



ComEd Home Energy Report Program Evaluation Report

FINAL
Energy Efficiency / Demand Response Plan:
Plan Year 8 (PY8)
(6/1/2015-5/31/2016)

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E. EXECUTIVE SUMMARY

This report presents a summary of the findings and results from the impact evaluation of the Opower portion of the Commonwealth Edison Company (ComEd) PY8¹ Home Energy Report (HER) program. The program is designed to generate energy savings by providing residential customers with information about energy use and energy conservation. Program participants received information in the form of regularly mailed and emailed² home energy reports that gave customers various information, including the following:

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

The design of the program did not change in PY8, but the enrollment configuration did. First, ComEd added a new wave (Wave 8 in this report) with approximately 81,679 customers in July 2015. Second, the New Mover Wave, which consists of customers who moved into their home just one month before receiving their first report, was added to the program in September 2014 and was evaluated for the first time in PY8.

E.1. Program Savings

Table E-1 summarizes the electricity savings from the HER program. Savings estimated by the implementation contractor, Opower, were 258,837 MWh. Verified savings prior to uplift were 254,696 MWh. After adjusting for uplift from other energy efficiency programs (see Section 2.5), final verified savings were 252,036 MWh. The evaluation team calculated savings using regression analysis of monthly billing data comparing participants to a matched set of nonparticipants. As discussed in Section 4, this type of analysis estimates net savings and no further net-to-gross (NTG) adjustment is necessary.

Table E-1. PY8 Total Program Electric Savings

Savings Category	Energy Savings (MWh)
Implementer Estimated Savings †	258,837
Verified Net Savings, Prior to Uplift Adjustment	254,696
Final Verified Net Savings	252,036
Realization Rate	97%

Source: ComEd data and Navigant team analysis.

† This estimate comes from the implementation contractor's ex-post analysis of the program.

The program realization rate compared to the savings estimated by the implementer was 97 percent. The uplift adjustment resulted in a one percent change in the net savings which is not accounted for in the implementer's savings estimate. The remaining two percent difference in the realization rate was likely due to small differences in the regression models used by Navigant and the implementer.

¹ The PY8 program year began June 1, 2015 and ended May 31, 2016.

² The frequency of reports sent through direct mail varied across the waves where customers identified by the program implementer as having a greater propensity to save received more frequent reports. Additionally, treatment customers with email addresses on file were sent monthly electronic reports.

E.2. Program Savings by Participant Wave

For the purposes of this report, Navigant characterizes the Opower portion of the HER program in the following nine waves:

1. A pilot program targeting 50,000 residential customers kicked off in July 2009 (Wave 1).
2. A wave of about 3,000 customers (Wave 2) targeted for program enrollment started 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 started in January 2012 (Wave 4).
5. A third fill-in wave of 20,000 customers introduced in July 2012 (Wave 5).³
6. A fourth fill-in of 10,000 customers and a major expansion targeting 90,000 customers began in June 2013 (Wave 6).
7. A “tsunami” wave of 1.2 million customers began in June 2014; this wave was split into two groups based on usage (Wave 7 Low and Wave 7 High).
8. A wave targeting customers who had just moved into a new home, this wave first started in September 2014 and was evaluated for the first time in PY8 (New Mover Wave).⁴
9. An expansion of 81,679 customers added to the program in July 2016 (Wave 8).

To examine the persistence of savings, reports for 10,000 customers within both Waves 1 and 3 were terminated beginning in October 2012 and restarted in August 2013; these customers are referred to as the Waves 1 and 3 lapsed report (LR) subgroups. In October 2013, ComEd chose 10,000 customers each in Waves 1, 3, and 5 for HER termination; these customers did not receive any reports in PY8 and are therefore not included in this report.⁵ Customers in Waves 1 and 3 who continued to receive reports are referred to as the continued report (CR) subgroup. This report only includes customers in Wave 5 who continued to receive reports as there was no LR subgroup and thus no qualifier is needed.

Table E-2 summarizes estimated program savings by participant wave. In this table, the number of PY8 participants, in the first row, represents the number of customers with an active ComEd account on the first day of PY8, while the sample sizes, in the second and third rows, indicate the number of customers with sufficient data for inclusion in the regression analysis. Across all waves, there were approximately two million participants for whom savings were calculated. Navigant estimated separate savings for each wave and subgroup (for example, Wave 1 CR) using regression analysis as described in Section 2.4. Navigant estimated savings for the New Mover Wave in two parts: for customers who started in the program before PY8 (New Mover Full) and for customers who started during PY8 (New Mover Partial). Splitting this wave into two parts allows for the examination of how savings for this wave change with length of time a recipient has been receiving the reports. The weighted average per customer savings estimate across all the waves was 1.45 percent (or 156.91 kWh annually).

³ This wave has been referred to as Wave 5 Non-AMI in previous reports, but as Wave 5 AMI has been dropped from the program this distinction is no longer necessary.

⁴ The New Mover Wave is made up of 21 groups of customers who received their first report in the same month (for example, customers who received their first report in September 2014 were one group, and customers who received their first report in March 2015 were another). Navigant estimated the impact for the New Mover Wave in two parts: for customers who started before PY8 and for customers who started during PY8.

⁵ The persistence of savings for these three terminated subgroups is the subject of a separate study. See: Navigant. 2016. *ComEd Home Energy Report Program Decay Rate and Persistence Study – Year 2*. Presented to Commonwealth Edison Company.

http://ilsagfiles.org/SAG_files/Evaluation_Documents/Draft%20Reports%20for%20Comment/ComEd_EPY7/ComEd_HER_Year_Two_Persistence_and_Decay_Study_2016-07-20_Draft.pdf

Table E-2. PY8 HER Program Results by Wave

Type of Statistic	Wave 1 CR	Wave 1 LR	Wave 2	Wave 3 CR	Wave 3 LR	Wave 4	Wave 5	Wave 6	Wave 7 Low	Wave 7 High	New Mover Full	New Mover Partial	Wave 8	Total
Number of PY8 Participants	20,994	6,464	2,187	142,081	7,749	16,673	11,896	81,591	543,816	559,279	102,465	143,735	81,679	1,720,609
Sample Size - Treatment	18,320	5,648	1,343	125,951	6,897	14,840	9,023	64,607	457,418	470,324	88,419	116,223	74,210	1,453,223
Sample Size - Control	27,715		1,362	34,449		15,012	5,779	19,713	38,245	39,223	22,165	29,025	9,920	242,608
% Savings	2.9%	2.5%	1.8%	2.6%	2.7%	2.7%	1.5%	2.0%	1.0%	1.8%	0.7%	0.8%	0.9%	1.45%
<i>Standard Error</i>	<i>0.3%</i>	<i>0.4%</i>	<i>1.1%</i>	<i>0.2%</i>	<i>0.4%</i>	<i>0.3%</i>	<i>0.6%</i>	<i>0.2%</i>	<i>0.1%</i>	<i>0.1%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>-</i>
Annualized Savings Per Customer, kWh †	399.02	351.55	241.72	455.36	478.11	308.16	310.49	307.23	61.19	174.65	62.20	76.35	100.40	156.91
<i>Standard Error</i>	39.39	60.11	153.99	28.70	62.65	31.14	114.85	31.95	7.77	11.08	27.71	29.64	29.98	<i>-</i>
Verified Gross Savings, Prior to Uplift Adj., MWh	8,137	2,200	511	62,809	3,583	4,987	1,754	23,892	31,289	92,856	4,821	10,576	7,282	254,696
<i>Standard Error</i>	<i>803</i>	<i>376</i>	<i>325</i>	<i>3,958</i>	<i>470</i>	<i>504</i>	<i>649</i>	<i>2,485</i>	<i>3,972</i>	<i>5,890</i>	<i>2,147</i>	<i>4,105</i>	<i>2,174</i>	<i>-</i>
Savings Uplift in other EE Programs, MWh ‡	8	3	4	43	20	11	9	31	52	688	78	92	10	1,049
Legacy Uplift in Other EE Programs, MWh ‡	152	150	3	541	19	20	39	112	85	490	-	-		1,611
Verified Gross Savings, MWh §	7,977	2,047	504	62,225	3,545	4,956	1,706	23,749	31,151	91,678	4,743	10,483	7,271	252,036

Source: ComEd data and Navigant team analysis.

† Total savings are pro-rated for participants that closed their accounts during PY8.

‡ No adjustment was made to total savings for negative uplift, i.e. cases where the HER program decreased participation in other programs.

§ Final Verified Net Savings are equal to Verified Net Savings, Prior to Uplift Adjustment less the uplift of savings in other EE programs.

E.3. Findings and Recommendations

The following includes program findings and recommendations.⁶ Across all waves, there were approximately 1.75 million participants for whom savings were calculated. Total verified savings for PY8 were 254,696 MWh prior to uplift and 252,036 MWh after the uplift adjustment.

Finding 1. From PY7 to PY8, the program average savings rate increased from 1.13 percent to 1.45 percent. Waves 7 High and Low, which together comprise about two-thirds of the participants in the program, saw particularly large increases in savings from PY7 to PY8. Both waves came close to doubling their savings rate from PY7 to PY8 which put these groups closer to expectations based on the performance of other waves. However, the second year savings rate for Wave 7 Low is still low compared to the other waves which may be due to the low average daily usage of Wave 7 Low. If that relationship holds, then it is possible that the New Mover Wave and Wave 8 could also experience lower savings rates as their average daily usage is also lower than many of the prior waves.

Finding 2. Given that high usage customers tend to save more energy and most of ComEd's high usage customers are already involved in the HER program, moving some existing control customers into new treatment groups might allow ComEd to add more high usage customers as participants in the HER program. Waves 1 and 3 in particular have higher ratios of treatment to control customers than the newer waves. As a proof of concept, Navigant ran a preliminary power analysis and found that if 10,000 customers in the control group for Wave 1 were randomly selected to be placed into a new treatment wave, the new wave and the existing CR and LR persistence subgroups in Wave 1 would each have statistically significant savings estimates at the 90 percent level.

Recommendation 1. ComEd should consider the feasibility of adding higher usage customers to the HER program by transferring customers from existing control groups, such as in Waves 1 and 3, into new treatment groups as participants. ComEd and the implementation contractor should first review the statistical significance for both the new and old waves prior to transferring customers.

⁶ Numbered findings and recommendations in this section are the same as those found in the Findings and Recommendations section of the evaluation report for ease of reference between each section.

1. INTRODUCTION

1.1 Program Description

This report presents a summary of the findings and results from the impact evaluation of the Opower portion of the Commonwealth Edison Company (ComEd) PY8⁷ Home Energy Report (HER) program. The program is designed to generate energy savings by providing residential customers with information about customer energy use and energy conservation. Program participants received information in the form of regularly mailed and emailed⁸ home energy reports that gave customers various information, including the following:

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

An important feature of the HER program is that it is a randomized controlled trial (RCT). Customers eligible for the program were randomly assigned to a treatment (participant) group or control (non-participant) group for the purpose of estimating changes in energy use due to the program. In this design, the treatment group received the home energy reports and the control group did not.

For the purposes of this report, Navigant characterizes the Opower portion of the HER program in the following nine waves:

1. A pilot program targeting 50,000 residential customers kicked off in July 2009 (Wave 1).
2. A wave of about 3,000 customers (Wave 2) targeted for program enrollment started 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 started in January 2012 (Wave 4).
5. A third fill-in wave of 20,000 customers introduced in July 2012 (Wave 5).⁹
6. A fourth fill-in of 10,000 customers and a major expansion targeting 90,000 customers began in June 2013 (Wave 6).
7. A "tsunami" wave of 1.2 million customers began in June 2014; this wave was split into two groups based on usage (Wave 7 Low and Wave 7 High).
8. A wave targeting customers who had just moved into a new home, this wave first started in September 2014 and was evaluated for the first time in PY8 (New Mover Wave).¹⁰
9. An expansion of 81,679 customers added to the program in July 2016 (Wave 8).

To examine the persistence of savings, reports for 10,000 customers within both Waves 1 and 3 were terminated beginning in October 2012 and restarted in August 2013; these customers are referred to as the Waves 1 and 3 lapsed report (LR) subgroups. In October 2013, ComEd chose 10,000 customers each in Waves 1, 3, and 5 for HER termination; these customers did not receive any reports in PY8 and

⁷ The PY8 program year began June 1, 2015 and ended May 31, 2016.

⁸ The frequency of reports sent through direct mail varied across the waves where customers identified by the program implementer as having a greater propensity to save received more frequent reports. Additionally, treatment customers with email addresses on file were sent monthly electronic reports.

⁹ This wave has been referred to as Wave 5 Non-AMI in previous reports, but as Wave 5 AMI has been dropped from the program this distinction is no longer necessary.

¹⁰ The New Mover Wave is made up of 21 groups of customers who received their first report in the same month (for example, customers who received their first report in September 2014 were one group, and customers who received their first report in March 2015 were another). Navigant estimated the impact for the New Mover Wave in two parts: for customers who started before PY8 and for customers who started during PY8.

are therefore not included in this report.¹¹ Customers in Waves 1 and 3 who continued to receive reports are referred to as the continued report (CR) subgroup. This report only includes customers in Wave 5 who continued to receive reports as there was no LR subgroup and thus no qualifier is needed.

The rollout of the nine waves is summarized in Table 1-1. Navigant estimated savings for the New Mover Wave in two parts: for customers who started in the program before PY8 (New Mover Full) and for customers who started during PY8 (New Mover Partial). As shown in the rightmost column, daily electricity usage varied widely across the different waves. Wave 7 Low had the lowest usage at 17 kilowatt-hours (kWh) per day and Wave 5 had the highest at 56 kWh per day. Figure 1-1 provides a graphical depiction of average daily usage levels by wave.

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 PY8 (kWh)
1	CR	July 2009	-	-	50,000	50,000	36.74
1	LR	July 2009	August 2012	August 2013	10,000	50,000	36.69
2	-	September 2010	-	-	3,000	3,000	35.41
3	CR	May 2011	-	-	200,000	50,000	46.47
3	LR	May 2011	August 2012	August 2013	10,000	50,000	46.40
4	-	January 2012	-	-	20,000	20,000	30.61
5	-	July 2012	-	-	20,000	20,000	55.93
6	-	June 2013	-	-	100,000	30,000	41.10
7 Low	-	June 2014	-	-	600,000	50,000	16.73
7 High	-	June 2014	-	-	600,000	50,000	26.33
New Mover Full	-	Rolling starting in September 2014	-	-	NA	NA	25.06
New Mover Partial	-	Rolling starting in June 2016	-	-	NA	NA	24.95
8	-	July 2015	-	-	75,000	10,000	30.95

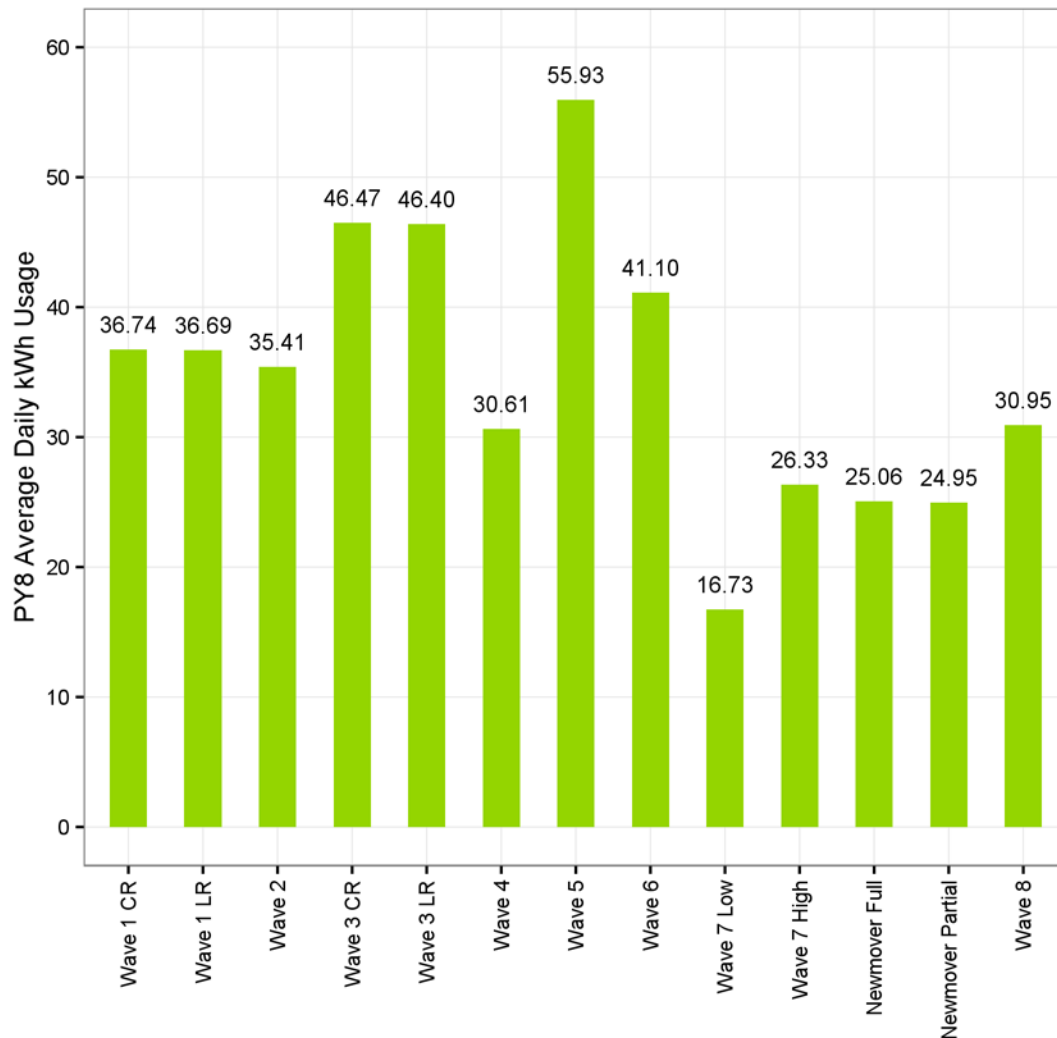
Source: ComEd data and Navigant team analysis.

†This is the month of the "RCT start date" in the Opower dataset when a wave was initiated. Participants likely received their first report approximately one month after this date.

‡These numbers are the targeted numbers for each wave. The actual number of participants and control customers at the start of PY8 is used in this evaluation.

