as water efficiency measures and compact fluorescent lamps (CFLs) at eligible multifamily residences.

For each EE program, double-counted savings were calculated separately for each wave of the HER program and for each persistence subgroup in Waves 1, 3, and 5 Non-AMI. Section 4, Net Impact Evaluation, discusses this fully.

2.6 Process Evaluation

The PY6 HER program evaluation did not include a process evaluation.

3 Gross Impact Evaluation

The PY6 planning target for this program was 100,000 megawatt-hours (MWh). The program reported ex ante savings of 110,582 MWh for PY6. Verified savings, prior to uplift, were 129,244 MWh in PY6, resulting in a verified realization rate of 117 percent. Of that total, 181 MWh was due to uplift in other EE programs, resulting in final verified savings of 129,063 MWh for PY6, as shown in Table 3-1 below.

Table 3-1. PY6 Total HER Program Verified Savings

Savings Category	Energy Savings (MWh)
Ex Ante Savings	110,582
Verified Savings, Prior to Uplift Adjustment	129,244
Verified Realization Rate	117%
Uplift Adjustment	181
Final Verified Savings	129,063

Source: Navigant analysis of ComEd program tracking data

3.1 PPR and LFER Model Parameter Estimates

The PPR and LFER models generate very similar results for program savings estimates. Navigant uses the PPR results for reporting total program savings for PY6. In the past, we have reported the LFER results, but we have switched this year for two reasons. One, the implementer is also using a post-only model for evaluation. Two, although both the LFER and PPR models generate unbiased estimates of program savings, as an empirical matter—based on our past analyses and those in the academic literature—estimated savings from the PPR model tend to have lower standard errors than those from the LFER model, though the differences are usually very small.[14] Table 6-1 provides regression parameter estimates for program savings. The table presents estimates for the PPR and LFER models together, by wave, to provide a better sense of the similarity of estimates across the two models for the same wave. The model estimates for each wave are very close, and not statistically different, between the two models. Furthermore, the pattern across waves between the two models is very similar. For example, Wave 3 had the highest estimated savings for both models and Wave 5 AMI had the lowest.

3.2 Uplift of Savings in Other EE Programs

PPR program savings estimates include savings resulting from the uplift in participation in other EE programs caused by the HER program. To avoid double-counting savings, program savings due to this uplift must be counted towards either the HER program or the other EE programs, but not both programs. The uplift of savings in other EE programs was a very small proportion of the total savings: 181 MWh, or 0.14 percent. Subtracting these savings from gross savings (129,244 MWh) generates a net

[14] Allcott, Hunt and Todd Rogers. "The Short-Run and Long-Run Effects of Behavioral Intervention: Experimental Evidence from Energy Conservation. Forthcoming. *American Economic Review.*

savings estimate of 129,063 MWh. To put this in perspective, across all waves the weighted average percentage savings for PY6 due to the HER program was 1.94 percent, and removing the savings uplift in other EE programs reduces this value to 1.937 percent.[15]

Table 3-2 presents a summary of the PY6 double-counted savings due to uplift in other EE programs and the verified gross savings for the HER program obtained by removing these savings from the estimate of verified gross program savings prior to uplift adjustment, by program wave. Table 6-2 through Table 6-13 in the appendix present the details of the calculation of the double-counted savings for each of the four ComEd EE programs considered in the analysis. As previously mentioned, the programs included in the uplift analysis were the FFRR program, the CSR program, MCEEP, and the SFHES program.[16] Where possible, Navigant used a DID statistic to estimate double-counted savings, and otherwise used a simple comparison of the rate of participation in EE programs by treatment and control households in PY6–the POD estimate of double-counted savings. The appendix tables indicate the statistic used for each calculation.

The estimate of double-counted savings is most likely an *overestimate* because it presumes participation in the other EE programs occurs at the very start of PY6. Under the more reasonable assumption that participation occurs at a uniform rate throughout the year, the estimate of double-counted savings would be approximately 90.5 MWh, half the estimated value of 181 MWh. The upshot is that double counting of savings with other ComEd EE programs *is not a significant issue* for the HER program.

3.3 Verified Program Impact Results

Table 3-2 presents savings across all program groups, and Figure 3-1 shows the estimated percentage savings for each group across multiple program years. In Table 3-2, the number of participants represents the number of customers assigned to each participant group, while the sample size indicates the number of customers with sufficient data for inclusion in the regression analysis. Table 3-2 summarizes estimated program savings by participant wave. The number of participants represents the number of customers assigned to each participant group, while the sample size indicates the number of customers with sufficient data for inclusion in the regression analysis. Across all waves, there were 446,587 participants for which savings were applied. Navigant estimated separate savings for each wave and subgroup (for example, Wave 1 CR) using regression analysis as described in Section 2.4. The weighted average per customer savings estimate was 1.94 percent (289.40 kWh) in PY6.

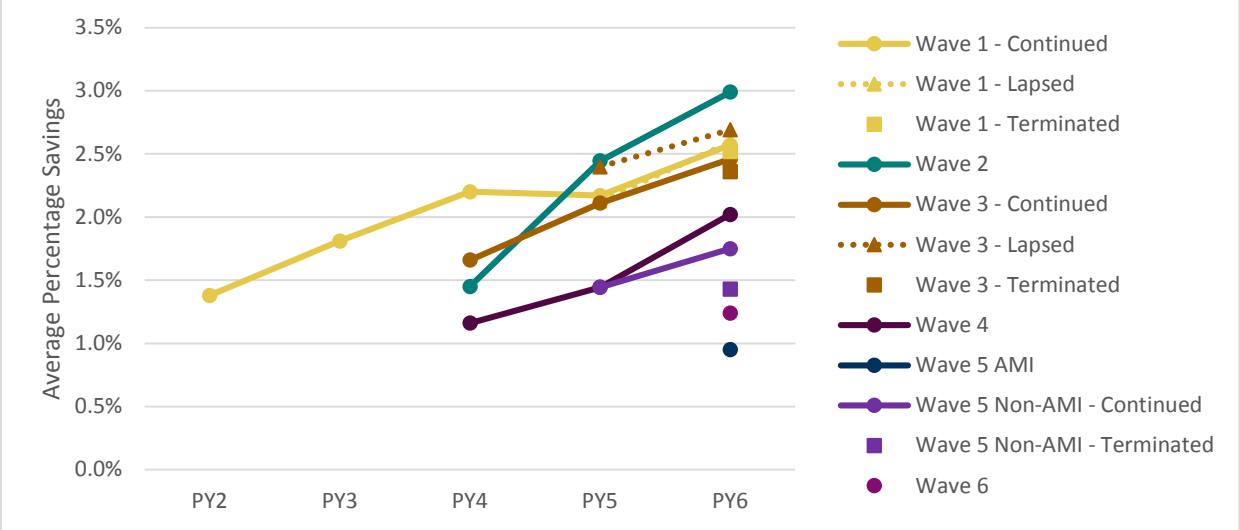
The four waves that entered PY6 with at least one full year in the program (Waves 1-4) achieved estimated savings of at least two percent in PY6. Average estimated savings for Wave 5 were 0.95 percent for the AMI group and 1.59 percent for the Non-AMI group. Customers in Wave 6 started the program at the beginning of PY6, and in their first year generated estimated savings of 1.24 percent.