¹¹ The persistence of savings for these three terminated subgroups is the subject of a separate study. See: Navigant. 2016. *ComEd Home Energy Report Program Decay Rate and Persistence Study – Year 2*. Presented to Commonwealth Edison Company. http://ilsagfiles.org/SAG_files/Evaluation_Documents/Draft%20Reports%20for%20Comment/ComEd_EPY7/ComEd_HER_Year_Two_Persistence_and_Decay_Study_2016-07-20_Draft.pdf

Figure 1-1. PY8 Average Daily Usage by Wave



Source: ComEd data and Navigant team analysis.

1.2 Evaluation Objectives

The primary objective of the analysis in this report is to determine the extent to which participants in the PY8 HER program reduced their energy consumption. A secondary objective is to evaluate how program savings have changed over time.

2. EVALUATION APPROACH

The evaluation approach in PY8 was consistent with that of the evaluations in previous years, relying on statistical analysis appropriate for RCTs. Navigant estimated program impacts using two approaches applied to monthly billing data: a post-program regression (PPR) analysis with lagged controls and a linear fixed-effects regression (LFER) analysis.

2.1 Overview of Data Collection Activities

The core data collection activities included receiving billing and tracking data for the HER program, receiving tracking data for the other programs used in the uplift analysis, and conducting interviews with program and implementation staff. The full set of data collection activities is shown in Table 2-1.

Table 2-1. Primary Data Collection Activities

What	Who	Target Completes	Completes Achieved	When
HER Program Tracking Database	Participants and Controls	-	-	May 2016
HER Program Billing Database	Participants and Controls	-	-	July 2008 - May 2016
Other Program Tracking Database	Participants and Controls	-	-	July 2008 - May 2016
In Depth Interviews	Program Manager/Implementer Staff	1	1	June 2016

2.2 Consistency of New Mover Wave with RCT

The New Mover Wave was analyzed for the first time in PY8. To test the consistency of this wave with an RCT, Navigant examined customers in groups who started receiving reports in the same month and year. This created 21 groups that covered the time period from September 2014 to May 2016. Testing for consistency with an RCT requires using pre-program data to verify that energy usage is similar for the treatment and control groups. Since the customers in the New Mover Wave moved into their home just one month before receiving their first home energy report, pre-program data was not available for these customers. Instead Navigant obtained usage data for the home's prior occupant during the pre-program period. The prior occupant usage was used in the RCT check and in the regression models described in the next section.

For each group, Navigant compared the monthly energy usage of the prior occupant for the treatment and control groups during the twelve-month period prior to the start of each group.¹² If the allocation of households across the treatment and control groups was truly random, the two groups should have the same distribution of energy usage for each of the twelve months before the start of the program. To check this, Navigant compared the mean energy usage for each of the twelve months before the start of each monthly group. Graphs of the mean usage for each of the 21 monthly groups are included in Section 6.1 of the appendix. As an additional check, Navigant conducted a regression analysis in which average daily usage in the pre-program period was a function of monthly binary variables and a binary participation variable.

The results of these analyses indicated that the allocation of program households across the treatment and control groups was consistent with an RCT design for each of the groups. In light of these results,

¹² For example, for the September 2013 group, the twelve-month pre period was September 2013 to August 2014.

Navigant used statistical methods appropriate for use with RCTs to quantify the energy savings for the New Mover Wave as detailed in the following sections.

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 1,720,609 treatment customers and 286,732 controls. Data during the twelve-month pre-period for each wave and during PY8 was used in the regression analysis for each of the two models as described in Section 2.4.

Navigant removed customers and data points from the analysis in the following steps:

- Observations outside the analysis period which was PY8 and the relevant pre-program year for each wave.
- Observations with a bill duration of zero days.
- Customers with an active account and less than 11 bills or any customer with more than 13 bills in either PY8 or the pre-program year.¹³
- Observations with missing or negative usage.
- Observations with less than 20 or more than 40 days in the billing cycle.
- Outliers, defined as observations with average daily usage more than one order of magnitude from the median usage.¹⁴

Detailed counts of the customers and observations removed by wave are included in Section 6.1 of the appendix.

2.4 Statistical Models Used in the Impact Evaluation

Navigant estimated program impacts using two approaches applied to monthly billing data: a post-program regression (PPR) analysis with lagged controls and a linear fixed-effects regression (LFER) analysis. Navigant used the PPR results for reporting total program savings for PY8 but ran both models as a robustness check.¹⁵ 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.

The PPR model combines both cross-sectional and time-series data in a panel format. It uses post-program data as the dependent variable, with lagged energy use from 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 format. The regression essentially compares pre- and post-program billing data for participants and controls to identify the program's effect. 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 or the

¹³ Due to limitations in the New Mover wave, there was no lower limit in the number of bills customers were required to have for inclusion in the model. Similarly, Wave 8 customers were required to have at least eight bills in PY8 and six pre-period bills to be included in the model.

¹⁴ Median usage was calculated by Wave. Chronologically by wave, median daily kWh usages were 33.60, 32.40, 45.10, 30.60, 50.80, 38.30, 15.90 (Low), 25.40 (High), 19.60 (Full), 19.00 (Partial), and 27.30.

¹⁵ Navigant prefers to report out the PPR model 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.

home's physical location. The fixed effect represents an attempt to control for small, systematic differences between treatment and control customers that might occur due to chance.

Section 6.3 in the Appendix presents the details specifications of the PPR and LFER models used in the analysis.

2.5 Accounting for Uplift in Other Energy Efficiency Programs

2.5.1 Accounting for Uplift in PY8

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 treatment and control groups, the savings estimates from the regression analyses are already “net” of savings from other programs as this indicates the HER program does not increase or decrease participation in 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.¹⁶ Note that when the HER program decreases participation in other programs there is no issue of double-counting and thus no adjustment to the savings total is made.

Data permitting, Navigant uses a difference-in-difference (DID) statistic to estimate uplift in other EE programs. To calculate the DID statistic, the change in the participation rate in another EE program between PY8 and the pre-program year for the control group is subtracted from the same change for the treatment group. For instance, if the rate of participation in an EE program during PY8 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 in Equation 2-1.

Equation 2-1. DID Statistic Calculation

$$\begin{aligned} & (PY8 \text{ treatment group participation} - \text{prePY treatment group participation}) \\ & - (PY8 \text{ control group participation} - \text{prePY control group participation}) \\ & = DID \text{ statistic} \\ & (5\% - 2\%) - (3\% - 1\%) = 1\% \end{aligned}$$

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 residence's square footage.

An alternative to the DID statistic is the post-only difference (POD) statistic, which is the simple difference in participation rates between the treatment and control groups during PY8. The POD statistic 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. Navigant uses this alternative statistic in cases where the EE program did not exist in the pre-program year.

Navigant examined the uplift associated with four EE programs: the Fridge and Freezer Recycling (FFR) program, the Home Energy Assessment (HEA) program, the Home Energy Rebates (Rebate) program, and the Multi-Family Energy Savings Program (MESp). The FFR program achieves energy savings through retirement and recycling of older, inefficient refrigerators, freezers, and room air conditioners. The HEA program is offered jointly with the local gas utilities and achieves savings by providing direct

¹⁶ It is not possible to avoid double counting of savings generated by programs for which tracking data are not available, such as upstream lighting programs.

installation of low-cost efficiency measures for single family homes, such as CFLs and low-flow showerheads. The Rebate program offers weatherization and incentives to residential customers to encourage customer purchases of higher efficiency heating, ventilating, and air-conditioning (HVAC) equipment. The MESP offers direct installation of low-cost efficiency measures, such as water efficiency measures and 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 and 3.

2.5.2 Accounting for Legacy Uplift

The uplift adjustment methodology described in Section 2.5.1 only accounts for uplift which occurs in the current program year because EE program tracking files in any given program year only capture the new measures installed in that year, regardless of the expected measure life.¹⁷ However, for other EE programs that include measures with multi-year measure lives, HER program savings capture the portion of their savings due to uplift in each year of that program's measure life. For instance, a measure with a ten-year measure life that was installed in PY2 would generate savings captured in the HER program savings not just in PY2, but in PY3 through PY11 as well.

Consider the following example. A household receiving home energy reports through the HER program enrolls in the FFR program in PY6. The uplift adjustment subtracts FFR PY6 program savings to avoid double counting. In PY7 this household still receives savings from the FFR program because it has an eight-year measure life. However, the PY7 HER uplift adjustment does not remove these savings because the PY7 adjustment only accounts for measures installed in PY7, the initial year that the household entered a program. Thus, when only relying on the uplift adjustment described in Section 2.5.1, FFR second year savings would be included in the PY7 HER program's savings, which is inconsistent with Illinois's practice of only crediting utilities with first-year EE program savings. Legacy uplift removes double counted energy savings from programs that include measures with a multiple-year measure life.

Navigant accounts for legacy uplift by subtracting the double counted savings from previous years, adjusted for the average annual move-out rate, from PY8 HER savings through the measure lives of measures from other EE programs.¹⁸ The legacy uplift adjustment is shown in Equation 2-2.

Equation 2-2. Legacy Uplift Calculation

$$\text{HER Savings}_{\text{PY}}^{\text{Adjusted}} = \text{HER Savings}_{\text{PY}}^{\text{Unadjusted}} - \text{Uplift Savings}_{\text{PY}} - \sum_{i=1}^{\text{PY}-1} \text{"Live" Legacy Uplift Savings}_i \cdot (1 - \text{MOR})^{\text{PY} - i}$$

Where, "Live" Legacy Uplift Savings" refers to uplift savings where the other EE programs' measure lives have not yet run out (i.e., where measure life exceeds the difference between PY and i) and MOR refers to the move out rate.

The legacy uplift adjustment goes back to PY4 when Navigant first considered uplift for the HER program. In PY4, Navigant considered double-counted savings for the Fridge Freezer Recycle Rewards (FFRR), the Central Air Conditioning Efficiency Services (CACES), and the Single Family Home Performance (SFHP) programs. In PY5, Navigant considered double-counted savings for the FFRR, the CSR, the Clothes Washer Rebate (CW), the Multi-Family Home Energy Savings (MF), and the Single Family Home Energy Savings (SFHES) programs. The same programs were considered in PY6, with the exception of

¹⁷ Tracking data files are set-up this way because, in conformity the Illinois Technical Reference Manual Section 3.2, savings are first-year savings, not lifetime savings.

¹⁸ Since HER program participants are dropped from that program when they move, other EE programs' savings are no longer captured in the HER program savings from that point forward.

the CW program which was discontinued. In PY7 Navigant considered double-counted savings for the same four programs as PY8: the FFR program, the HEA program, the Rebate program, and MESP.

2.6 Process Evaluation

The PY8 HER program evaluation did not include a process evaluation.

3. GROSS IMPACT EVALUATION

Total program savings are summarized in Table 3-1 below. The reported savings from the implementation contractor were 258,837 MWh. Verified savings, prior to uplift, were 254,696 MWh. Of that total, 1,049 MWh was due to PY8 uplift in other EE programs and 1,611 was due to legacy uplift, resulting in final verified savings of 252,036 MWh for PY8. This is a final verified realization rate of 97 percent. The uplift adjustment resulted in a one percent change in the net savings which is not accounted for in the implementer's savings estimate. The remaining two percent difference in the realization rate was likely due to small differences in the regression models used by Navigant and the implementer.

Table 3-1. PY8 Total Program Electric Savings

Savings Category	Energy Savings (MWh)
Implementer Estimated Savings†	258,837
Verified Net Savings, Prior to Uplift Adjustment	254,696
Final Verified Net Savings	252,036
Realization Rate	97%

Source: ComEd data and Navigant team analysis.

† This estimate comes from the implementation contractor's ex-post analysis of the program.

3.1 PPR and LFER Model Parameter Estimates

The PPR and LFER models generated very similar results for program savings estimates. Navigant used the PPR results for reporting PY8 total program savings. Across the two models, the parameter estimates are not statistically different; that is, the estimates for each model are within the 90 percent confidence bounds for the other model. Furthermore, the pattern across the different program waves between the two models is very similar. Section 6.4 includes detailed estimate information for each wave and model.

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: 2,660 MWh, or 1.0 percent. The uplift can be broken down into uplift in PY8 and legacy uplift from previous program years. The PY8 uplift was 1,049 MWh or 0.41 percent of total program savings and the legacy uplift was 1,611 MWh or 0.63 percent of total program savings. Table 3-2 shows how the uplift adjustment affects total savings.

Table 3-2. PY8 Uplift Adjustment

Savings Category	Energy Savings (MWh)
Verified Net Savings, Prior to Uplift Adjustment	254,696
PY8 Uplift Adjustment	1,049
Legacy Uplift Adjustment	1,661
Final Verified Net Savings	252,036

Source: ComEd data and Navigant team analysis.

Subtracting the savings uplift from total savings (254,696 MWh) generates a final savings estimate of 252,036 MWh. To put this in perspective, across all waves the weighted average percentage savings for PY8 due to the HER program was 1.45 percent, and removing the savings uplift in other EE programs reduces this value to 1.44 percent.¹⁹

Section 6.5 in the appendix presents the details of the calculation of the PY8 and legacy uplift for each of the four ComEd EE programs considered in the analysis. As previously mentioned, the programs included in the uplift analysis were the FFR program, the HEA program, the Rebate program and the MESP.²⁰

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 PY8. Under the more reasonable assumption that participation occurs at a uniform rate throughout the year, the estimate of double-counted savings would be approximately 1,330 MWh, half the estimated value of 2,660 MWh. The upshot is that double counting of savings with other ComEd EE programs does not appear to be a significant issue for the HER program.

3.3 Verified Program Impact Results

Table 3-3 summarizes estimated program savings by participant wave. In this table, the number of PY8 participants, in the first row, represents the number of customers with an active ComEd account on the first day of PY8, while the sample sizes, in the second and third rows, indicate the number of customers with sufficient data for inclusion in the regression analysis. The weighted average per customer savings estimate across all the waves was 1.45 percent (or 156.91 kWh annually).

¹⁹ Multiplying 1.45 percent (the percentage of total energy use saved) by 1.0 percent (the percentage of total savings uplift in other EE programs) generates the value 0.015 percent. Formally, as shown in the following calculation: $0.0145 \times 0.010 = 0.00015$. Subtracting this value from 0.0145 gives 0.0144, or 1.44 percent.

²⁰ 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.

Table 3-3. PY8 HER Program Results, by Wave

Type of Statistic	Wave 1 CR	Wave 1 LR	Wave 2	Wave 3 CR	Wave 3 LR	Wave 4	Wave 5	Wave 6	Wave 7 Low	Wave 7 High	New Mover Full	New Mover Partial	Wave 8	Total
Number of Participants	20,994	6,464	2,187	142,081	7,749	16,673	11,896	81,591	543,816	559,279	102,465	143,735	81,679	1,720,609
Sample Size - Treatment	18,320	5,648	1,343	125,951	6,897	14,840	9,023	64,607	457,418	470,324	88,419	116,223	74,210	1,453,223
Sample Size - Control	27,715		1,362	34,449		15,012	5,779	19,713	38,245	39,223	22,165	29,025	9,920	242,608
% Savings	2.9%	2.5%	1.8%	2.6%	2.7%	2.7%	1.5%	2.0%	1.0%	1.8%	0.7%	0.8%	0.9%	1.45%
<i>Standard Error</i>	<i>0.3%</i>	<i>0.4%</i>	<i>1.1%</i>	<i>0.2%</i>	<i>0.4%</i>	<i>0.3%</i>	<i>0.6%</i>	<i>0.2%</i>	<i>0.1%</i>	<i>0.1%</i>	<i>0.3%</i>	<i>0.3%</i>	<i>0.3%</i>	-
Annualized Savings Per Customer, kWh †	399.02	351.55	241.72	455.36	478.11	308.16	310.49	307.23	61.19	174.65	62.20	76.35	100.40	156.91
<i>Standard Error</i>	39.39	60.11	153.99	28.70	62.65	31.14	114.85	31.95	7.77	11.08	27.71	29.64	29.98	-
Verified Gross Savings, Prior to Uplift Adj., MWh	8,137	2,200	511	62,809	3,583	4,987	1,754	23,892	31,289	92,856	4,821	10,576	7,282	254,696
<i>Standard Error</i>	<i>803</i>	<i>376</i>	<i>325</i>	<i>3,958</i>	<i>470</i>	<i>504</i>	<i>649</i>	<i>2,485</i>	<i>3,972</i>	<i>5,890</i>	<i>2,147</i>	<i>4,105</i>	<i>2,174</i>	-
Savings Uplift in other EE Programs, MWh ‡	8	3	4	43	20	11	9	31	52	688	78	92	10	1,049
Legacy Uplift in Other EE Programs, MWh ‡	152	150	3	541	19	20	39	112	85	490	-	-		1,611
Verified Gross Savings, MWh §	7,977	2,047	504	62,225	3,545	4,956	1,706	23,749	31,151	91,678	4,743	10,483	7,271	252,036

Source: ComEd data and Navigant team analysis.

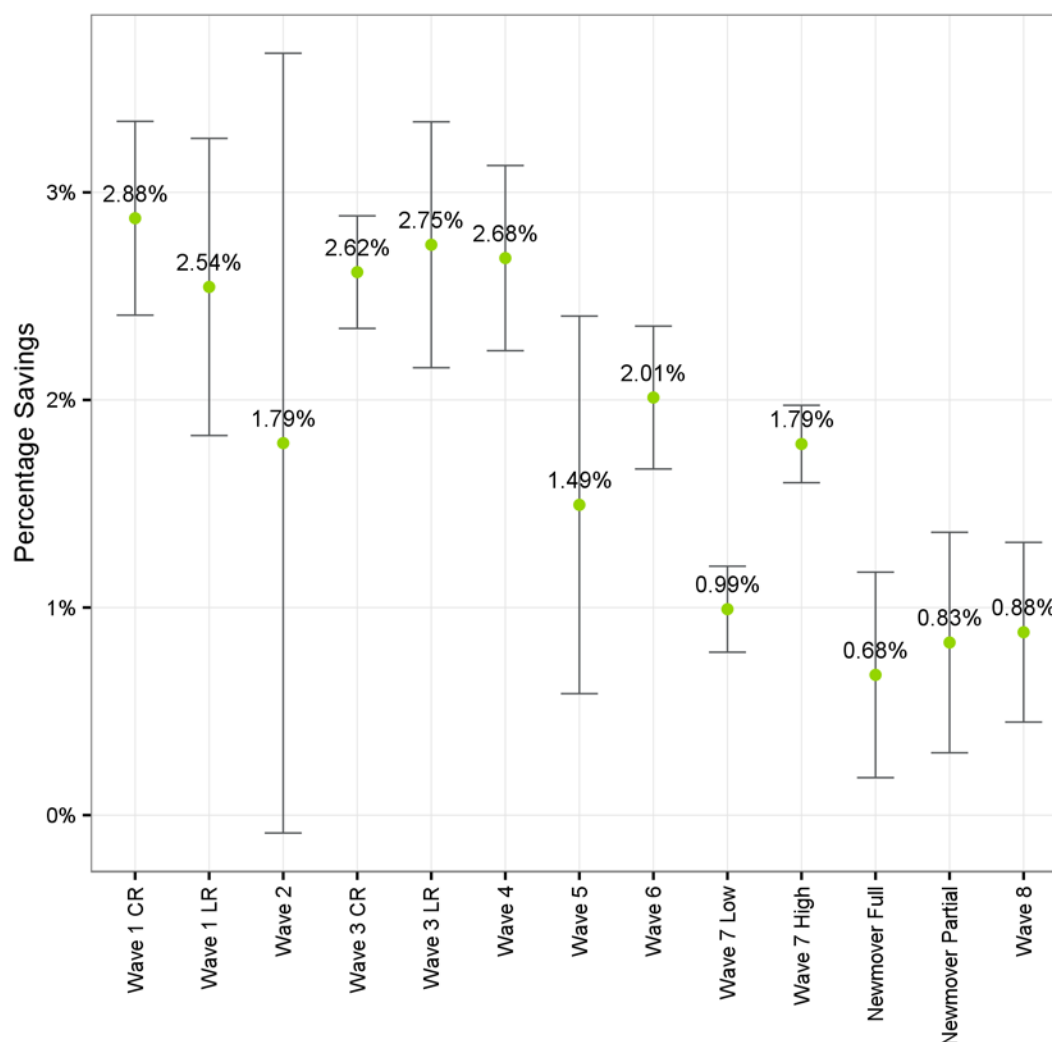
† Total savings are pro-rated for participants that closed their accounts during PY8.

‡ No adjustment was made to total savings for negative uplift, i.e. cases where the HER program decreased participation in other programs.

§ Final Verified Net Savings are equal to Verified Net Savings, Prior to Uplift Adjustment less the uplift of savings in other EE programs.

Figure 3-1 shows the energy savings for each wave with the 90 percent confidence interval. Waves with larger confidence bounds mostly had smaller sample sizes, which reduces the level of certainty for percent savings estimates. For example, Wave 2 had a sample size of 1,343 participants and 1,362 controls and large confidence bounds, while Wave 7 Low had 457,418 participants and 38,245 controls and small confidence bounds.

Figure 3-1. PY8 Percent Savings and 90 Percent Confidence Interval, by Wave



Source: ComEd data and Navigant team analysis.

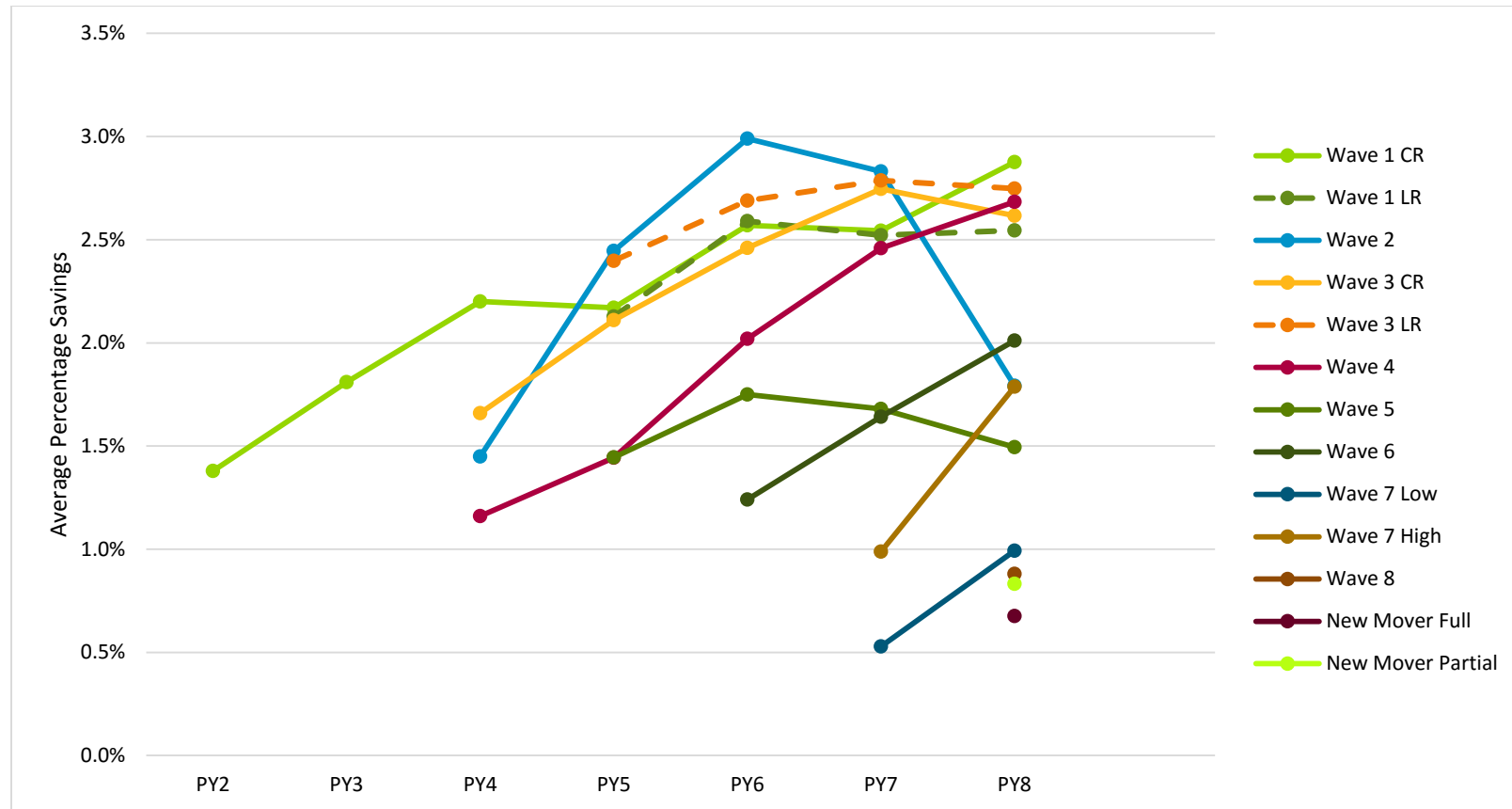
Figure 3-2 combines PY8 results with those from previous years to show how the estimated percentage savings have changed over multiple program years for each wave. With a few exceptions, such as Wave 2 from PY6 to PY8, savings each year have increased relative to the previous program year.

Wave 1 CR and LR customers had almost the exact same savings in PY5, PY6, and PY7, but diverged in PY8 with the LR group falling relative to the CR group. 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.

From PY7 to PY8, savings rates went up in each wave except Wave 2 and Wave 3 CR. Waves 7 High and Low, which are relatively large, saw particularly large savings increases from PY7 to PY8, which likely led to a higher PY8 average savings rate compared to PY7. In fact, the increase in the program savings rate from 1.13 percent in PY7 to 1.45 percent in PY8 was largely due to the almost 100% growth in savings for the two Wave 7 usage groups. These increases put Wave 7 groups closer to expectations based on past performance of other waves. However, the second year savings rate for Wave 7 Low is still below that seen in any other wave. It is possible that this low savings rate is due to the wave's low average daily usage figures. The New Mover Wave and Wave 8 have similarly low average daily usage meaning that these two waves could also continue to experience lower savings rates. However, based on the performance of previous waves, it is reasonable to expect that Wave 8 and the New Mover Wave will see increased savings in PY9.

Figure 3-2. HER Program Savings over Time, by Wave



Source: ComEd data and Navigant team analysis.

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 would 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 would be expected to exhibit the same degree of energy-conserving behavior and purchases. Therefore, this method estimates net savings and no further NTG adjustment is necessary.

5. FINDINGS AND RECOMMENDATIONS

The following includes program findings and recommendations.²¹ Across all waves, there were approximately two million participants for whom savings were calculated. Total verified savings for PY8 were 254,696 MWh prior to uplift and 252,036 MWh after the uplift adjustment.

Finding 1. From PY7 to PY8, the program average savings rate increased from 1.13 percent to 1.45 percent. Waves 7 High and Low, which together comprise about two-thirds of the participants in the program, saw particularly large increases in savings from PY7 to PY8. Both waves came close to doubling their savings rate from PY7 to PY8 which put these groups closer to expectations based on the performance of other waves. However, the second year savings rate for Wave 7 Low is still low compared to the other waves which may be due to the low average daily usage of Wave 7 Low. If that relationship holds, then it is possible that the New Mover Wave and Wave 8 could also experience lower savings rates as their average daily usage is also lower than many of the prior waves.

Finding 2. Given that high usage customers tend to save more energy and most of ComEd's high usage customers are already involved in the HER program, moving some existing control customers into new treatment groups might allow ComEd to add more high usage customers as participants in the HER program. Waves 1 and 3 in particular have higher ratios of treatment to control customers than the newer waves. As a proof of concept, Navigant ran a preliminary power analysis and found that if 10,000 customers in the control group for Wave 1 were randomly selected to be placed into a new treatment wave, the new wave and the existing CR and LR persistence subgroups in Wave 1 would each have statistically significant savings estimates at the 90 percent level.

Recommendation 1. ComEd should consider the feasibility of adding higher usage customers to the HER program by transferring customers from existing control groups, such as in Waves 1 and 3, into new treatment groups as participants. ComEd and the implementation contractor should first review the statistical significance for both the new and old waves prior to transferring customers.

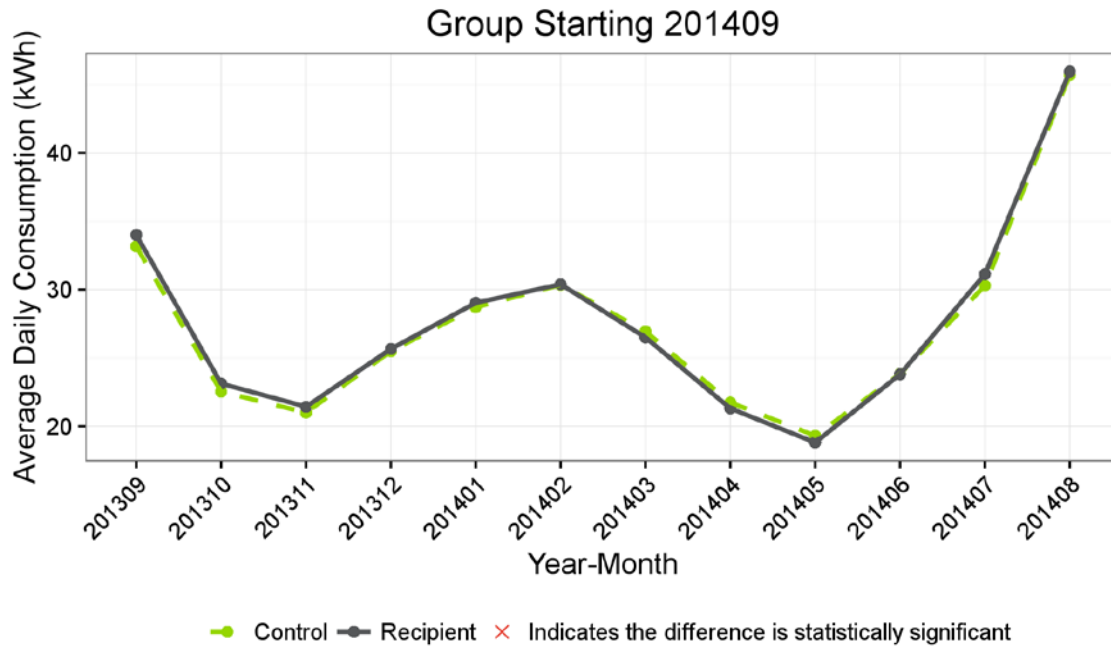
²¹ Numbered findings and recommendations in this section are the same as those found in the Findings and Recommendations section of the evaluation report for ease of reference between each section.

6. APPENDIX

6.1 Graphs for New Mover RCT Check

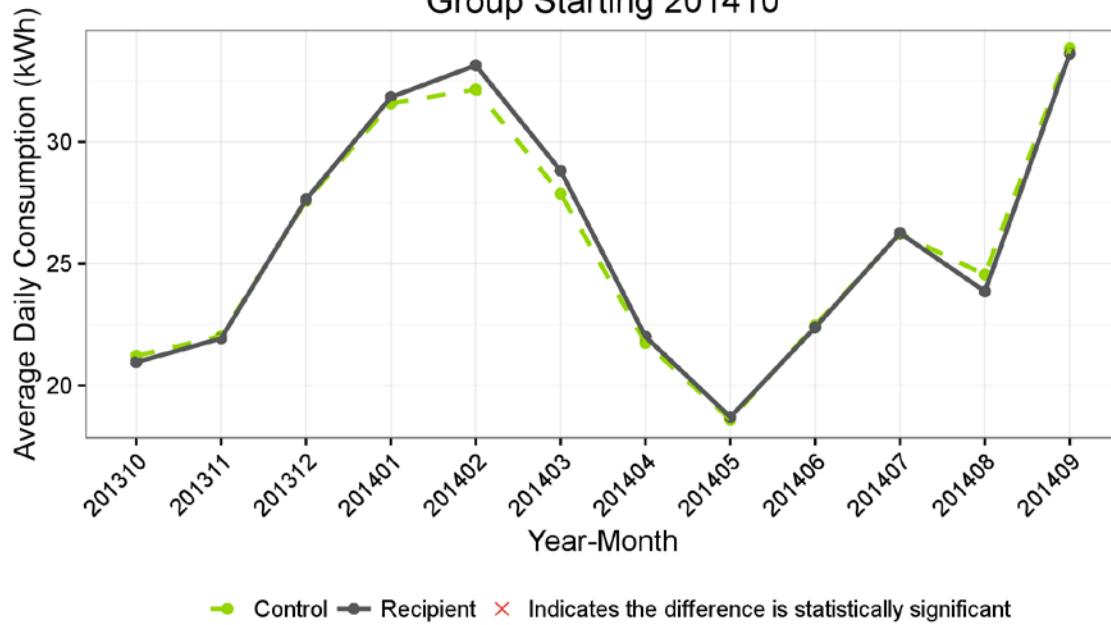
Figure 6-1 through Figure 6-21 show participant and control usage for each group of the New Mover Wave during the twelve-month pre-period. As a whole, these graphs show that the assignment of customers into the treatment and control groups was consistent with randomization.

Figure 6-1. RCT Usage Comparison for New Mover Group Starting September, 2014



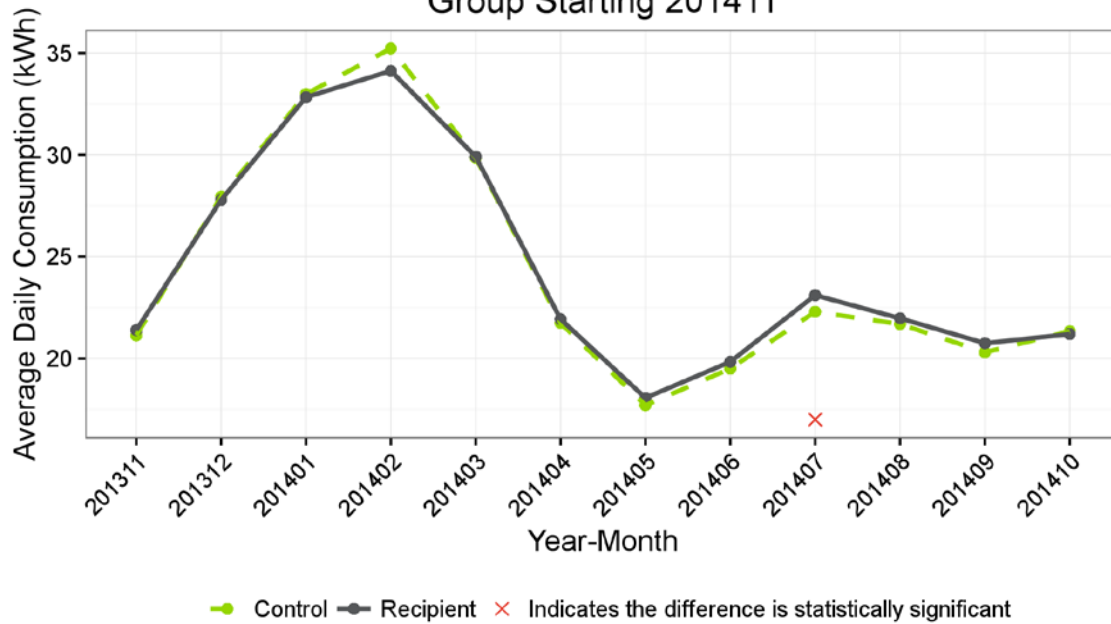
Source: ComEd Data and Navigant Team Analysis.

Figure 6-2. RCT Usage Comparison for New Mover Group Starting October, 2014
Group Starting 201410



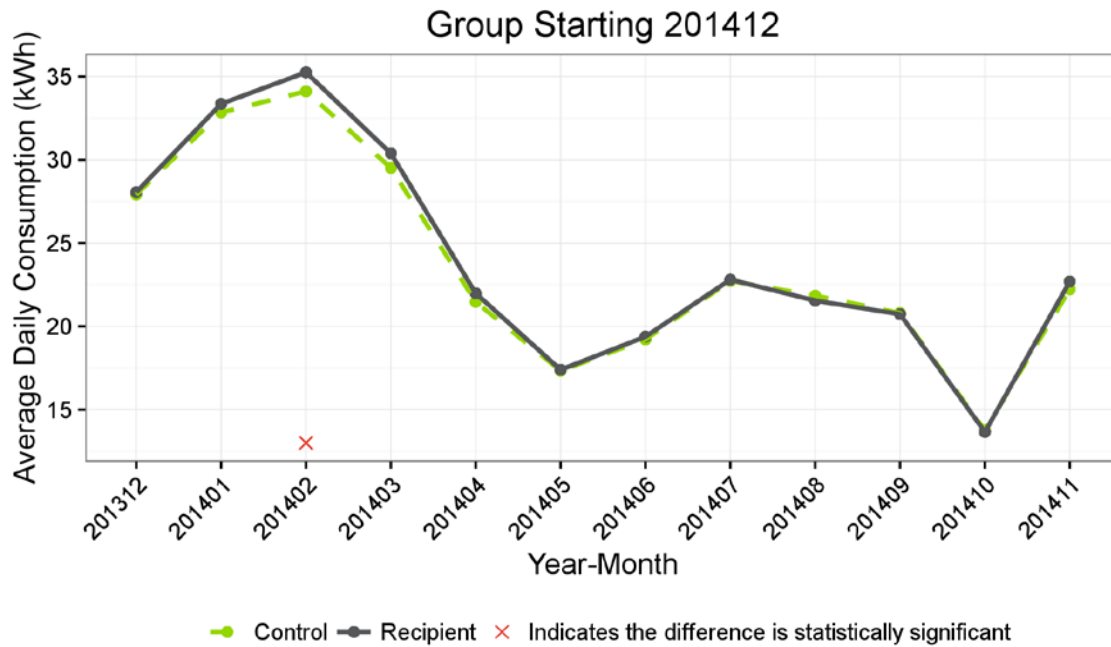
Source: ComEd Data and Navigant Team Analysis.