[15] Multiplying 1.94 percent (the percentage of total energy use saved) by 0.14 percent (the percentage of total savings uplift in other EE programs) generates the value 0.003 percent. Formally, as shown in the following calculation: 0.0194 × 0.0014 = 0.00003. Subtracting this value from 0.0194 gives 0.01937, or 1.937 percent.

[16] ComEd has other residential programs that were not included in the analysis. The Residential Lighting and Elementary Education programs do not track participation at the customer level, and so do not have the data necessary for the uplift analysis. Double counting between the Residential New Construction and HER programs is not possible due to the requirement that HER participants have sufficient historical usage data.

Estimated savings for the Wave 3 LR participants exceeded estimated savings for the Wave 3 CR participants during PY5 and PY6, though the differences were not statistically significant. As noted in the PY5 report, Navigant identified statistically significant differences in pre-program usage patterns between the LR (referred to as TR in the PY5 report) and control groups for Waves 1 and 3, indicating that the assignment to the LR group is not consistent with an RCT and they are not drawn from the same population. Consequently, it is not possible to conclude that the difference in the savings rate estimates for the LR and CR groups is solely attributable to the lapse in reports. For the TR groups started in October 2013 for Waves 1, 3, and 5 Non-AMI allocation is consistent with an RCT, as shown in Section 6.1 of this report, and estimated savings are at or below the CR group.

Figure 3-1. Behavioral Program Savings Over Time



Source: Navigant analysis

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Table 3-2. PY6 Gross Program Savings and Uplift of Savings in Other EE programs, by Wave

Type of Statistic	Wave 1 CR	Wave 1 LR	Wave 1 TR	Wave 2	Wave 3 CR	Wave 3 LR	Wave 3 TR	Wave 4	Wave 5 AMI	Wave 5 Non-AMI CR	Wave 5 Non-AMI TR	Wave 6	Total
Number of Participants	28,806	8,781	8,722	2,973	176,826	9,694	9,682	20,378	60,389	9,116	9,043	102,177	446,587
Sample Size, Treatment	22,974	7,054	6,989	2,397	152,006	8,280	8,286	18,422	37,188	5,696	5,663	87,312	-
Sample Size, Control	34,759			2,403	41,719			18,509	18,307	7,181		26,467	-
Percentage Savings	2.57%	2.59%	2.52%	2.99%	2.46%	2.69%	2.36%	2.02%	0.95%	1.75%	1.43%	1.24%	1.94%
	0.23%	*0.36%*	*0.36%*	*0.78%*	*0.13%*	*0.28%*	*0.28%*	*0.21%*	*0.30%*	*0.42%*	*0.42%*	*0.13%*	-
kWh Savings per Customer	307.32	310.25	302.88	345.99	416.82	455.1	396.74	227.25	58.88	320.33	263.43	181.54	289.40
	26.93	*41.75*	*44.32*	*88.21*	*21.65*	*46.11*	*45.64*	*23.41*	*18.35*	*84.34*	*70.91*	*18.3*	-
Verified Gross Savings, Prior to Uplift Adjustment, MWh*	8,853	2,724	2,642	1,029	73,704	4,412	3,841	4,631	3,556	2,920	2,382	18,550	129,244
	775.69	*366.58*	*372.51*	*262.25*	*3828.98*	*447.03*	*441.04*	*476.96*	*1108*	*768.85*	*641.28*	*1869.71*	-
Savings Uplift in Other EE Programs, MWh**	-3	7	9	-9	-2	9	4	-10	78	20	-17	95	181
Verified Gross Savings, MWh***	8,856	2,717	2,633	1,038	73,706	4,403	3,837	4,641	3,478	2,900	2,399	18,455	129,063

Note: The table provides standard errors in gray italics.

Source: Navigant analysis

* Total savings are prorated for participants that close their accounts during PY6.

** Negative double-counted savings indicate that the participation rate in the EE program is higher for the control group than the treatment group. This lowers the baseline and underestimates HER program savings.

*** Gross savings adjusted for savings uplift are equal to gross savings less the uplift of savings in other EE programs.

4 Net Impact Evaluation

A key feature of the RCT design of the HER program is that the analysis inherently estimates net savings because there are no participants who otherwise might have received the individualized reports in the absence of the program. While some customers receiving reports may have taken energy-conserving actions or purchased high-efficiency equipment anyway, the random selection of program participants (as opposed to voluntary participation) implies that the control group of customers *not* receiving reports is expected to exhibit the same degree of energy-conserving behavior and purchases. Thus, there is no free ridership, and no "net-to-gross" (NTG) adjustment is necessary.

5 Findings and Recommendations

Key findings and recommendations include the following:

- **Verified Program Savings**
  - **Finding 1.** Overall, the program continues to generate savings at the level expected. The PY6 planning target for this program was 100,000 MWh. The program reported ex ante savings of 110,582 MWh for PY6. Verified savings, prior to uplift, were 129,244 MWh in PY6, resulting in a verified realization rate of 117 percent. Of that total, 181 MWh was due to uplift in other energy efficiency programs, resulting in final verified savings of 129,063 MWh for PY6. The double counting of savings with other ComEd EE programs *is not a significant issue* for the HER program.
  - **Finding 2.** The final verified savings of 129,063 MWh for PY6 corresponds to a weighted average across the six waves of a 1.94 percent reduction in usage for program participants. Of the four waves in PY6 that included at least a second full year of participation in the program (i.e., Waves 1-4), estimated energy savings were over two percent.
  - **Finding 3.** Compared to reported savings in PY5, estimated savings for all waves increased in PY6; however, not all of the differences were statistically significant. The increases were only significant for the CR group in Wave 3 and for Wave 4. This suggests that the savings for the two longest running waves (Waves 1 and 2) have levelled out. The largest increase in estimated savings occurred for Wave 4, where estimated savings increased by 0.58 percentage points; this increase was likely driven by ramp-up, as Wave 4 started in January 2012 and PY6 was their first full year of reported savings.
  - **Finding 4.** The average estimated savings for the Wave 5 AMI group were 0.95 percent. On a percentage basis, this is the lowest savings per customer of all the waves. Wave 5 AMI is made up of very low usage customers. (Their average consumption in the year before they began receiving reports was 20.02 kWh per day compared to an average of 37.69 kWh per day for the other waves.) Therefore, it is not surprising that they have low savings.
  - **Finding 5.** Wave 5 Non-AMI enrolled in July 2012 and had estimated savings of 1.59 percent. Wave 6 enrolled in June 2013 and had estimated savings of 1.24 percent. Navigant's experience in evaluating the first year of this program for Waves 1-4, and for the same program for other utilities, is that the ramp-up phase is typically 8 to 13 months. Both Wave 5 Non-AMI and Wave 6 would have been in a ramp-up phase for at least several months of PY6.
- **Persistence Findings**
  - **Finding 6.** The LR customers in Waves 1 and 3 whose reports were terminated in October 2012 and then restarted in August 2013 generated estimated savings in PY6 at least as high as their counterparts who continued to receive reports, although the differences are not statistically significant. It is unlikely that this result reflects that program effects increase when reports are stopped for ten months. Rather, this

difference in program effect could be due to differences between the lapsed group and the continued group; in PY5 Navigant found the assignment of customers into the lapsed groups for Waves 1 and 3 (referred to as terminated groups in the PY5 report) was not consistent with an RCT.

- **Finding 7.** The estimated savings for all three groups of TR customers were lower than their CR counterparts, but in all three cases the differences were not statistically significant. Estimated savings decreased 0.05 percentage points (2 percent) for Wave 1 customers (who had been in the program four years before termination), 0.01 percentage points (0.4 percent) for Wave 3 customers (who had been in the program two years), and 0.32 percentage points (18 percent) for Wave 5 Non-AMI customers (who had been in the program one year). It is problematic to draw conclusions about the relationship between program participation time and the persistence of savings for three reasons. First, none of the TR groups' savings estimates were statistically different than their CR counterparts. Second, the groups are not the same in terms of their pre-program energy use; usage in the relevant pre-program year was 42.94 kWh per day for Wave 1, 57.24 kWh per day for Wave 3, and 62.31 kWh per day for Wave 5 Non-AMI. Third, the groups could be different in other, unobservable ways.
- **Recommendation 1.** Given the small decay in estimated savings after report termination, Navigant recommends that ComEd continue the persistence study with TR customers continuing not to receive reports. In the future, Navigant will be able to explore whether savings continue to decay through time or whether the decay levels out.
- **Recommendation 2.** In order to find statistically significant decreases from termination, which might allow further analysis of the differences between Waves 1, 3, and 5 Non-AMI, larger sample sizes are needed. Using the results of the PY6 analysis, Navigant could conduct a power analysis to determine the TR group sample size necessary to find statistically significant decreases from termination for each wave.

6 Appendix

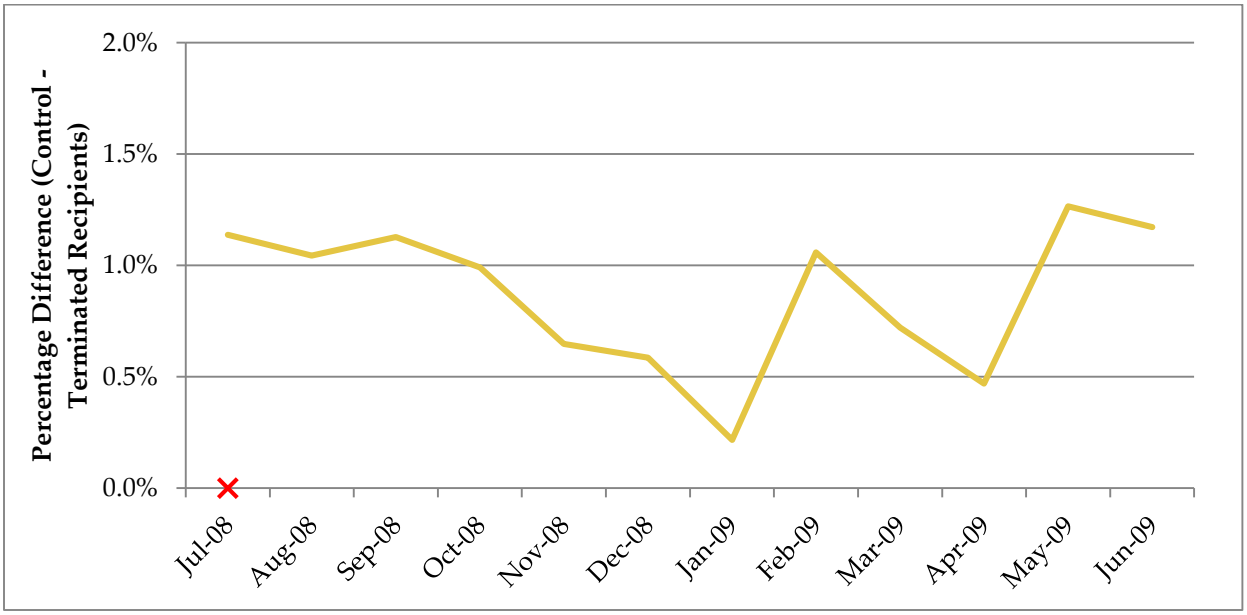
6.1 Statistical Verification of the RCT Design

Statistical analysis can be used to determine whether the assignment of customers to the treatment and control groups is consistent with an RCT design. The analysis involves comparing the means of the two groups with respect to energy use in the pre-program year. Navigant previously evaluated the RCT design for Waves 1-4 and Wave 5 Non-AMI. We found an anomaly in Group 1 of Wave 1—evidence against an RCT—but found that the standard statistical analysis for an RCT design corrected for it. The allocation of customers from Waves 1 and 3 into the lapsed report group was also previously examined and was found not to be consistent with an RCT.