Figure 6-3. RCT Usage Comparison for New Mover Group Starting November, 2014
Group Starting 201411



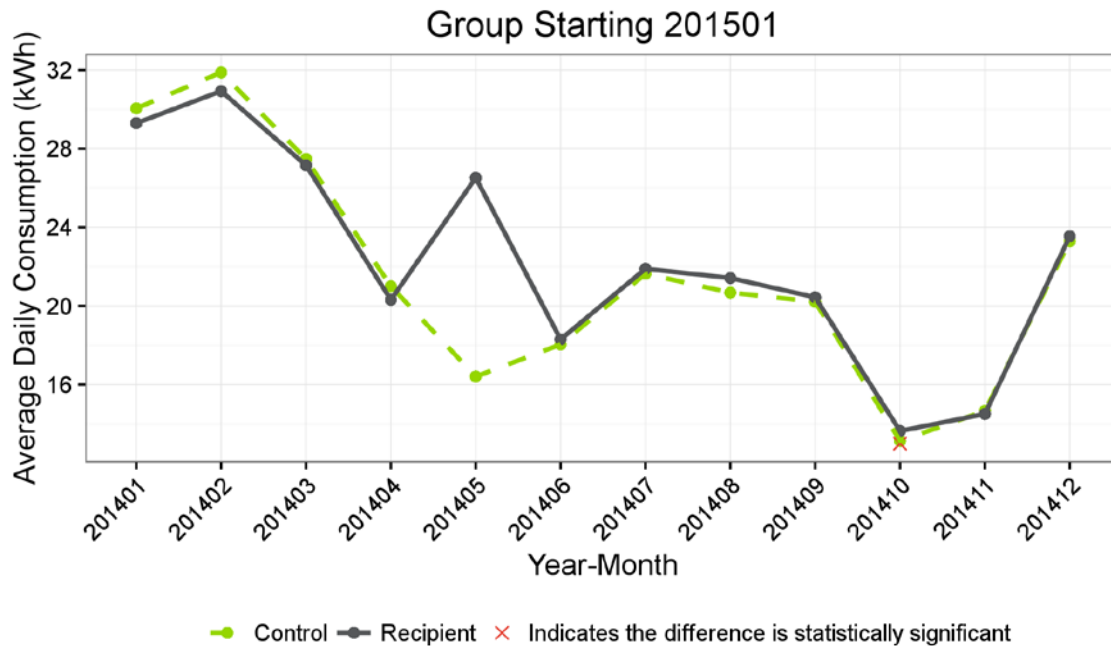
Source: ComEd Data and Navigant Team Analysis.

Figure 6-4. RCT Usage Comparison for New Mover Group Starting December, 2014



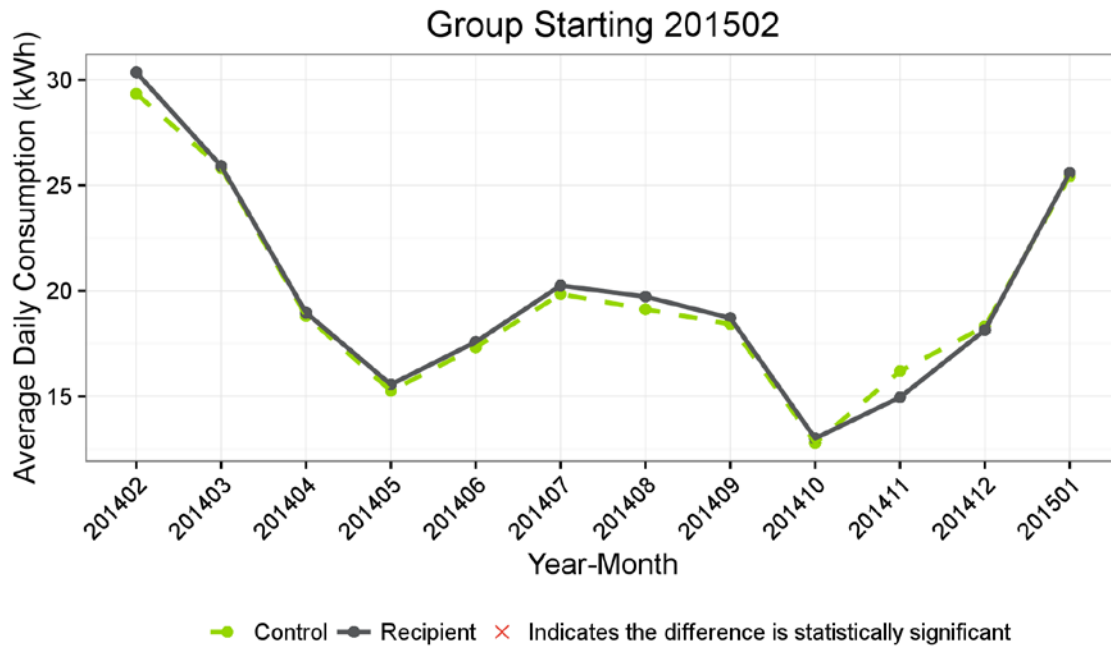
Source: ComEd Data and Navigant Team Analysis.

Figure 6-5. RCT Usage Comparison for New Mover Group Starting January, 2015



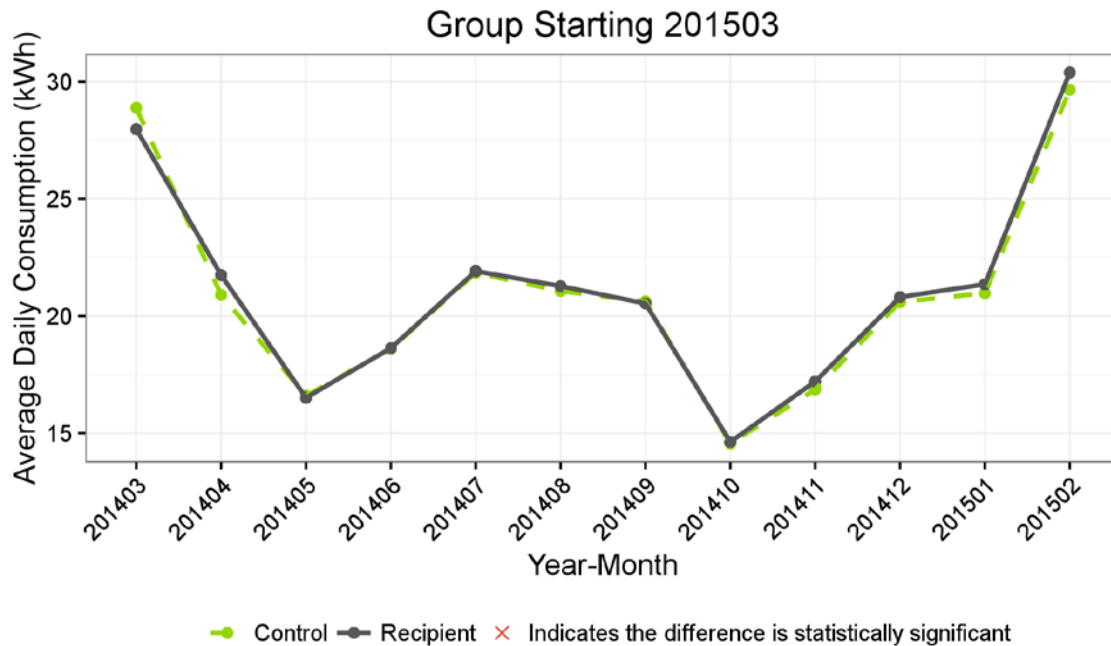
Source: ComEd Data and Navigant Team Analysis.

Figure 6-6. RCT Usage Comparison for New Mover Group Starting February, 2015



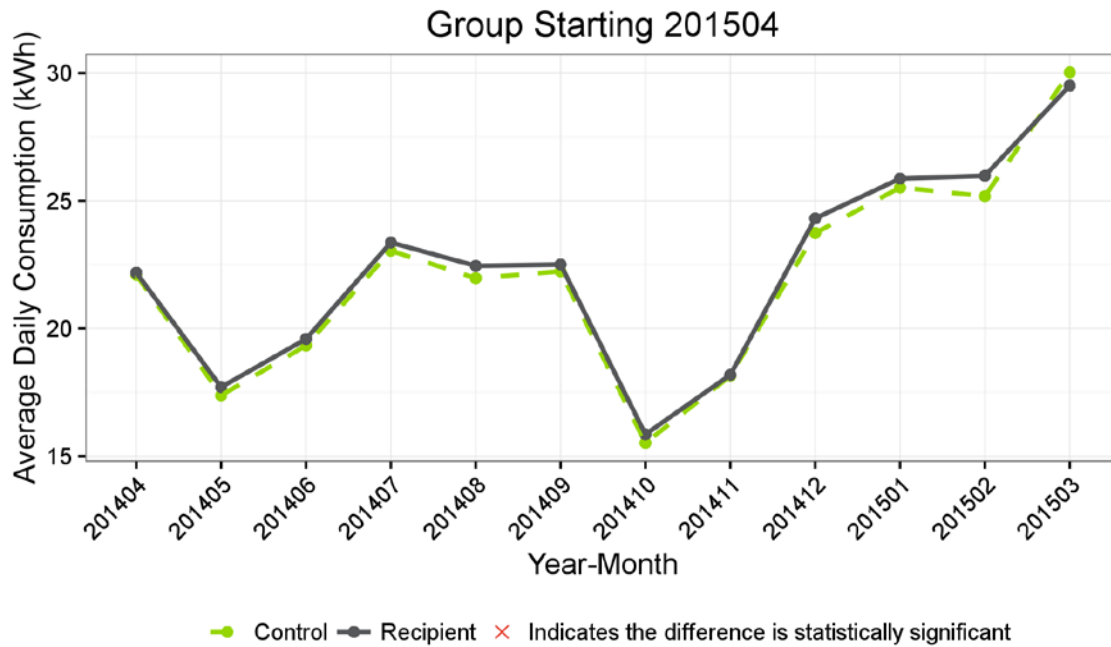
Source: ComEd Data and Navigant Team Analysis.

Figure 6-7. RCT Usage Comparison for New Mover Group Starting March, 2015



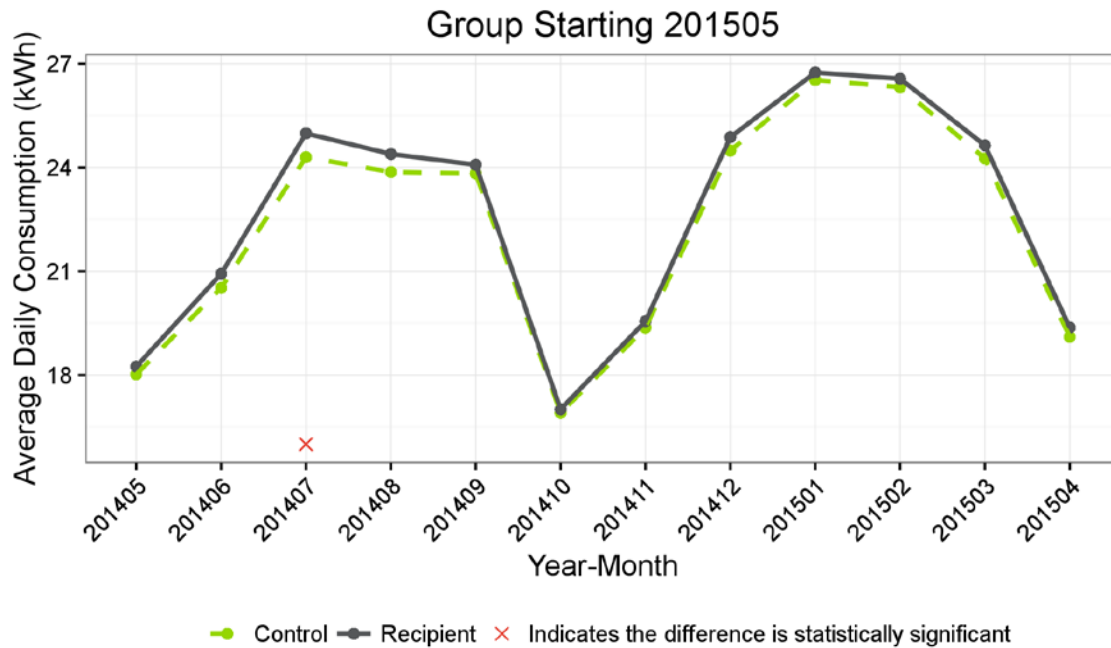
Source: ComEd Data and Navigant Team Analysis.

Figure 6-8. RCT Usage Comparison for New Mover Group Starting April, 2015



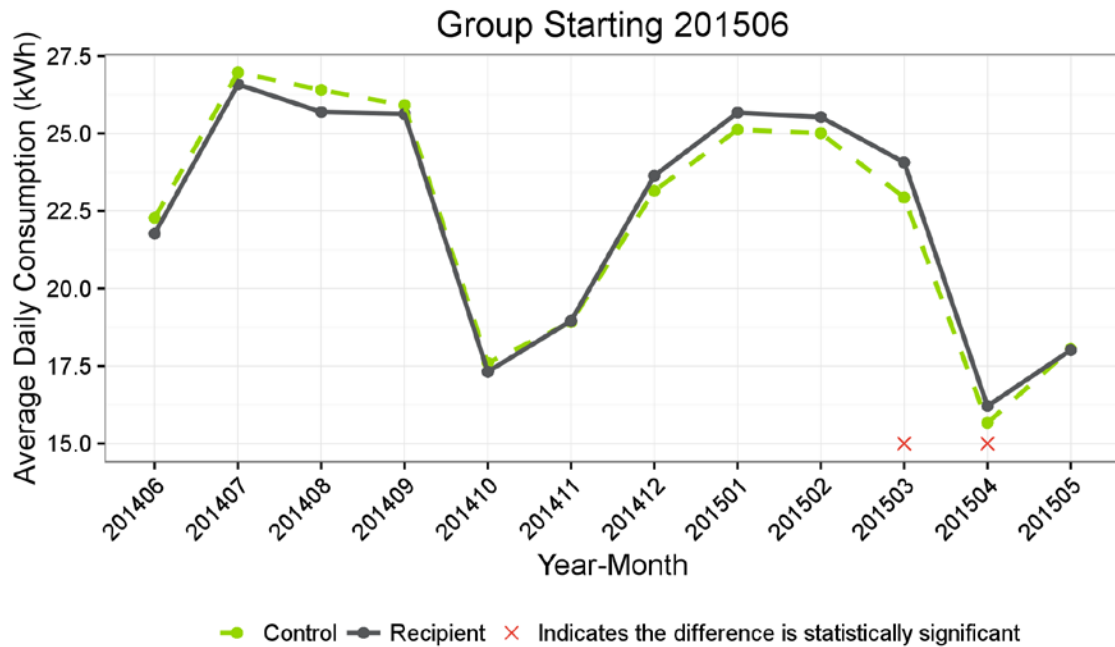
Source: ComEd Data and Navigant Team Analysis.

Figure 6-9. RCT Usage Comparison for New Mover Group Starting May, 2015



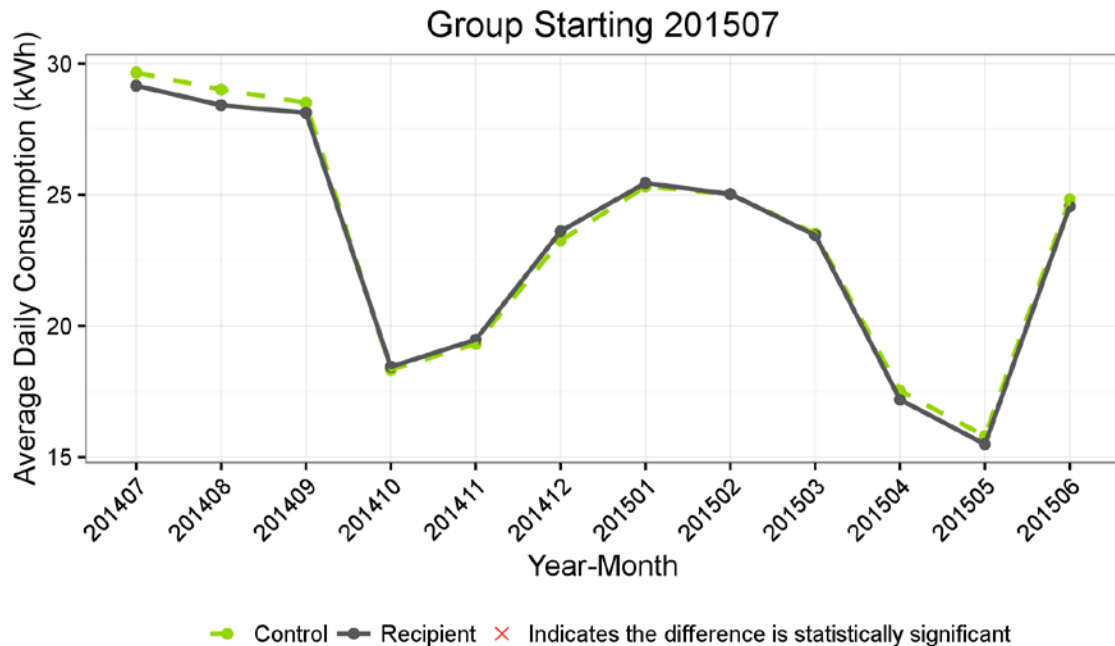
Source: ComEd Data and Navigant Team Analysis.