In the current analysis, we examined whether the assignment of customers to the new terminated groups for Waves 1, 3, and 5 Non-AMI was statistically consistent with an RCT design, and further examined whether the allocation of customers in the waves evaluated for the first time in PY6—Wave 5 AMI and Wave 6—was consistent with an RCT.

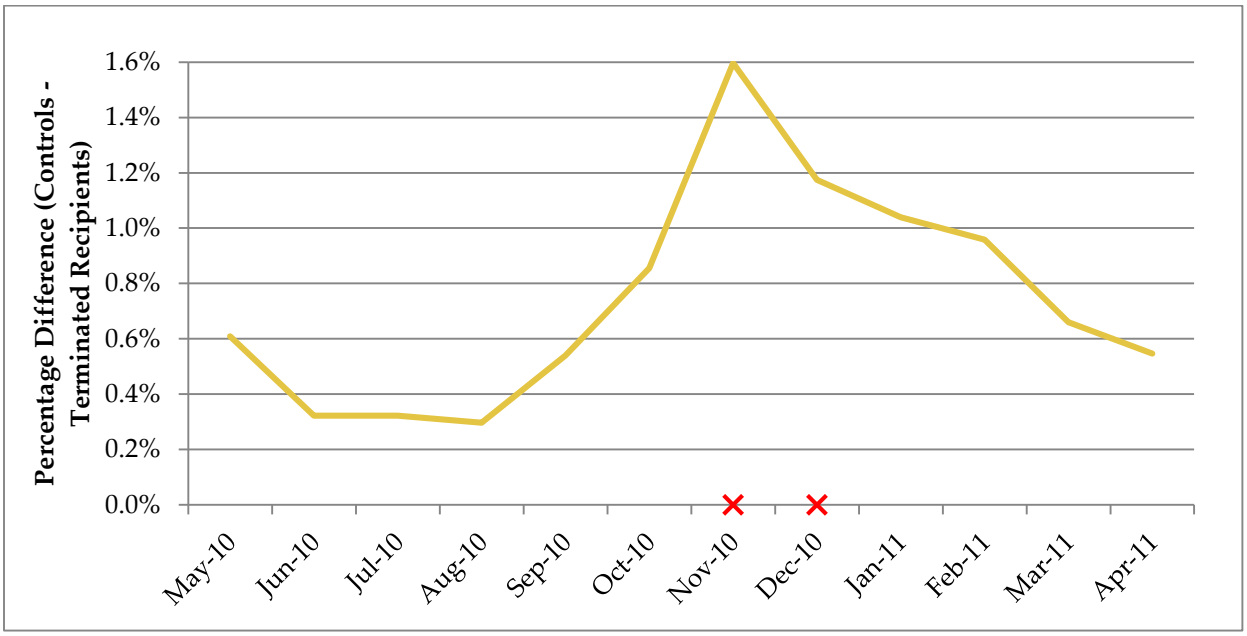
Figure 6-1 through Figure 6-5 present estimation results. The results show that the selection of terminated groups in Waves 1, 3 and 5 Non-AMI and the selection of control and treatment groups in Waves 5 AMI and 6 were consistent with an RCT. The analysis involves comparing the mean energy use of participant and control groups in each month of the particular wave's pre-program year. In the figures, months where there was a statistically significant difference at the 90 percent confidence level are marked with a red "X." Under the assumption of an RCT, and at the 90 percent confidence level, we would expect that for each wave, chance alone would yield a statistical difference in mean consumption between the treatment and control groups for one or two months of the pre-program year.

Figure 6-1. Percentage Difference in Average Daily Energy Use between Wave 1 Control Group and TR Participants, Pre-Program Year



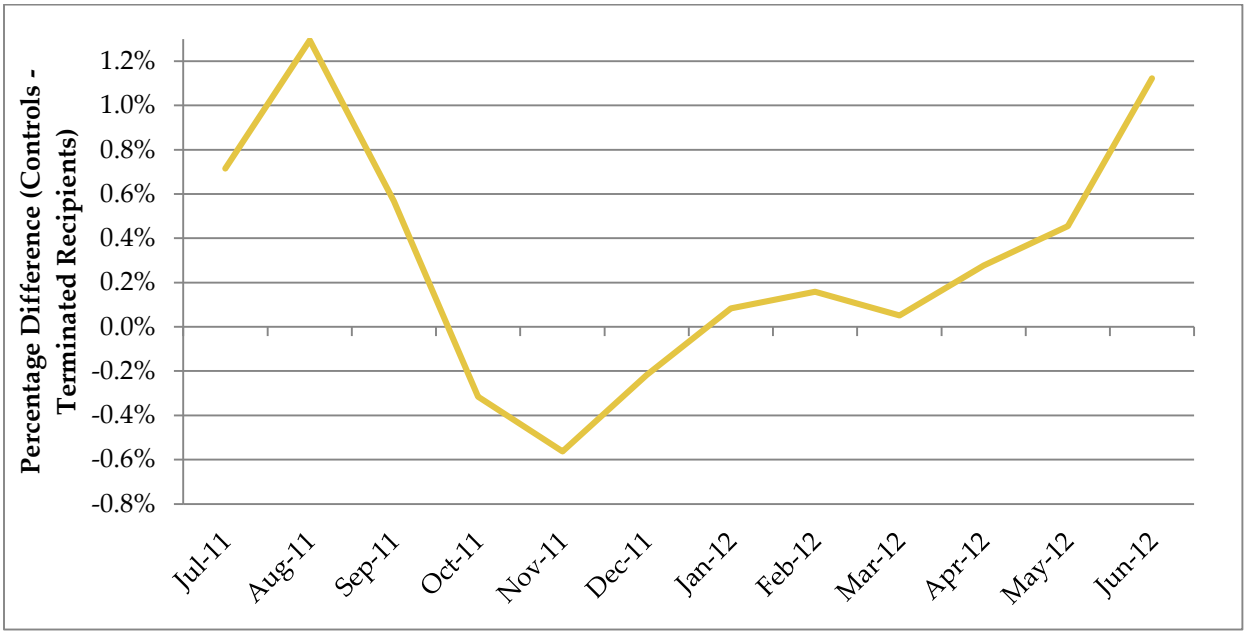
Source: Navigant analysis

Figure 6-2. Percentage Difference in Average Daily Energy Use between Wave 3 Control Group and TR Participants, Pre-Program Year