Figure 6-10. RCT Usage Comparison for New Mover Group Starting June, 2015



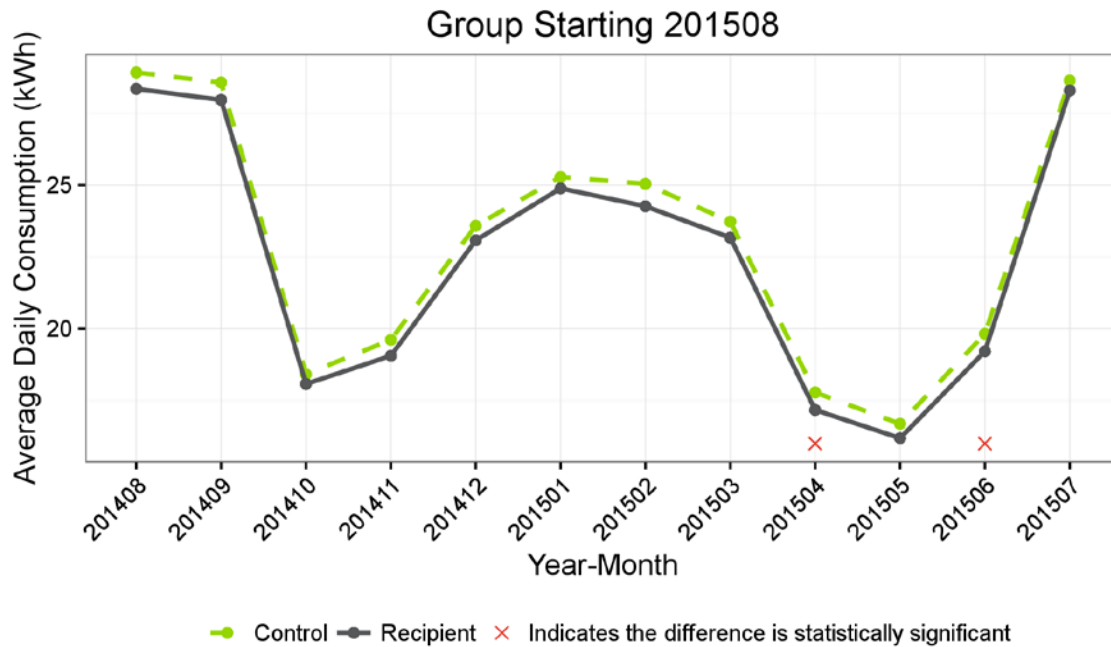
Source: ComEd Data and Navigant Team Analysis.

Figure 6-11. RCT Usage Comparison for New Mover Group Starting July, 2015



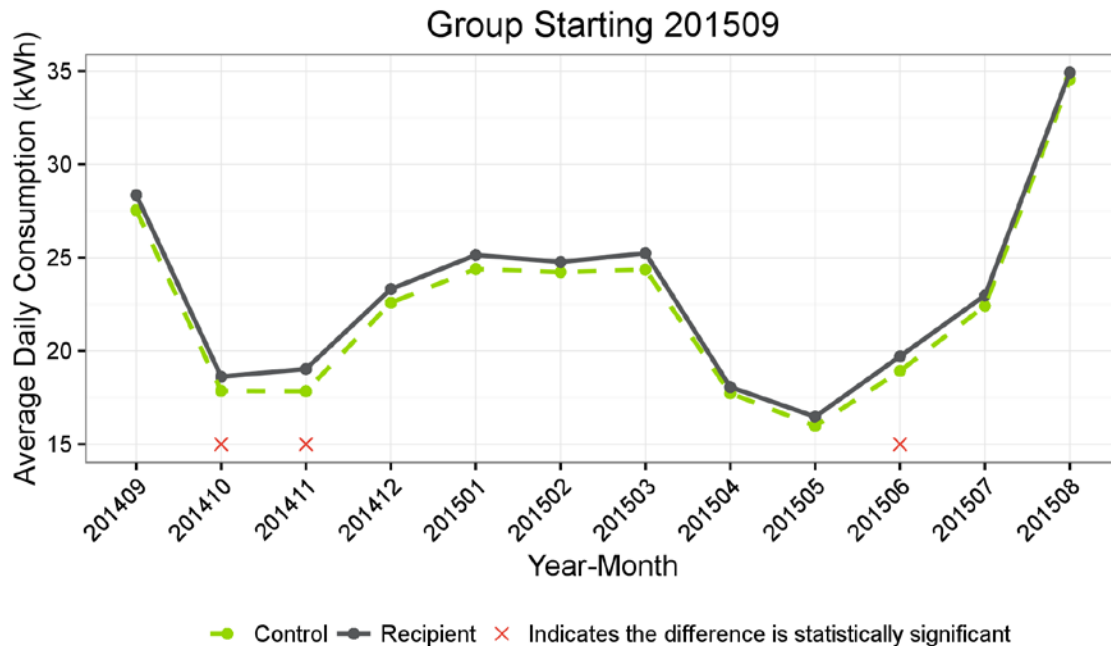
Source: ComEd Data and Navigant Team Analysis.

Figure 6-12. RCT Usage Comparison for New Mover Group Starting August, 2015



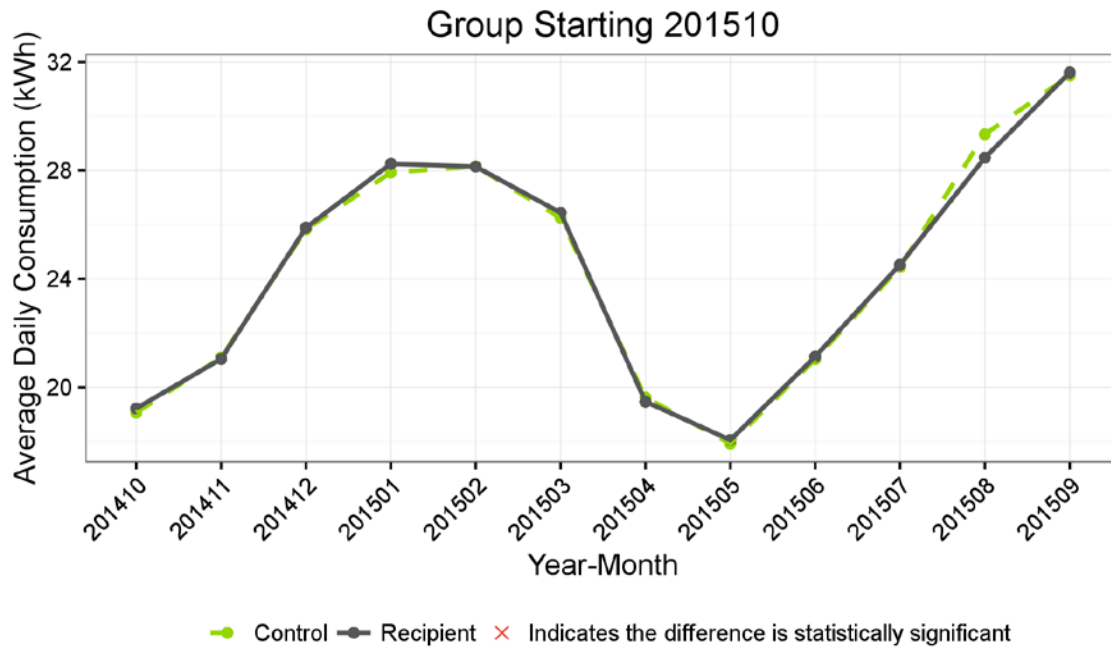
Source: ComEd Data and Navigant Team Analysis.

Figure 6-13. RCT Usage Comparison for New Mover Group Starting September, 2015



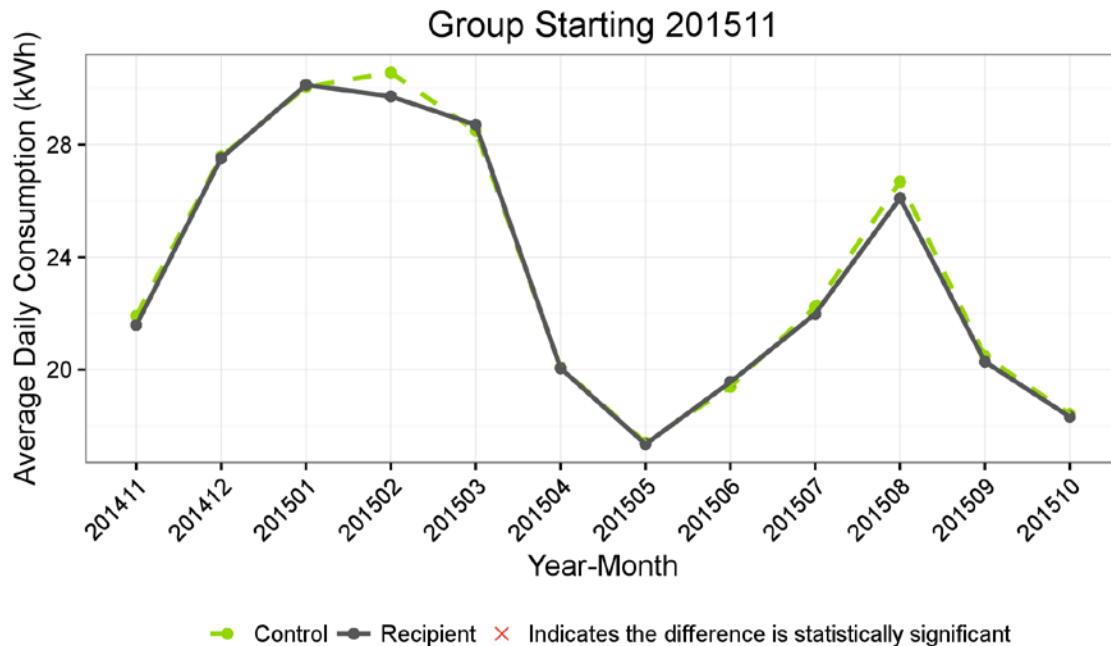
Source: ComEd Data and Navigant Team Analysis.

Figure 6-14. RCT Usage Comparison for New Mover Group Starting October, 2015



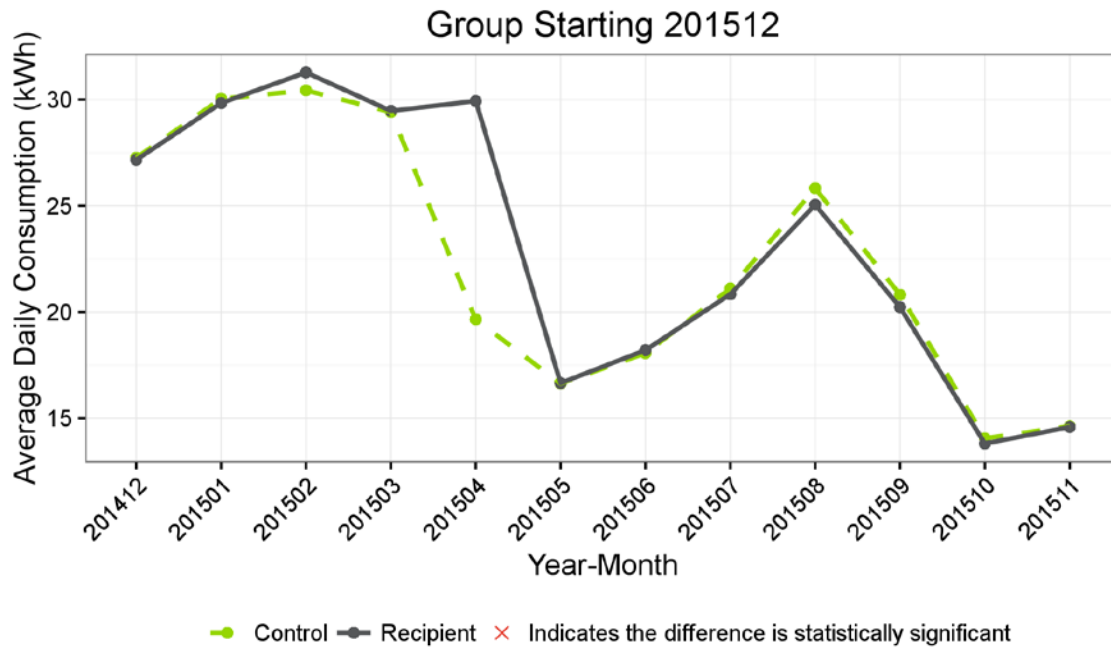
Source: ComEd Data and Navigant Team Analysis.

Figure 6-15. RCT Usage Comparison for New Mover Group Starting November, 2015



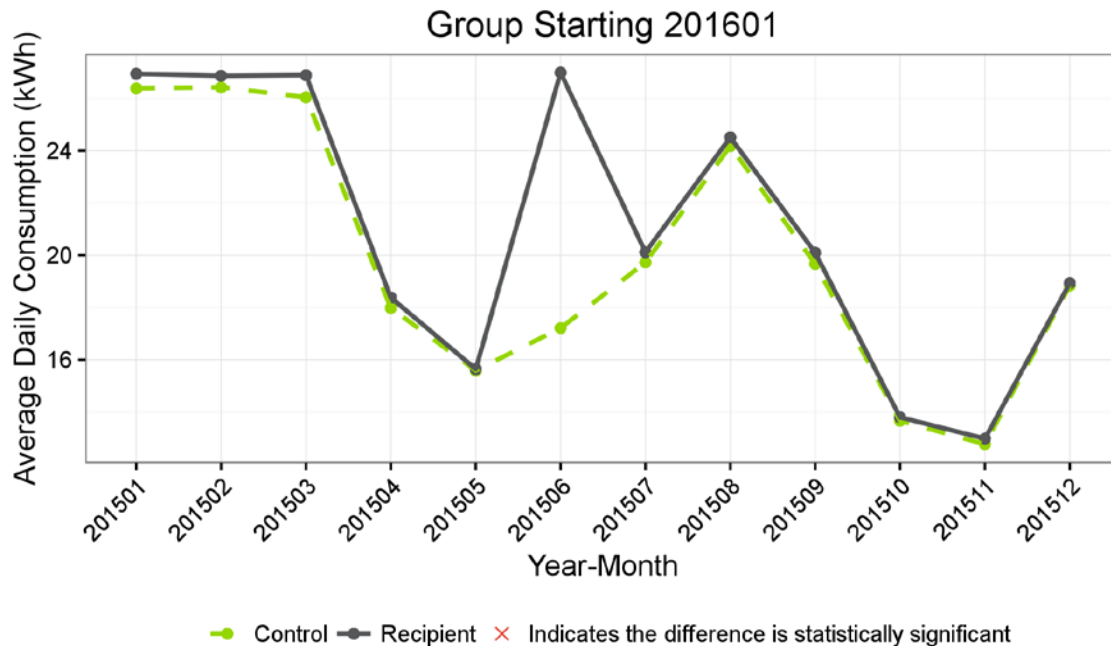
Source: ComEd Data and Navigant Team Analysis.

Figure 6-16. RCT Usage Comparison for New Mover Group Starting December, 2015



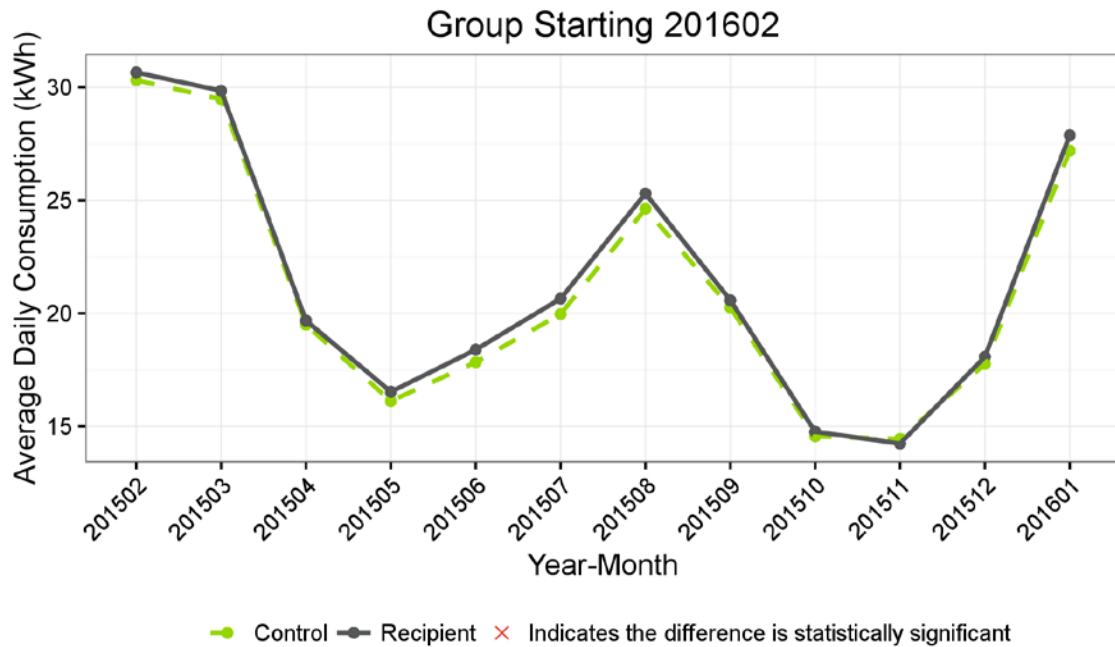
Source: ComEd Data and Navigant Team Analysis.

Figure 6-17. RCT Usage Comparison for New Mover Group Starting January, 2016



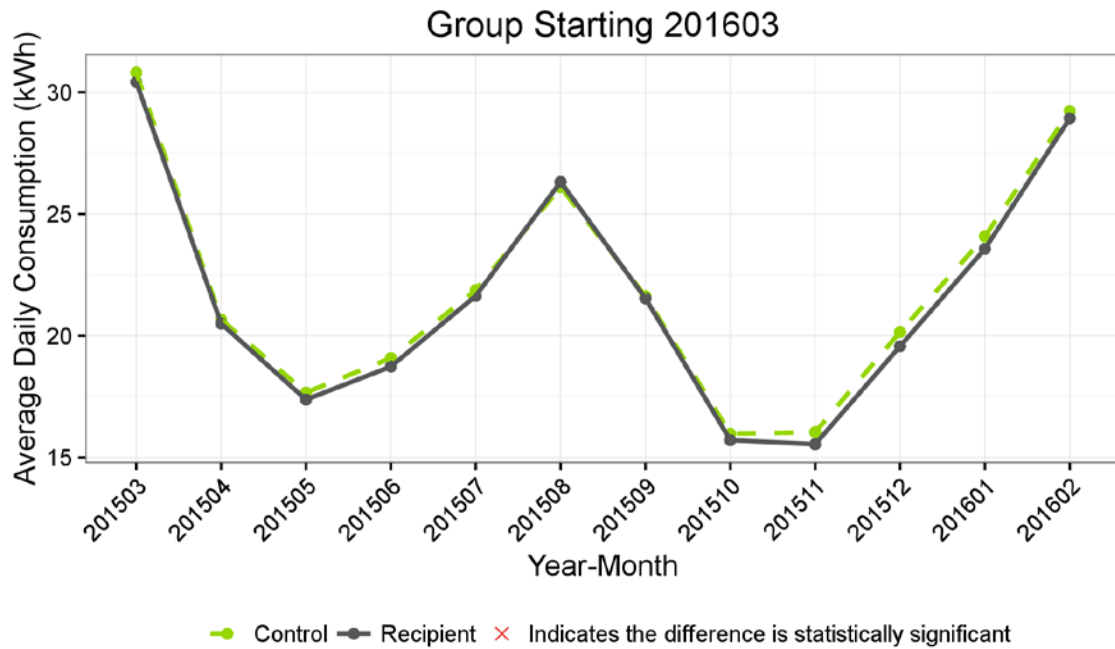
Source: ComEd Data and Navigant Team Analysis.

Figure 6-18. RCT Usage Comparison for New Mover Group Starting February, 2016



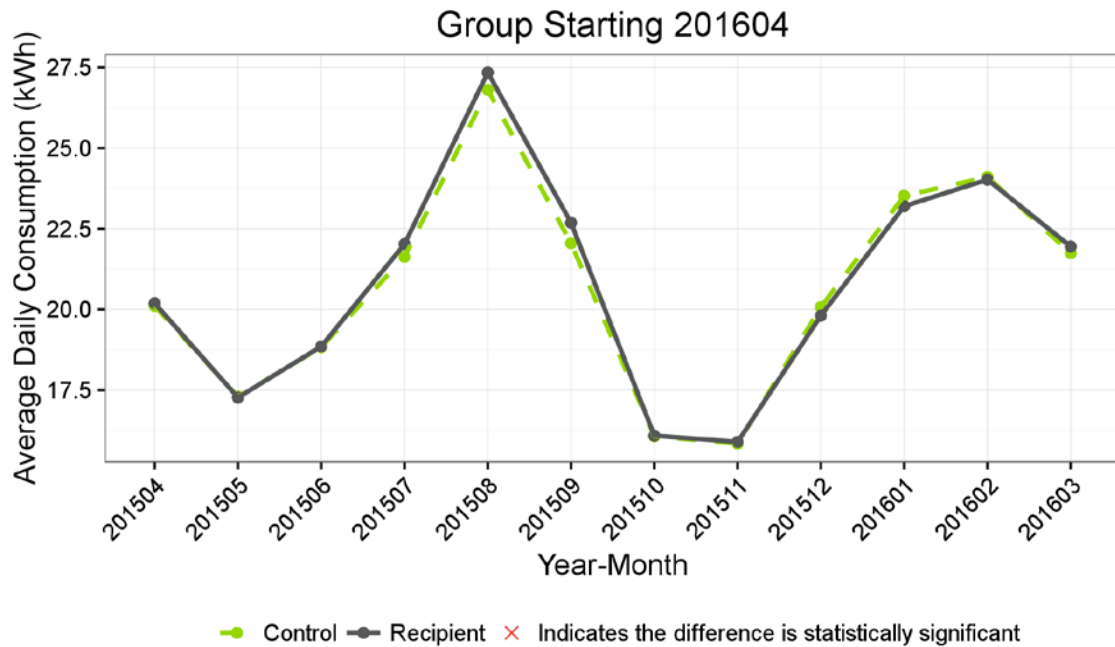
Source: ComEd Data and Navigant Team Analysis.

Figure 6-19. RCT Usage Comparison for New Mover Group Starting March, 2016



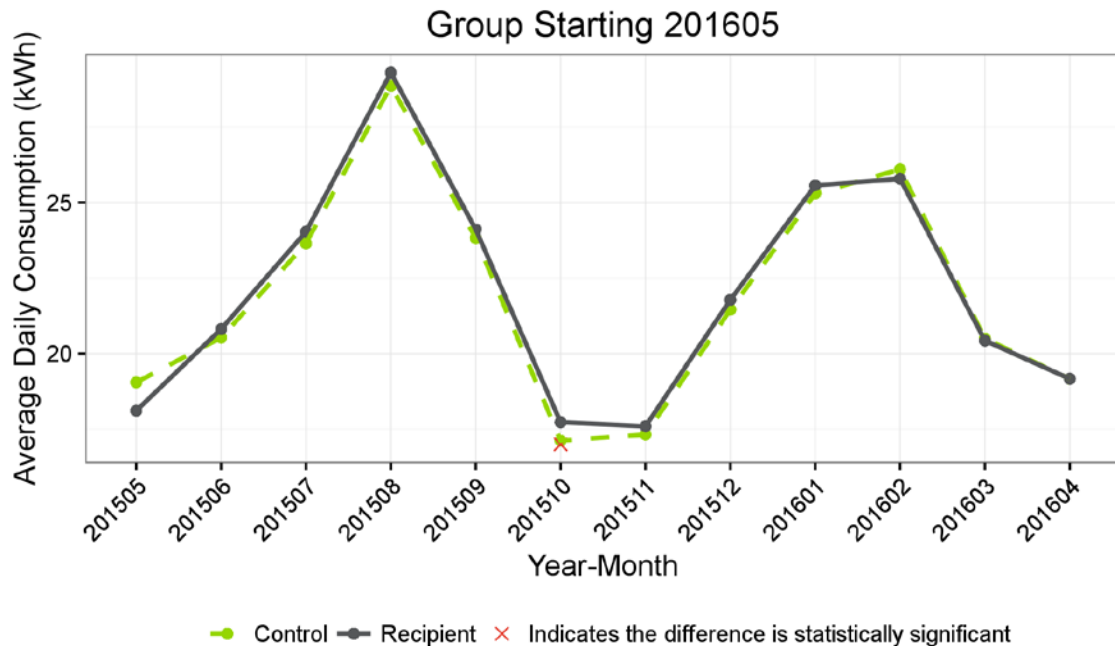
Source: ComEd Data and Navigant Team Analysis.

Figure 6-20. RCT Usage Comparison for New Mover Group Starting April, 2016



Source: ComEd Data and Navigant Team Analysis.

Figure 6-21. RCT Usage Comparison for New Mover Group Starting May, 2016



Source: ComEd Data and Navigant Team Analysis.

6.2 Detailed Data Cleaning

Navigant removed customers and data points from the analysis in the following steps:

- Observations outside the analysis period which was PY8 and the relevant pre-program year for each wave.
- Observations with a bill duration of zero days.
- Customers with an active account and less than 11 bills or any customer with more than 13 bills in either PY8 or the pre-program year.²²
- Observations with missing or negative usage.
- Observations with less than 20 or more than 40 days in the billing cycle.
- Outliers, defined as observations with average daily usage more than one order of magnitude from the median usage.²³

Table 6-1 through Table 6-11 give counts and percentages of customers and observations removed for the data cleaning steps identified above.²⁴ It is evident from the table that the percentage of customers and observations removed is very similar across the treatment and control groups for each wave. This suggests that non-random biases were not introduced into the data by our cleaning.

²² Due to limitations in the New Mover wave, there was no lower limit in the number of bills customers were required to have for inclusion in the model. Wave 8 customers were required to have at least eight bills in PY8 and six pre-period bills to be included in the model.

²³ Median usage was calculated by Wave. Chronologically by wave, median daily kWh usages were 33.60, 32.40, 45.10, 30.60, 50.80, 38.30, 15.90 (Low), 25.40 (High), 19.60 (Full), 19.00 (Partial), and 27.30.

²⁴ The tables for Waves 1 and 3 show slightly different customers counts than the sample sizes in Table 3-3 because Terminated Report (TR) customers who stopped receiving reports in October 2013 are included in these appendix tables but not in the rest of this report.

Table 6-1. Customers/Observations Removed by Data Cleaning Step, Wave 1

Step	Customers		Observations		Customer % Change		Observation % Change	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Raw Data	33,898	31,874	3,316,011	3,118,495				
Bill duration does not equal 0	33,898	31,874	3,316,011	3,118,495	0%	0%	0%	0%
Subset to pre/post periods	33,898	31,874	799,680	751,781	0%	0%	76%	76%
Bill Flattening	33,898	31,874	781,345	734,382	0%	0%	2%	2%
Exclude observations missing usage	33,898	31,874	781,345	734,382	0%	0%	0%	0%
Remove observations with negative usage	33,898	31,874	781,345	734,382	0%	0%	0%	0%
Remove customers with too many/few bills	29,731	27,848	693,737	649,593	12%	13%	11%	12%
Exclude bills with long or short durations	29,731	27,848	692,796	648,730	0%	0%	0%	0%
Exclude outliers	29,728	27,844	690,893	646,880	0%	0%	0%	0%
Remove pre-period data for PPR analysis	29,604	27,716	341,159	319,325	0%	0%	51%	51%
Remove observations without a monthly pre-use value (for PPR analysis)	29,602	27,715	335,264	313,829	0%	0%	2%	2%

Source: ComEd data and Navigant team analysis.

Table 6-2. Customers/Observations Removed by Data Cleaning Step, Wave 2

Step	Customers		Observations		Customer % Change		Observation % Change	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Raw Data	2,187	2,236	184,000	188,250				
Bill duration does not equal 0	2,187	2,236	184,000	188,250	0%	0%	0%	0%
Subset to pre/post periods	2,187	2,236	52,520	53,825	0%	0%	71%	71%
Bill Flattening	2,187	2,236	48,090	49,372	0%	0%	8%	8%
Exclude observations missing usage	2,187	2,236	48,090	49,372	0%	0%	0%	0%
Remove observations with negative usage	2,187	2,236	48,090	49,368	0%	0%	0%	0%
Remove customers with too many/few bills	1,347	1,365	30,593	31,169	38%	39%	36%	37%
Exclude bills with long or short durations	1,347	1,365	30,504	31,081	0%	0%	0%	0%
Exclude outliers	1,347	1,365	30,350	30,968	0%	0%	1%	0%
Remove pre-period data for PPR analysis	1,343	1,362	14,860	15,245	0%	0%	51%	51%
Remove observations without a monthly pre-use value (for PPR analysis)	1,343	1,362	14,253	14,643	0%	0%	4%	4%

Source: ComEd data and Navigant team analysis.

Table 6-3. Customers/Observations Removed by Data Cleaning Step, Wave 3

Step	Customers		Observations		Customer % Change		Observation % Change	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Raw Data	157,525	38,981	11,980,140	2,964,949				
Bill duration does not equal 0	157,525	38,981	11,980,140	2,964,949	0%	0%	0%	0%
Subset to pre/post periods	157,520	38,977	3,714,054	918,844	0%	0%	69%	69%
Bill Flattening	157,520	38,977	3,622,252	895,857	0%	0%	2%	3%
Exclude observations missing usage	157,520	38,977	3,622,252	895,857	0%	0%	0%	0%
Remove observations with negative usage	157,520	38,977	3,622,241	895,854	0%	0%	0%	0%
Remove customers with too many/few bills	140,373	34,628	3,272,996	807,239	11%	11%	10%	10%
Exclude bills with long or short durations	140,373	34,628	3,262,516	804,650	0%	0%	0%	0%
Exclude outliers	140,373	34,628	3,250,035	801,905	0%	0%	0%	0%
Remove pre-period data for PPR analysis	139,690	34,455	1,605,267	396,119	0%	1%	51%	51%
Remove observations without a monthly pre-use value (for PPR analysis)	139,680	34,449	1,572,111	387,921	0%	0%	2%	2%

Source: ComEd data and Navigant team analysis.

Table 6-4. Customers/Observations Removed by Data Cleaning Step, Wave 4

Step	Customers		Observations		Customer % Change		Observation % Change	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Raw Data	16,673	16,776	1,132,914	1,140,071				
Bill duration does not equal 0	16,673	16,776	1,132,914	1,140,071	0%	0%	0%	0%
Subset to pre/post periods	16,671	16,772	393,965	396,410	0%	0%	65%	65%
Bill Flattening	16,671	16,772	384,331	386,841	0%	0%	2%	2%
Exclude observations missing usage	16,671	16,772	384,331	386,841	0%	0%	0%	0%
Remove observations with negative usage	16,671	16,772	384,331	386,841	0%	0%	0%	0%
Remove customers with too many/few bills	14,914	15,079	348,722	352,323	11%	10%	9%	9%
Exclude bills with long or short durations	14,914	15,079	347,903	351,429	0%	0%	0%	0%
Exclude outliers	14,914	15,079	346,708	350,365	0%	0%	0%	0%
Remove pre-period data for PPR analysis	14,846	15,017	171,010	172,884	0%	0%	51%	51%
Remove observations without a monthly pre-use value (for PPR analysis)	14,840	15,012	168,228	169,908	0%	0%	2%	2%

Source: ComEd data and Navigant team analysis.

Table 6-5. Customers/Observations Removed by Data Cleaning Step, Wave 5

Step	Customers		Observations		Customer % Change		Observation % Change	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Raw Data	11,896	7,628	716,475	459,390				
Bill duration does not equal 0	11,896	7,628	716,475	459,390	0%	0%	0%	0%
Subset to pre/post periods	11,860	7,600	268,447	172,222	0%	0%	63%	63%
Bill Flattening	11,860	7,600	262,228	168,165	0%	0%	2%	2%
Exclude observations missing usage	11,860	7,600	262,228	168,165	0%	0%	0%	0%
Remove observations with negative usage	11,860	7,600	262,224	168,165	0%	0%	0%	0%
Remove customers with too many/few bills	9,118	5,823	211,192	135,003	23%	23%	19%	20%
Exclude bills with long or short durations	9,118	5,823	210,418	134,533	0%	0%	0%	0%
Exclude outliers	9,114	5,822	209,018	133,678	0%	0%	1%	1%
Remove pre-period data for PPR analysis	9,031	5,783	101,981	65,291	1%	1%	51%	51%
Remove observations without a monthly pre-use value (for PPR analysis)	9,023	5,779	100,113	64,084	0%	0%	2%	2%

Source: ComEd data and Navigant team analysis.

Table 6-6. Customers/Observations Removed by Data Cleaning Step, Wave 6

Step	Customers		Observations		Customer % Change		Observation % Change	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Raw Data	81,591	24,688	4,100,061	1,241,938				
Bill duration does not equal 0	81,591	24,688	4,100,061	1,241,938	0%	0%	0%	0%
Subset to pre/post periods	81,591	24,688	1,884,052	571,070	0%	0%	54%	54%
Bill Flattening	81,591	24,688	1,832,800	555,746	0%	0%	3%	3%
Exclude observations missing usage	81,591	24,688	1,832,800	555,746	0%	0%	0%	0%
Remove observations with negative usage	81,591	24,688	1,832,800	555,746	0%	0%	0%	0%
Remove customers with too many/few bills	65,135	19,866	1,516,067	462,650	20%	20%	17%	17%
Exclude bills with long or short durations	65,135	19,866	1,513,127	461,735	0%	0%	0%	0%
Exclude outliers	65,107	19,855	1,506,013	459,702	0%	0%	0%	0%
Remove pre-period data for PPR analysis	64,704	19,738	737,316	225,203	1%	1%	51%	51%
Remove observations without a monthly pre-use value (for PPR analysis)	64,607	19,713	726,637	221,916	0%	0%	1%	1%

Source: ComEd data and Navigant team analysis.

Table 6-7. Customers/Observations Removed by Data Cleaning Step, Wave 7 Low

Step	Customers		Observations		Customer % Change		Observation % Change	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Raw Data	543,816	45,401	20,931,179	1,747,460				
Bill duration does not equal 0	543,816	45,401	20,931,179	1,747,460	0%	0%	0%	0%
Subset to pre/post periods	543,816	45,401	12,592,667	1,051,319	0%	0%	40%	40%
Bill Flattening	543,816	45,401	12,277,681	1,024,889	0%	0%	3%	3%
Exclude observations missing usage	543,816	45,401	12,277,681	1,024,889	0%	0%	0%	0%
Remove observations with negative usage	543,816	45,401	12,277,681	1,024,889	0%	0%	0%	0%
Remove customers with too many/few bills	461,011	38,537	10,655,638	890,542	15%	15%	13%	13%
Exclude bills with long or short durations	461,011	38,537	10,640,650	889,280	0%	0%	0%	0%
Exclude outliers	461,008	38,535	10,608,650	886,633	0%	0%	0%	0%
Remove pre-period data for PPR analysis	458,109	38,302	5,155,454	430,956	1%	1%	51%	51%
Remove observations without a monthly pre-use value (for PPR analysis)	457,418	38,245	5,091,056	425,446	0%	0%	1%	1%

Source: ComEd data and Navigant team analysis.

Table 6-8. Customers/Observations Removed by Data Cleaning Step, Wave 7 High

Step	Customers		Observations		Customer % Change		Observation % Change	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Raw Data	559,279	46,706	21,603,065	1,803,820				
Bill duration does not equal 0	559,279	46,706	21,603,065	1,803,820	0%	0%	0%	0%
Subset to pre/post periods	559,279	46,706	13,016,515	1,086,869	0%	0%	40%	40%
Bill Flattening	559,279	46,706	12,690,157	1,059,577	0%	0%	3%	3%
Exclude observations missing usage	559,279	46,706	12,690,157	1,059,577	0%	0%	0%	0%
Remove observations with negative usage	559,279	46,706	12,690,157	1,059,577	0%	0%	0%	0%
Remove customers with too many/few bills	473,538	39,476	11,001,285	917,434	15%	15%	13%	13%
Exclude bills with long or short durations	473,538	39,476	10,985,075	916,127	0%	0%	0%	0%
Exclude outliers	473,537	39,476	10,959,135	914,077	0%	0%	0%	0%
Remove pre-period data for PPR analysis	470,825	39,271	5,353,256	446,634	1%	1%	51%	51%
Remove observations without a monthly pre-use value (for PPR analysis)	470,324	39,223	5,289,928	441,449	0%	0%	1%	1%

Source: ComEd data and Navigant team analysis.