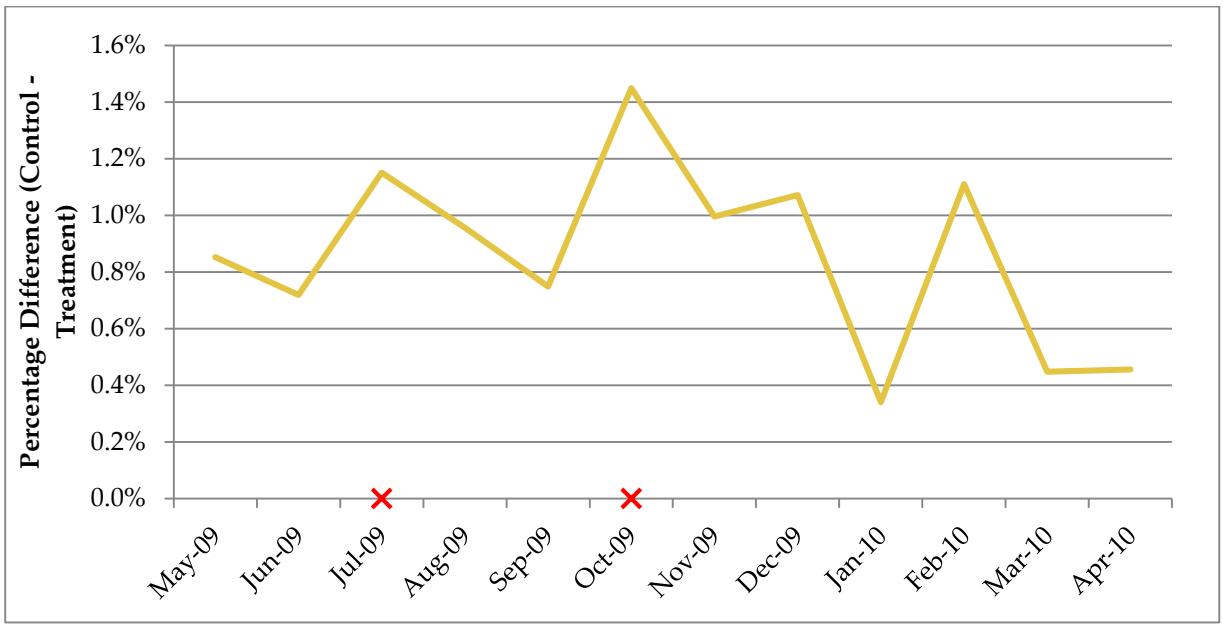
Source: Navigant analysis

Figure 6-3. Percentage Difference in Average Daily Energy Use Between Wave 5 Non-AMI Control Group and TR Participants, Pre-Program Year



Source: Navigant analysis

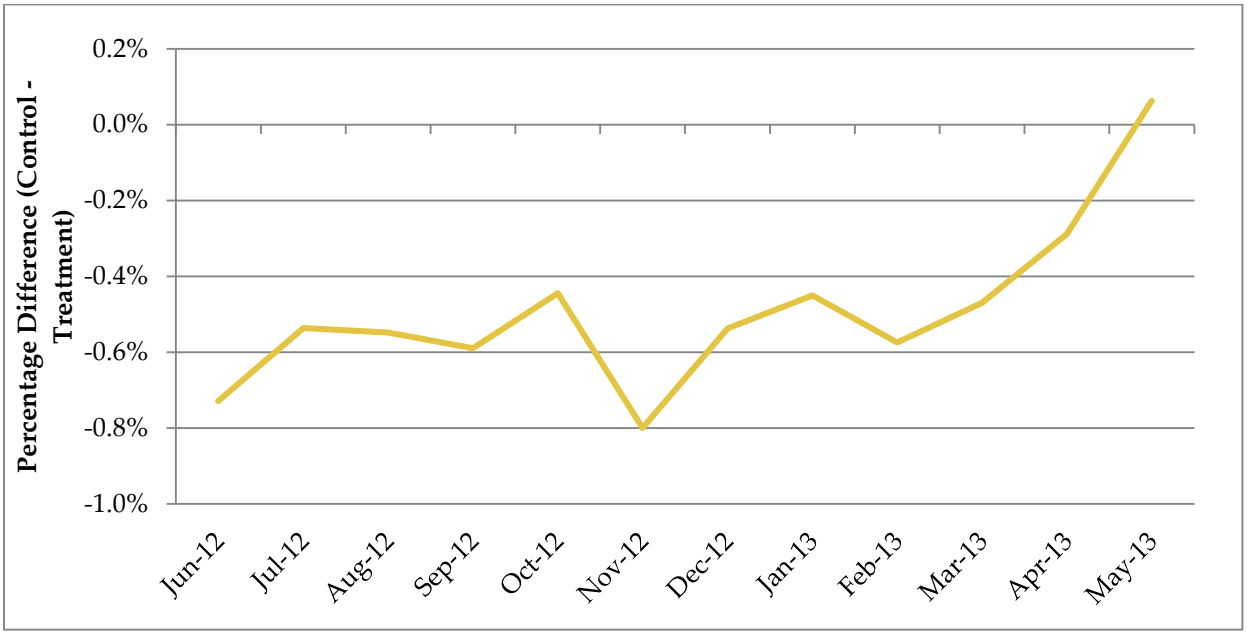
Figure 6-4. Percentage Difference in Average Daily Energy Use between Wave 5 AMI Control Group and Participants, Pre-Program Year[17]



Source: Navigant analysis

[17] For Wave 5 AMI we have used May 2009 to April 2010 as the pre-program year to ensure that none of the participants were receiving reports in the period used to validate the RCT.