Table 6-9. Customers/Observations Removed by Data Cleaning Step, New Mover Wave Partial

Step	Customers		Observations		Customer % Change		Observation % Change	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Raw Data	143,735	35,934	2,658,282	665,682				
Bill duration does not equal 0	143,725	35,933	2,657,922	665,609	0%	0%	0%	0%
Subset to pre/post periods	143,622	35,911	2,475,486	620,027	0%	0%	7%	7%
Bill Flattening	143,622	35,911	2,340,238	586,181	0%	0%	5%	5%
Exclude observations missing usage	143,622	35,911	2,340,238	586,181	0%	0%	0%	0%
Remove observations with negative usage	143,622	35,911	2,340,238	586,181	0%	0%	0%	0%
Remove customers with too many/few bills	128,439	32,166	2,210,859	554,280	11%	10%	6%	5%
Exclude bills with long or short durations	128,433	32,158	2,075,568	520,342	0%	0%	6%	6%
Exclude outliers	128,405	32,152	2,027,729	508,554	0%	0%	2%	2%
Remove pre-period data for PPR analysis	128,050	32,056	1,249,199	313,652	0%	0%	38%	38%
Remove observations without a monthly pre-use value (for PPR analysis)	116,223	29,025	641,606	161,011	9%	9%	49%	49%

Source: ComEd data and Navigant team analysis.

Table 6-10. Customers/Observations Removed by Data Cleaning Step, New Mover Wave Full

Step	Customers		Observations		Customer % Change		Observation % Change	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Raw Data	102,465	25,618	2,630,627	658,975				
Bill duration does not equal 0	102,464	25,616	2,630,590	658,960	0%	0%	0%	0%
Subset to pre/post periods	101,813	25,468	2,022,952	507,313	1%	1%	23%	23%
Bill Flattening	101,813	25,468	1,926,705	483,018	0%	0%	5%	5%
Exclude observations missing usage	101,813	25,468	1,926,705	483,018	0%	0%	0%	0%
Remove observations with negative usage	101,813	25,468	1,926,705	483,018	0%	0%	0%	0%
Remove customers with too many/few bills	101,803	25,466	1,926,612	482,996	0%	0%	0%	0%
Exclude bills with long or short durations	101,609	25,418	1,831,764	459,090	0%	0%	5%	5%
Exclude outliers	101,382	25,352	1,794,837	449,652	0%	0%	2%	2%
Remove pre-period data for PPR analysis	91,995	23,047	903,026	226,425	9%	9%	50%	50%
Remove observations without a monthly pre-use value (for PPR analysis)	88,419	22,165	700,332	175,505	4%	4%	22%	22%

Source: ComEd data and Navigant team analysis.

Table 6-11. Customers/Observations Removed by Data Cleaning Step, Wave 8

Step	Customers		Observations		Customer % Change		Observation % Change	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Raw Data	81,679	10,890	1,942,155	259,671				
Bill duration does not equal 0	81,679	10,890	1,942,155	259,671	0%	0%	0%	0%
Subset to pre/post periods	81,679	10,890	1,639,779	219,192	0%	0%	16%	16%
Bill Flattening	81,679	10,890	1,592,920	212,988	0%	0%	3%	3%
Exclude observations missing usage	81,679	10,890	1,592,920	212,988	0%	0%	0%	0%
Remove observations with negative usage	81,679	10,890	1,592,920	212,988	0%	0%	0%	0%
Remove customers with too many/few bills	78,597	10,505	1,555,410	208,161	4%	4%	2%	2%
Exclude bills with long or short durations	78,597	10,505	1,538,187	205,878	0%	0%	1%	1%
Exclude outliers	78,594	10,505	1,530,762	204,783	0%	0%	0%	1%
Remove pre-period data for PPR analysis	76,468	10,221	739,478	99,045	3%	3%	52%	52%
Remove observations without a monthly pre-use value (for PPR analysis)	74,210	9,920	683,073	91,494	3%	3%	8%	8%

Source: ComEd data and Navigant team analysis.

6.3 Detailed Impact Methodology

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

6.3.1 Post Program Regression 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 shown in Equation 6-1.

Equation 6-1. Post Program Regression Model

$$ADU_{kt} = \beta_1 Treatment_k + \sum_j \beta_{2j} Month_{jt} + \sum_j \beta_{4j} Month_{jt} \cdot ADUlag_{kt} + \varepsilon_{kt}$$

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 ²⁵
ε_{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. ²⁶

The coefficient β_1 is the estimate of average daily kWh energy savings due to the program.

6.3.2 Linear Fixed Effects Regression Model

The LFER model used by Navigant 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, the LFER model is shown in Equation 6-2.

Equation 6-2. Linear Fixed Effects Regression Model

$$ADU_{kt} = \alpha_{0k} + \alpha_1 Post_t + \alpha_2 Treatment_k \cdot Post_t + \varepsilon_{kt}$$

²⁵ In other words, if there are T post-program months, there are T monthly dummy variables in the model, with the dummy variable $Month_{jt}$ the only one to take a value of 1 at time t . These are, in other words, monthly fixed effects.

²⁶ 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.

Three observations about this specification deserve comment. First, the coefficient α_{0k} captures all household-specific effects on energy use that do not change over time, including those that are unobservable. Second, α_1 captures the average effect *across all households* of being in the post-treatment period. Third, the effect of being both in the treatment group and in the post period, i.e., the effect directly attributable to the program, is captured by the coefficient α_2 . In other words, whereas the coefficient α_1 captures the change in average daily kWh use across the pre- and post-treatment for the *control* group, the sum $\alpha_1 + \alpha_2$ captures this change for the treatment group, and so α_2 is the estimate of average daily kWh energy savings due to the program.

6.4 Detailed Impact Results: Parameter Estimates

Table 6-12 through Table 6-33 show the PPR and LFER model results for each wave. Across the two models, parameter estimates were not statistically different, that is, the estimates for each model were within the 90 percent confidence bounds for the other model. Furthermore, the pattern across the different program waves between the two models is similar.

Table 6-12. PPR Model Estimates, Wave 1

	Estimate	Std. Error	T value	P value
treatment	-1.09	0.11	-10.13	0.00
yrmo201506	7.74	0.25	31.56	0.00
yrmo201507	6.22	0.25	25.28	0.00
yrmo201508	10.26	0.26	39.22	0.00
yrmo201509	9.29	0.25	37.19	0.00
yrmo201510	6.21	0.24	26.07	0.00
yrmo201511	5.79	0.26	22.68	0.00
yrmo201512	7.99	0.25	31.49	0.00
yrmo201601	8.62	0.25	33.83	0.00
yrmo201602	8.70	0.26	33.59	0.00
yrmo201603	6.95	0.26	27.19	0.00
yrmo201604	6.38	0.27	23.38	0.00
yrmo201605	5.55	0.27	20.92	0.00
treatment:LR	0.13	0.17	0.76	0.45
treatment:TR	0.34	0.18	1.90	0.06
yrmo201506:pre_use	0.84	0.01	111.10	0.00
yrmo201507:pre_use	0.71	0.01	139.09	0.00
yrmo201508:pre_use	0.76	0.00	158.57	0.00
yrmo201509:pre_use	0.75	0.01	135.65	0.00
yrmo201510:pre_use	0.70	0.01	102.77	0.00
yrmo201511:pre_use	0.68	0.01	90.31	0.00
yrmo201512:pre_use	0.63	0.01	103.08	0.00
yrmo201601:pre_use	0.63	0.01	117.21	0.00
yrmo201602:pre_use	0.67	0.01	106.01	0.00
yrmo201603:pre_use	0.67	0.01	97.87	0.00
yrmo201604:pre_use	0.69	0.01	84.14	0.00
yrmo201605:pre_use	0.73	0.01	83.87	0.00
Residual standard error: 15.52 on 649,066 degrees of freedom				
Multiple R-squared: 0.88, Adjusted R-squared: 0.88				
F-statistic: 181,201 on 27 and 649,066 DF, p-value: 0				

Source: ComEd data and Navigant team analysis.

Table 6-13. LFER Model Estimates, Wave 1

	Estimate	Std. Error	T value	P value
post	-5.50	0.07	-75.31	0.00
post_trt	-0.97	0.12	-8.39	0.00
post_trt:LR	0.21	0.18	1.12	0.26
post_trt:TR	0.36	0.19	1.89	0.06
R-Squared: 0.03; Adj. R-Squared: 0.03				
F-statistic: 10,040 on 4 and 1,280,197 DF, p-value: 0.00				

Source: ComEd data and Navigant team analysis.

Table 6-14. PPR Model Estimates, Wave 2

	Estimate	Std. Error	T value	P value
treatment	-0.66	0.42	-1.57	0.12
yrmo201506	8.39	0.80	10.44	0.00
yrmo201507	11.86	0.82	14.40	0.00
yrmo201508	11.48	0.92	12.51	0.00
yrmo201509	6.47	0.77	8.41	0.00
yrmo201510	5.82	0.78	7.43	0.00
yrmo201511	9.06	0.88	10.23	0.00
yrmo201512	12.55	0.89	14.13	0.00
yrmo201601	13.06	1.13	11.54	0.00
yrmo201602	10.58	1.10	9.62	0.00
yrmo201603	13.17	1.45	9.08	0.00
yrmo201604	12.75	1.17	10.91	0.00
yrmo201605	11.88	0.76	15.64	0.00
yrmo201506:pre_use	0.66	0.02	27.77	0.00
yrmo201507:pre_use	0.53	0.02	31.77	0.00
yrmo201508:pre_use	0.59	0.02	37.30	0.00
yrmo201509:pre_use	0.80	0.02	42.80	0.00
yrmo201510:pre_use	0.74	0.02	29.93	0.00
yrmo201511:pre_use	0.61	0.03	22.49	0.00
yrmo201512:pre_use	0.59	0.03	23.31	0.00
yrmo201601:pre_use	0.55	0.02	23.73	0.00
yrmo201602:pre_use	0.62	0.02	25.41	0.00
yrmo201603:pre_use	0.56	0.04	14.71	0.00
yrmo201604:pre_use	0.52	0.04	13.96	0.00
yrmo201605:pre_use	0.53	0.02	21.61	0.00

Residual standard error: 15.65 on 28,871 degrees of freedom

Multiple R-squared: 0.87, Adjusted R-squared: 0.87

F-statistic: 7,438 on 25 and 28,871 DF, p-value: 0

Source: ComEd data and Navigant team analysis.

Table 6-15. LFER Model Estimates, Wave 2

	Estimate	Std. Error	T value	P value
post	-6.26	0.29	-21.31	0.00
post_trt	-0.82	0.42	-1.94	0.05
R-Squared: 0.03; Adj. R-Squared: 0.03				
F-statistic: 1,037 on 2 and 58,604 DF, p-value: 0.00				
Source: ComEd data and Navigant team analysis.				

Table 6-16. PPR Model Estimates, Wave 3

	Estimate	Std. Error	T value	P value
treatment	-1.25	0.08	-15.87	0.00
yrmo201506	14.35	0.19	73.69	0.00
yrmo201507	15.39	0.20	78.37	0.00
yrmo201508	21.37	0.21	101.10	0.00
yrmo201509	22.32	0.21	107.97	0.00
yrmo201510	17.31	0.24	70.96	0.00
yrmo201511	15.25	0.24	64.54	0.00
yrmo201512	16.17	0.17	93.94	0.00
yrmo201601	15.66	0.18	84.66	0.00
yrmo201602	12.01	0.20	60.05	0.00
yrmo201603	13.33	0.20	66.87	0.00
yrmo201604	10.37	0.21	50.58	0.00
yrmo201605	15.78	0.22	72.32	0.00
treatment:LR	-0.06	0.16	-0.39	0.70
treatment:TR	0.25	0.15	1.65	0.10
yrmo201506:pre_use	0.56	0.00	162.55	0.00
yrmo201507:pre_use	0.50	0.00	192.39	0.00
yrmo201508:pre_use	0.54	0.00	202.09	0.00
yrmo201509:pre_use	0.53	0.00	155.34	0.00
yrmo201510:pre_use	0.56	0.01	93.08	0.00
yrmo201511:pre_use	0.54	0.01	94.65	0.00
yrmo201512:pre_use	0.52	0.00	173.87	0.00
yrmo201601:pre_use	0.57	0.00	195.57	0.00
yrmo201602:pre_use	0.66	0.00	190.03	0.00
yrmo201603:pre_use	0.61	0.00	152.16	0.00
yrmo201604:pre_use	0.64	0.00	138.62	0.00
yrmo201605:pre_use	0.50	0.01	95.61	0.00
Residual standard error: 18.53 on 1,960,005 degrees of freedom				
Multiple R-squared: 0.88, Adjusted R-squared: 0.88				
F-statistic: 532, on 27 and 1,960,005 DF, p-value: 0				
Source: ComEd data and Navigant team analysis.				

Table 6-17. LFER Model Estimates, Wave 3

	Estimate	Std. Error	T value	P value
post	-9.52	0.07	-139.45	0.00
post_trt	-1.21	0.08	-15.71	0.00
post_trt:LR	-0.04	0.16	-0.23	0.82
post_trt:TR	0.33	0.15	2.16	0.03
R-Squared: 0.05; Adj. R-Squared: 0.05				
F-statistic: 48,629 on 4 and 3,876,935 DF, p-value: 0.00				
Source: ComEd data and Navigant team analysis.				

Table 6-18. PPR Model Estimates, Wave 4

	Estimate	Std. Error	T value	P value
treatment	-0.84	0.09	-9.90	0.00
yrmo201506	12.43	0.34	36.12	0.00
yrmo201507	17.17	0.33	52.19	0.00
yrmo201508	19.79	0.37	53.23	0.00
yrmo201509	19.10	0.40	47.76	0.00
yrmo201510	16.27	0.56	29.14	0.00
yrmo201511	14.60	0.39	37.89	0.00
yrmo201512	13.45	0.30	45.59	0.00
yrmo201601	19.10	0.34	55.62	0.00
yrmo201602	16.08	0.34	47.53	0.00
yrmo201603	17.04	0.33	51.88	0.00
yrmo201604	15.25	0.34	44.73	0.00
yrmo201605	14.91	0.31	48.30	0.00
yrmo201506:pre_use	0.51	0.01	52.12	0.00
yrmo201507:pre_use	0.40	0.01	59.88	0.00
yrmo201508:pre_use	0.48	0.01	71.67	0.00
yrmo201509:pre_use	0.50	0.01	48.35	0.00
yrmo201510:pre_use	0.40	0.02	19.07	0.00
yrmo201511:pre_use	0.37	0.01	26.17	0.00
yrmo201512:pre_use	0.49	0.01	52.75	0.00
yrmo201601:pre_use	0.36	0.01	39.84	0.00
yrmo201602:pre_use	0.43	0.01	43.83	0.00
yrmo201603:pre_use	0.35	0.01	31.73	0.00
yrmo201604:pre_use	0.35	0.01	28.69	0.00
yrmo201605:pre_use	0.32	0.01	28.51	0.00
Residual standard error: 10.46 on 338,111 degrees of freedom				
Multiple R-squared: 0.90, Adjusted R-squared: 0.90				
F-statistic: 127,445 on 25 and 338,111 DF, p-value: 0				
Source: ComEd data and Navigant team analysis.				

Table 6-19. LFER Model Estimates, Wave 4

	Estimate	Std. Error	T value	P value
post	-4.59	0.06	-72.61	0.00
post_trt	-0.83	0.09	-9.33	0.00
R-Squared: 0.04; Adj. R-Squared: 0.03				
F-statistic: 12,187 on 2 and 667,078 DF, p-value: 0.00				
Source: ComEd data and Navigant team analysis.				

Table 6-20. PPR Model Estimates, Wave 5

	Estimate	Std. Error	T value	P value
treatment	-0.85	0.31	-2.70	0.01
yrmo201506	8.80	0.61	14.37	0.00
yrmo201507	10.38	0.71	14.61	0.00
yrmo201508	12.48	0.76	16.48	0.00
yrmo201509	11.37	0.61	18.58	0.00
yrmo201510	10.60	0.98	10.80	0.00
yrmo201511	13.85	1.28	10.79	0.00
yrmo201512	14.14	1.17	12.06	0.00
yrmo201601	9.63	0.83	11.63	0.00
yrmo201602	8.20	0.82	9.97	0.00
yrmo201603	9.36	0.75	12.49	0.00
yrmo201604	15.95	0.87	18.42	0.00
yrmo201605	12.57	0.77	16.24	0.00
treatment:TR	0.51	0.33	1.56	0.12
yrmo201506:pre_use	0.72	0.01	67.74	0.00
yrmo201507:pre_use	0.67	0.01	64.93	0.00
yrmo201508:pre_use	0.70	0.01	71.54	0.00
yrmo201509:pre_use	0.80	0.01	76.19	0.00
yrmo201510:pre_use	0.77	0.02	35.19	0.00
yrmo201511:pre_use	0.60	0.03	24.10	0.00
yrmo201512:pre_use	0.66	0.02	35.44	0.00
yrmo201601:pre_use	0.80	0.01	65.80	0.00
yrmo201602:pre_use	0.86	0.01	69.80	0.00
yrmo201603:pre_use	0.79	0.01	61.13	0.00
yrmo201604:pre_use	0.70	0.02	37.41	0.00
yrmo201605:pre_use	0.67	0.02	40.10	0.00
Residual standard error: 23.48 on 164,171 degrees of freedom				
Multiple R-squared: 0.88, Adjusted R-squared: 0.88				
F-statistic: 45,414 on 26 and 164,171 DF, p-value: 0				
Source: ComEd data and Navigant team analysis.				

Table 6-21. LFER Model Estimates, Wave 5

	Estimate	Std. Error	T value	P value
post	-5.39	0.22	-24.86	0.00
post_trt	-0.59	0.32	-1.86	0.06
post_trt:TR	0.30	0.33	0.93	0.35

R-Squared: 0.01; Adj. R-Squared: 0.01

F-statistic: 1,208 on 3 and 327,757 DF, p-value: 0.00

Source: ComEd data and Navigant team analysis.