Figure 6-5. Percentage Difference in Average Daily Energy Use Between Wave 6 Control Group and Participants, Pre-Program Year



Source: Navigant analysis

6.2 *Detailed Impact Methodology*

Navigant used two regression models to estimate impacts, a PPR model and an LFER model. The following sections present each model.

6.2.1 PPR Model

The PPR model controls for non-treatment differences in energy use between treatment and control customers using lagged energy use as an explanatory variable. In particular, the model frames energy use in calendar month *t* of the post-program period as a function of both the treatment variable and energy use in the same calendar month of the pre-program period. The underlying logic is that systematic differences between control and treatment customers will be reflected in differences in their past energy use, which is highly correlated with their current energy use. Formally, the model is the following:

$$ADU_{kt} = b_1 Treatment_k + b_2 ADUlag_{kt} + \sum_J b_{3j} Month_{jt} + \sum_J b_{4j} Month_{jt} \times ADUlag_{kt} + e_{kt}$$

where

ADU_{kt} is average daily consumption of kWh by household k in bill period t

$Treatment_k$ is a binary variable taking a value of 0 if household k is assigned to the control group, and 1 if assigned to the treatment group

$ADUlag_{kt}$ is household k's energy use in the same calendar month of the pre-program year as the calendar month of month t

$Month_{jt}$ is a binary variable taking a value of 1 when j = t and 0 otherwise[18]

e_{kt} is the cluster-robust error term for household k during billing cycle t; cluster-robust errors account for heteroskedasticity and autocorrelation at the household level.[19]

The coefficient b_1 is the estimate of average daily kWh energy savings due to the program in PY6.

6.2.2 LFER Model

The simplest version of an LFER model convenient for exposition is one in which average daily consumption of kWh by household k in bill period t, denoted by ADU_{kt}, is a function of the following three terms:

1. The binary variable $Treatment_k$
2. The binary variable $Post_t$, taking a value of 0 if month t is in the pre-treatment period, and 1 if in the post-treatment period
3. The interaction between these variables, $Treatment_k \cdot Post_t$

Formally, as shown in the following equation:

$$ADU_{kt} = a_{0k} + a_1 Post_t + a_2 Treatment_k \times Post_t + e_{kt}$$

Three observations about this specification deserve comment. First, the coefficient a_{0k} captures all household-specific effects on energy use that do not change over time, including those that are unobservable. Second, a_1 captures the average effect *across all households* of being in the post-treatment

[18] In other words, if there are T post-program months, there are T monthly dummy variables in the model, with the dummy variable $Month_{tt}$ the only one to take a value of 1 at time t. These are, in other words, monthly fixed effects.

[19] Ordinary Least Squares (OLS) regression models assume that the data are homoskedastic and not autocorrelated. If either of these assumptions is violated, the resulting standard errors of the parameter estimates are incorrect (usually underestimated). A random variable is heteroskedastic when the variance is not constant. A random variable is autocorrelated when the error term in one period is correlated with the error terms in at least some of the previous periods.

period. Third, the effect of being both in the treatment group and in the post period—the effect directly attributable to the program—is captured by the coefficient a_2. In other words, whereas the coefficient a_1 captures the change in average daily kWh use across the pre- and post-treatment for the *control* group, the sum $a_1 + a_2$ captures this change for the treatment group, and so a_2 is the estimate of average daily kWh energy savings due to the program in PY6.

6.2.3 Detailed Impact Results: Parameter Estimates

For each wave in the analysis, and for each of the two regression models presented in the previous sections, Table 6-1 provides the estimate of the average daily kWh savings, and the standard error, for PY6. For the PPR model, it is the coefficient b_1 and for the LFER model, this value is the coefficient a_2.

Table 6-1. Savings Parameter Estimates

Wave	Persistence	PPR Model		LFER Model	
		Parameter Estimate	*Standard Error*	Parameter Estimate	*Standard Error*
1	CR	1.066	*0.093*	1.007	*0.095*
1	LR	1.067	*0.144*	0.949	*0.147*
1	TR	1.042	*0.147*	0.946	*0.149*
2	-	1.173	*0.299*	1.128	*0.294*
3	CR	1.316	*0.068*	1.270	*0.066*
3	LR	1.439	*0.146*	1.326	*0.143*
3	TR	1.259	*0.145*	1.208	*0.143*
4	-	0.699	*0.072*	0.585	*0.055*
5 AMI	-	0.204	*0.064*	0.174	*0.062*
5 Non-AMI	CR	1.123	*0.263*	0.941	*0.275*
5 Non-AMI	TR	0.925	*0.269*	0.807	*0.281*
6	-	0.584	*0.059*	0.629	*0.061*

Source: Navigant analysis

6.2.4 Savings Due to Participation Uplift in Other EE Programs

Table 6-2 through Table 6-13 present program savings due to participation uplift in other EE programs. Each table provides the uplift for a single program group in each of four EE programs for which estimates of deemed savings are available: the FFRR program, CSR program, MCEEP, and SFHES program. In all tables, a dash (-) in a row concerning the change in rate of participation from the pre-program year indicates the EE program did not exist for the entire pre-program year. For all cases where the EE program did not exist in the pre-program year, the estimate is based on a POD statistic, otherwise it is based on a DID statistic. Average FFRR program savings are average net verified savings. Average

CSR and SFHES program savings are ex ante savings. Average MCEEP savings are average gross verified savings.

The tables also include the percentage change in EE program participation rate for HER participants. This differs from the change in EE program participation rate for the entire EE program, which is not reported here. These rates should be interpreted with caution because they likely have very wide error bounds, many of which likely include zero. The calculation of standard errors on these rates is not straightforward and therefore, Navigant does not report them here.

Table 6-2. Estimates of Double-Counted Savings: Wave 1, CR Persistence Group

	Program			
	SFHES	CSR	FFRR	MCEEP
Average program savings (annual kWh per participant)	500	593	592	272
# HER treatment households	28,806	28,806	28,806	28,806
Rate of participation, PY6 (%)	0.06%	0.49%	1.41%	0.07%
Change in rate of participation from pre-program year (%)	-	-	0.91%	-
# HER control households	43,651	43,651	43,651	43,651
Rate of participation, PY6 (%)	0.07%	0.50%	1.42%	0.09%
Change in rate of participation from pre-program year (%)	-	-	0.90%	-
DID/POD statistic	-0.01%	0.00%	0.01%	-0.03%
Change in program participation due to HER program	-2.46	-1.20	1.65	-8.06
Statistically significant at the 90% confidence level?	No	No	No	No
Savings attributable to other programs (kWh)	-1,229	-713	979	-2,195
Percentage change in EE program participation rate for HER participants	-12%	-1%	0%	-30%

Source: Navigant analysis

Table 6-3. Estimates of Double-Counted Savings: Wave 1, LR Persistence Group

	Program			
	SFHES	CSR	FFRR	MCEEP
Average program savings (annual kWh per participant)	500	593	592	272
# HER Treatment Households	8,781	8,781	8,781	8,781
Rate of participation, PY6 (%)	0.14%	0.55%	1.57%	0.08%
Change in rate of participation from pre-program Year (%)	-	-	0.95%	-
# HER control households	43,651	43,651	43,651	43,651
Rate of participation, PY6 (%)	0.07%	0.50%	1.42%	0.09%
Change in rate of participation from pre-program Year (%)	-	-	0.90%	-
DID/POD statistic	0.07%	0.05%	0.04%	-0.01%
Change in program participation due to HER program	5.76	4.35	3.94	-1.25
Statistically Significant at the 90% Confidence Level?	Yes	No	No	No
Savings attributable to other programs (kWh)	2,882	2,579	2,334	-340
Percentage change in EE program participation rate for HER participants	92%	10%	3%	-15%

Source: Navigant analysis

Table 6-4. Estimates of Double-Counted Savings: Wave 1, TR Persistence Group

	Program			
	SFHES	CSR	FFRR	MCEEP
Average program savings (annual kWh per participant)	500	593	592	272
# HER treatment households	8,722	8,722	8,722	8,722
Rate of participation, PY6 (%)	0.13%	0.46%	1.50%	0.05%
Change in rate of participation from pre-program year (%)	-	-	1.09%	-
# HER control households	43,651	43,651	43,651	43,651
Rate of participation, PY6 (%)	0.07%	0.50%	1.42%	0.09%
Change in rate of participation from pre-program year (%)	-	-	0.90%	-
DID/POD statistic	0.06%	-0.04%	0.19%	-0.05%
Change in program participation due to HER program	4.81	-3.36	16.47	-4.19
Statistically significant at the 90% confidence level?	Yes	No	Yes	No
Savings attributable to other programs (kWh)	2,403	-1,993	9,753	-1,142
Percentage change in EE program participation rate for HER participants	78%	-8%	14%	-51%

Source: Navigant analysis

Table 6-5. Estimates of Double-Counted Savings: Wave 2

	Program			
	SFHES	CSR	FFRR	MCEEP
Average program savings (annual kWh per participant)	500	593	592	272
# HER treatment households	2,973	2,973	2,973	2,973
Rate of participation, PY6 (%)	0.03%	0.47%	1.31%	0.40%
Change in rate of participation from pre-program year (%)	-	-	0.24%	-
# HER control households	2,975	2,975	2,975	2,975
Rate of participation, PY6 (%)	0.00%	0.47%	1.48%	0.37%
Change in rate of participation from pre-program year (%)	-	-	0.77%	-
DID/POD statistic	0.03%	0.00%	-0.54%	0.03%
Change in program participation due to HER program	1.00	0.01	-15.98	1.01
Statistically significant at the 90% confidence level?	No	No	Yes	No
Savings attributable to other programs (kWh)	500	6	-9,463	274
Percentage change in EE program participation rate for HER participants	100%	0%	-29%	9%

Source: Navigant analysis

Table 6-6. Estimates of Double-Counted Savings: Wave 3, CR Persistence Group

	Program			
	SFHES	CSR	FFRR	MCEEP
Average program savings (annual kWh per participant)	500	593	592	272
# HER treatment households	176,826	176,826	176,826	176,826
Rate of participation, PY6 (%)	0.09%	0.59%	1.40%	0.03%
Change in rate of participation from pre-program year (%)	-	-	-1.23%	-
# HER control households	48,459	48,459	48,459	48,459
Rate of participation, PY6 (%)	0.07%	0.62%	1.31%	0.05%
Change in rate of participation from pre-program year (%)	-	-	-1.24%	-
DID/POD statistic	0.02%	-0.03%	0.01%	-0.01%
Change in program participation due to HER program	32.93	-47.05	26.04	-22.28
Statistically significant at the 90% confidence level?	No	No	No	No
Savings attributable to other programs (kWh)	16,467	-27,912	15,414	-6,069
Percentage change in EE program participation rate for HER participants	27%	-4%	1%	-28%

Source: Navigant analysis

Table 6-7. Estimates of Double-Counted Savings: Wave 3, LR Persistence Group

	Program			
	SFHES	CSR	FFRR	MCEEP
Average program savings (annual kWh per participant)	500	593	592	272
# HER treatment households	9,694	9,694	9,694	9,694
Rate of participation, PY6 (%)	0.11%	0.59%	1.53%	0.05%
Change in rate of participation from pre-program year (%)	-	-	-1.09%	-
# HER control households	48,459	48,459	48,459	48,459
Rate of participation, PY6 (%)	0.07%	0.62%	1.31%	0.05%
Change in rate of participation from pre-program year (%)	-	-	-1.24%	-
DID/POD statistic	0.04%	-0.03%	0.15%	0.01%
Change in program participation due to HER program	4.20	-2.81	14.23	0.60
Statistically significant at the 90% confidence level?	No	No	No	No
Savings attributable to other programs (kWh)	2,099	-1,669	8,423	163
Percentage change in EE program participation rate for HER participants	62%	-5%	11%	14%

Source: Navigant analysis

Table 6-8. Estimates of Double-Counted Savings: Wave 3, TR Persistence Group

	Program			
	SFHES	CSR	FFRR	MCEEP
Average program savings (annual kWh per participant)	500	593	592	272
# HER treatment households	9,682	9,682	9,682	9,682
Rate of participation, PY6 (%)	0.06%	0.66%	1.72%	0.05%
Change in rate of participation from pre-program year (%)	-	-	-1.22%	-
# HER control households	48,459	48,459	48,459	48,459
Rate of participation, PY6 (%)	0.07%	0.62%	1.31%	0.05%
Change in rate of participation from pre-program year (%)	-	-	-1.24%	-
DID/POD statistic	-0.01%	0.04%	0.02%	0.01%
Change in program participation due to HER program	-0.79	4.26	2.08	0.60
Statistically significant at the 90% confidence level?	No	No	No	No
Savings attributable to other programs (kWh)	-397	2,528	1,230	165
Percentage change in EE program participation rate for HER participants	-12%	7%	1%	14%

Source: Navigant analysis

Table 6-9. Estimates of Double-Counted Savings: Wave 4

	Program			
	SFHES	CSR	FFRR	MCEEP
Average program savings (annual kWh per participant)	500	593	592	272
# HER treatment households	20,378	20,378	20,378	20,378
Rate of participation, PY6 (%)	0.10%	0.48%	1.48%	0.05%
Change in rate of participation from pre-program year (%)	-	-	-0.44%	-
# HER control households	20,414	20,414	20,414	20,414
Rate of participation, PY6 (%)	0.08%	0.56%	1.45%	0.02%
Change in rate of participation from pre-program year (%)	-	-	-0.41%	-
DID/POD statistic	0.01%	-0.08%	-0.03%	0.03%
Change in program participation due to HER program	3.03	-16.80	-6.15	6.01
Statistically significant at the 90% confidence level?	No	No	No	No
Savings attributable to other programs (kWh)	1,515	-9,967	-3,639	1,637
Percentage change in EE program participation rate for HER participants	18%	-15%	-2%	120%

Source: Navigant analysis

Table 6-10. Estimates of Double-Counted Savings: Wave 5 AMI

	Program			
	SFHES	CSR	FFRR	MCEEP
Average program savings (annual kWh per participant)	500	593	592	272
# HER treatment households	60,389	60,389	60,389	60,389
Rate of participation, PY6 (%)	0.09%	0.14%	0.78%	0.45%
Change in rate of participation from pre-program year (%)	-	-	0.29%	-
# HER control households	29,795	29,795	29,795	29,795
Rate of participation, PY6 (%)	0.08%	0.08%	0.63%	0.49%
Change in rate of participation from pre-program year (%)	-	-	0.12%	-
DID/POD statistic	0.01%	0.06%	0.17%	-0.03%
Change in program participation due to HER program	4.36	34.36	102.01	-19.89
Statistically significant at the 90% confidence level?	No	Yes	Yes	No
Savings attributable to other programs (kWh)	2,178	20,384	60,389	-5,418
Percentage change in EE program participation rate for HER participants	9%	71%	27%	-7%

Source: Navigant analysis

Table 6-11. Estimates of Double-Counted Savings: Wave 5 Non-AMI, CR Persistence Group

	Program			
	SFHES	CSR	FFRR	MCEEP
Average program savings (annual kWh per participant)	500	593	592	272
# HER treatment households	9,116	9,116	9,116	9,116
Rate of participation, PY6 (%)	0.10%	0.46%	1.04%	0.12%
Change in rate of participation from pre-program year (%)	0.03%	-	-0.31%	-
# HER control households	11,545	11,545	11,545	11,545
Rate of participation, PY6 (%)	0.06%	0.35%	0.89%	0.20%
Change in rate of participation from pre-program year (%)	0.01%	-	-0.58%	-
DID/POD statistic	0.00%	0.11%	0.27%	-0.08%
Change in program participation due to HER program	2.21	10.42	24.90	-7.16
Statistically significant at the 90% confidence level?	No	No	Yes	No
Savings attributable to other programs (kWh)	1,105	6,180	14,743	-1,951
Percentage change in EE program participation rate for HER participants	33%	33%	36%	-39%

Source: Navigant analysis

Table 6-12. Estimates of Double-Counted Savings: Wave 5 Non-AMI, TR Persistence Group

	Program			
	SFHES	CSR	FFRR	MCEEP
Average program savings (annual kWh per participant)	500	593	592	272
# HER treatment households	9,043	9,043	9,043	9,043
Rate of participation, PY6 (%)	0.02%	0.31%	0.79%	0.13%
Change in rate of participation from pre-program year (%)	-0.01%	-	-0.81%	-
# HER control households	11,545	11,545	11,545	11,545
Rate of participation, PY6 (%)	0.06%	0.35%	0.89%	0.20%
Change in rate of participation from pre-program year (%)	0.01%	-	-0.58%	-
DID/POD statistic	0.00%	-0.04%	-0.23%	-0.07%
Change in program participation due to HER program	-1.78	-3.33	-20.52	-6.02
Statistically significant at the 90% confidence level?	Yes	No	Yes	No
Savings attributable to other programs (kWh)	-892	-1,976	-12,148	-1,639
Percentage change in EE program participation rate for HER participants	-47.14%	-10.63%	-22.42%	-33.39%

Source: Navigant analysis

Table 6-13. Estimates of Double-Counted Savings: Wave 6

	Program			
	SFHES	CSR	FFRR	MCEEP
Average program savings (annual kWh per participant)	500	593	592	272
# HER treatment households	102,177	102,177	102,177	102,177
Rate of participation, PY6 (%)	0.09%	0.48%	1.39%	0.12%
Change in rate of participation from pre-program year (%)	-0.01%	0.16%	-0.06%	-0.07%
# HER control households	30,673	30,673	30,673	30,673
Rate of participation, PY6 (%)	0.05%	0.41%	1.28%	0.09%
Change in rate of participation from pre-program year (%)	-0.04%	0.06%	-0.08%	-0.08%
DID/POD statistic	0.00%	0.00%	0.03%	0.00%
Change in program participation due to HER program	29.97	100.71	28.61	12.61
Statistically significant at the 90% confidence level?	Yes	Yes	Yes	No
Savings attributable to other programs (kWh)	14,987	59,750	16,937	3,435
Percentage change in EE program participation rate for HER participants	48%	26%	2%	11%

Source: Navigant analysis