Table 6-22. PPR Model Estimates, Wave 6

	Estimate	Std. Error	T value	P value
treatment	-0.84	0.09	-9.62	0.00
yrmo201506	4.93	0.28	17.42	0.00
yrmo201507	3.05	0.32	9.64	0.00
yrmo201508	10.49	0.30	34.99	0.00
yrmo201509	7.47	0.32	23.64	0.00
yrmo201510	6.17	0.30	20.26	0.00
yrmo201511	4.52	0.30	15.19	0.00
yrmo201512	5.03	0.28	17.89	0.00
yrmo201601	6.56	0.27	24.53	0.00
yrmo201602	6.05	0.26	23.23	0.00
yrmo201603	6.97	0.25	28.12	0.00
yrmo201604	6.58	0.26	25.50	0.00
yrmo201605	3.37	0.26	12.75	0.00
yrmo201506:pre_use	0.73	0.01	120.53	0.00
yrmo201507:pre_use	0.61	0.00	132.66	0.00
yrmo201508:pre_use	0.74	0.00	150.23	0.00
yrmo201509:pre_use	0.80	0.01	125.10	0.00
yrmo201510:pre_use	0.82	0.01	92.75	0.00
yrmo201511:pre_use	0.75	0.01	92.94	0.00
yrmo201512:pre_use	0.79	0.01	118.86	0.00
yrmo201601:pre_use	0.77	0.01	136.29	0.00
yrmo201602:pre_use	0.78	0.01	136.11	0.00
yrmo201603:pre_use	0.68	0.01	118.37	0.00
yrmo201604:pre_use	0.69	0.01	102.37	0.00
yrmo201605:pre_use	0.78	0.01	105.02	0.00

Residual standard error: 15.64 on 948,528 degrees of freedom

Multiple R-squared: 0.90, Adjusted R-squared: 0.90

F-statistic: 337,004 on 25 and 948,528 DF, p-value: 0

Source: ComEd data and Navigant team analysis.

Table 6-23. LFER Model Estimates, Wave 6

	Estimate	Std. Error	T value	P value
post	-6.80	0.08	-87.24	0.00
post_trt	-0.91	0.09	-10.16	0.00
R-Squared: 0.04; Adj. R-Squared: 0.04				
F-statistic: 37,945 on 2 and 1,880,751 DF, p-value: 0.00				
Source: ComEd data and Navigant team analysis.				

Table 6-24. PPR Model Estimates, Wave 7 Low

	Estimate	Std. Error	T value	P value
treatment	-0.17	0.02	-7.88	0.00
yrmo201506	6.58	0.05	132.48	0.00
yrmo201507	7.73	0.04	187.44	0.00
yrmo201508	11.19	0.05	207.28	0.00
yrmo201509	7.01	0.05	145.18	0.00
yrmo201510	6.09	0.05	122.68	0.00
yrmo201511	6.81	0.06	109.94	0.00
yrmo201512	7.65	0.05	157.08	0.00
yrmo201601	8.42	0.05	160.17	0.00
yrmo201602	9.21	0.05	188.04	0.00
yrmo201603	8.82	0.05	190.27	0.00
yrmo201604	7.51	0.05	140.60	0.00
yrmo201605	6.29	0.06	112.75	0.00
yrmo201506:pre_use	0.58	0.00	197.05	0.00
yrmo201507:pre_use	0.50	0.00	317.79	0.00
yrmo201508:pre_use	0.68	0.00	295.19	0.00
yrmo201509:pre_use	0.61	0.00	317.08	0.00
yrmo201510:pre_use	0.56	0.00	178.51	0.00
yrmo201511:pre_use	0.46	0.00	110.65	0.00
yrmo201512:pre_use	0.46	0.00	173.22	0.00
yrmo201601:pre_use	0.48	0.00	180.53	0.00
yrmo201602:pre_use	0.40	0.00	164.56	0.00
yrmo201603:pre_use	0.36	0.00	139.16	0.00
yrmo201604:pre_use	0.43	0.00	119.99	0.00
yrmo201605:pre_use	0.49	0.00	121.67	0.00
Residual standard error: 5.77 on 5,516,477 degrees of freedom				
Multiple R-squared: 0.90 Adjusted R-squared: 0.90				
F-statistic: 2,017,543 on 25 and 5,516,477 DF, p-value: 0				
Source: ComEd data and Navigant team analysis.				

Table 6-25. LFER Model Estimates, Wave 7 Low

	Estimate	Std. Error	T value	P value
post	-1.00	0.02	-49.08	0.00
post_trt	-0.18	0.02	-8.43	0.00
R-Squared: 0.01; Adj. R-Squared: 0.01				
F-statistic: 44,619 on 2 and 11,495,281 DF, p-value: 0.00				
Source: ComEd data and Navigant team analysis.				

Table 6-26. PPR Model Estimates, Wave 7 High

	Estimate	Std. Error	T value	P value
treatment	-0.48	0.03	-15.77	0.00
yrmo201506	8.10	0.08	105.72	0.00
yrmo201507	9.38	0.07	136.98	0.00
yrmo201508	14.27	0.08	185.69	0.00
yrmo201509	8.59	0.07	121.98	0.00
yrmo201510	7.63	0.08	96.61	0.00
yrmo201511	9.34	0.09	108.46	0.00
yrmo201512	11.15	0.08	146.86	0.00
yrmo201601	11.93	0.08	155.95	0.00
yrmo201602	12.19	0.07	179.50	0.00
yrmo201603	12.53	0.07	191.83	0.00
yrmo201604	11.01	0.08	133.75	0.00
yrmo201605	8.34	0.09	90.86	0.00
yrmo201506:pre_use	0.67	0.00	237.03	0.00
yrmo201507:pre_use	0.58	0.00	333.93	0.00
yrmo201508:pre_use	0.73	0.00	347.59	0.00
yrmo201509:pre_use	0.66	0.00	360.97	0.00
yrmo201510:pre_use	0.62	0.00	197.42	0.00
yrmo201511:pre_use	0.50	0.00	139.38	0.00
yrmo201512:pre_use	0.48	0.00	187.11	0.00
yrmo201601:pre_use	0.50	0.00	217.66	0.00
yrmo201602:pre_use	0.46	0.00	224.73	0.00
yrmo201603:pre_use	0.39	0.00	178.01	0.00
yrmo201604:pre_use	0.44	0.00	130.31	0.00
yrmo201605:pre_use	0.54	0.00	131.32	0.00
Residual standard error: 8.49 on 5,731,352 degrees of freedom				
Multiple R-squared: 0.91 Adjusted R-squared: 0.91				
F-statistic: 2,436,827 on 25 and 5,731,352 DF, p-value: 0				
Source: ComEd data and Navigant team analysis.				

Table 6-27. LFER Model Estimates, Wave 7 High

	Estimate	Std. Error	T value	P value
post	-2.79	0.03	-92.42	0.00
post_trt	-0.48	0.03	-15.23	0.00
R-Squared: 0.02; Adj. R-Squared: 0.02				
F-statistic: 132,631 on 2 and 11,873,210 DF, p-value: 0.00				
Source: ComEd data and Navigant team analysis.				

Table 6-28. PPR Model Estimates, New Mover Wave Full

	Estimate	Std. Error	T value	P value
treatment	-0.17	0.08	-2.25	0.02
yrmo201506	12.53	0.12	106.29	0.00
yrmo201507	14.61	0.13	115.72	0.00
yrmo201508	18.94	0.15	130.18	0.00
yrmo201509	15.07	0.13	112.83	0.00
yrmo201510	11.45	0.13	86.97	0.00
yrmo201511	10.57	0.13	80.43	0.00
yrmo201512	11.47	0.12	95.90	0.00
yrmo201601	10.67	0.14	78.41	0.00
yrmo201602	8.69	0.13	66.97	0.00
yrmo201603	7.97	0.11	71.44	0.00
yrmo201604	5.64	0.13	42.98	0.00
yrmo201605	4.55	0.13	35.76	0.00
yrmo201506:pre_use	0.45	0.01	89.16	0.00
yrmo201507:pre_use	0.47	0.00	102.54	0.00
yrmo201508:pre_use	0.59	0.01	108.42	0.00
yrmo201509:pre_use	0.55	0.00	111.18	0.00
yrmo201510:pre_use	0.53	0.01	76.66	0.00
yrmo201511:pre_use	0.49	0.01	78.44	0.00
yrmo201512:pre_use	0.52	0.00	121.71	0.00
yrmo201601:pre_use	0.64	0.00	138.40	0.00
yrmo201602:pre_use	0.71	0.00	159.10	0.00
yrmo201603:pre_use	0.59	0.00	156.82	0.00
yrmo201604:pre_use	0.75	0.01	121.91	0.00
yrmo201605:pre_use	0.77	0.01	120.14	0.00
Residual standard error: 13.10 on 875,812 degrees of freedom				
Multiple R-squared: 0.82 Adjusted R-squared: 0.82				
F-statistic: 157,040 on 23 and 875,812 DF, p-value: 0				
Source: ComEd data and Navigant team analysis.				

Table 6-29. LFER Model Estimates, New Mover Wave Full

	Estimate	Std. Error	T value	P value
post	1.02	0.07	14.69	0.00
post_trt	-0.21	0.08	-2.68	0.01
R-Squared: 0.00; Adj. R-Squared: 0.00				
F-statistic: 1,063 on 2 and 2,117,753 DF, p-value: 0.00				
Source: ComEd data and Navigant team analysis.				

Table 6-30. PPR Model Estimates, New Mover Wave Partial

	Estimate	Std. Error	T value	P value
treatment	-0.21	0.08	-2.58	0.01
yrmo201506	18.04	0.35	52.01	0.00
yrmo201507	19.51	0.25	79.09	0.00
yrmo201508	24.98	0.22	111.88	0.00
yrmo201509	19.69	0.18	111.54	0.00
yrmo201510	13.61	0.14	96.72	0.00
yrmo201511	11.58	0.13	87.91	0.00
yrmo201512	12.53	0.12	105.38	0.00
yrmo201601	12.50	0.13	97.50	0.00
yrmo201602	12.07	0.12	99.28	0.00
yrmo201603	12.17	0.10	116.30	0.00
yrmo201604	12.14	0.11	111.22	0.00
yrmo201605	12.10	0.11	111.76	0.00
yrmo201506:pre_use	0.37	0.01	25.53	0.00
yrmo201507:pre_use	0.41	0.01	48.47	0.00
yrmo201508:pre_use	0.49	0.01	63.93	0.00
yrmo201509:pre_use	0.45	0.01	72.46	0.00
yrmo201510:pre_use	0.46	0.01	64.25	0.00
yrmo201511:pre_use	0.46	0.01	75.34	0.00
yrmo201512:pre_use	0.49	0.00	114.59	0.00
yrmo201601:pre_use	0.58	0.00	129.69	0.00
yrmo201602:pre_use	0.61	0.00	144.12	0.00
yrmo201603:pre_use	0.47	0.00	136.50	0.00
yrmo201604:pre_use	0.49	0.00	98.36	0.00
yrmo201605:pre_use	0.42	0.01	80.86	0.00
Residual standard error: 13.46 on 802,592 degrees of freedom				
Multiple R-squared: 0.80 Adjusted R-squared: 0.80				
F-statistic: 131,119 on 25 and 802,592 DF, p-value: 0				
Source: ComEd data and Navigant team analysis.				

Table 6-31. LFER Model Estimates, New Mover Wave Partial

	Estimate	Std. Error	T value	P value
post	0.67	0.07	9.00	0.00
post_trt	-0.15	0.08	-1.75	0.08
R-Squared: 0.00; Adj. R-Squared: 0.00				
F-statistic: 482 on 2 and 2,375,724 DF, p-value: 0.00				
Source: ComEd data and Navigant team analysis.				

Table 6-32. PPR Model Estimates, Wave 8

	Estimate	Std. Error	T value	P value
treatment	-0.28	0.08	-3.35	0.00
yrmo201507	6.79	0.18	38.23	0.00
yrmo201508	9.93	0.20	48.67	0.00
yrmo201509	6.87	0.18	38.80	0.00
yrmo201510	6.72	0.22	30.70	0.00
yrmo201511	9.14	0.24	38.24	0.00
yrmo201512	11.12	0.19	59.67	0.00
yrmo201601	8.93	0.20	45.33	0.00
yrmo201602	7.57	0.19	40.20	0.00
yrmo201603	9.35	0.16	58.38	0.00
yrmo201604	7.40	0.22	34.04	0.00
yrmo201605	5.89	0.22	26.34	0.00
yrmo201507:pre_use	0.76	0.01	150.18	0.00
yrmo201508:pre_use	0.92	0.01	152.69	0.00
yrmo201509:pre_use	0.80	0.01	155.70	0.00
yrmo201510:pre_use	0.75	0.01	81.80	0.00
yrmo201511:pre_use	0.55	0.01	63.18	0.00
yrmo201512:pre_use	0.53	0.01	103.66	0.00
yrmo201601:pre_use	0.67	0.01	133.99	0.00
yrmo201602:pre_use	0.74	0.00	152.19	0.00
yrmo201603:pre_use	0.56	0.00	134.35	0.00
yrmo201604:pre_use	0.70	0.01	85.93	0.00
yrmo201605:pre_use	0.73	0.01	78.49	0.00
treatment	-0.28	0.08	-3.35	0.00
yrmo201507	6.79	0.18	38.23	0.00
Residual standard error: 11.65 on 774,544 degrees of freedom				
Multiple R-squared: 0.90 Adjusted R-squared: 0.90				
F-statistic: 288,561 on 25 and 774,544 DF, p-value: 0				
Source: ComEd data and Navigant team analysis.				

Table 6-33. LFER Model Estimates, Wave 8

	Estimate	Std. Error	T value	P value
post	-2.25	0.08	-27.66	0.00
post_trt	-0.25	0.09	-2.87	0.00
R-Squared: 0.01; Adj. R-Squared : 0.01				
F-statistic: 5,520 on 2 and 1,646,444 DF, p-value: 0.00				

Source: ComEd data and Navigant team analysis.

6.5 Detailed Uplift Analysis Results

6.5.1 PY8 Uplift

Table 6-34 through Table 6-46 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 FFR program, the HEA program, the Rebate program, and MESP. These tables show estimates of both positive and negative uplift, however, only positive uplift was used to adjust program savings for double-counting.

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 in the 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. For Wave 2, Navigant left out MESP as no treatment or control customers participated in that program in either the pre- or post-program periods.

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 6-34. Estimates of Double-Counted Savings, Wave 1 CR

	FFR	HEA	MESP	Rebate
Median program savings (annual kWh per participant)	592	462	72	317
Number of treatment customers	28,915	28,915	28,915	28,915
Treatment rate of participation, PY8	0.73%	0.56%	0.00%	1.12%
Change in rate of treatment participation from pre-program year	0.22%	-	-	-
Number of control customers	43,861	43,861	43,861	43,861
Control rate of participation, PY8	0.78%	0.50%	0.00%	1.12%
Change in rate of control participation from pre-program year	0.26%	-	-	-
DID or POD statistic	-0.04%	0.06%	0.00%	0.00%
Participant uplift	-11	18	0	0
Statistically significant at the 90% confidence level?	No	No	No	No
Savings attributable to other programs (kWh)	-6,401.17	8,451.47	-22.93	-109.90
Percentage change in EE program participation rate for HER participants	-4.85%	12.72%	-24.16%	-0.11%

Source: ComEd data and Navigant team analysis.

Table 6-35. Estimates of Double-Counted Savings, Wave 1 LR

	FFR	HEA	MESP	Rebate
Median program savings (annual kWh per participant)	592	469	480	317
Number of treatment customers	8,827	8,827	8,827	8,827
Treatment rate of participation, PY8	0.84%	0.49%	0.01%	1.22%
Change in rate of treatment participation from pre-program year	0.22%	-	-	-
Number of control customers	43,861	43,861	43,861	43,861
Control rate of participation, PY8	0.78%	0.50%	0.00%	1.12%
Change in rate of control participation from pre-program year	0.26%	-	-	-
DID or POD statistic	-0.05%	-0.01%	0.01%	0.10%
Participant uplift	-4	-1	1	9
Statistically significant at the 90% confidence level?	No	No	No	No
Savings attributable to other programs (kWh)	-2,453.06	-409.25	286.80	2,846.45
Percentage change in EE program participation rate for HER participants	-5.30%	-1.99%	148.45%	9.07%

Source: ComEd data and Navigant team analysis.

Table 6-36. Estimates of Double-Counted Savings, Wave 2

	FFR	HEA	Rebate
Median program savings (annual kWh per participant)	592	405	305
Number of treatment customers	2,975	2,975	2,975
Treatment rate of participation, PY8	0.74%	0.61%	1.41%
Change in rate of treatment participation from pre-program year	-0.37%	-	-
Number of control customers	2,976	2,976	2,976
Control rate of participation, PY8	1.01%	0.71%	1.01%
Change in rate of control participation from pre-program year	0.30%	-	-
DID or POD statistic	-0.67%	-0.10%	0.40%
Participant uplift	-20	-3	12
Statistically significant at the 90% confidence level?	Yes	No	No
Savings attributable to other programs (kWh)	-11,838.21	-1,212.76	3,664.85
Percentage change in EE program participation rate for HER participants	-47.62%	-14.26%	40.05%

Source: ComEd data and Navigant team analysis.

Table 6-37. Estimates of Double-Counted Savings, Wave 3 CR

	FFR	HEA	MESP	Rebate
Median program savings (annual kWh per participant)	592	507	8098	298
Number of treatment customers	179,057	179,057	179,057	179,057
Treatment rate of participation, PY8	0.89%	0.30%	0.00%	1.15%
Change in rate of treatment participation from pre-program year	-1.80%	-	-	-
Number of control customers	49,060	49,060	49,060	49,060
Control rate of participation, PY8	0.89%	0.25%	0.00%	1.17%
Change in rate of control participation from pre-program year	-1.72%	-	-	-
DID or POD statistic	-0.08%	0.05%	0.00%	-0.02%
Participant uplift	-137	84	-4	-39
Statistically significant at the 90% confidence level?	No	Yes	No	No
Savings attributable to other programs (kWh)	-81,285.70	42,509.84	-34,818.47	-11,508.50
Percentage change in EE program participation rate for HER participants	-7.94%	18.36%	-58.90%	-1.84%

Source: ComEd data and Navigant team analysis.

Table 6-38. Estimates of Double-Counted Savings, Wave 3 LR

	FFR	HEA	MESP	Rebate
Median program savings (annual kWh per participant)	592	415	32369	317
Number of treatment customers	9,825	9,825	9,825	9,825
Treatment rate of participation, PY8	1.00%	0.26%	0.01%	1.08%
Change in rate of treatment participation from pre-program year	-1.73%	-	-	-
Number of control customers	49,060	49,060	49,060	49,060
Control rate of participation, PY8	0.89%	0.25%	0.00%	1.17%
Change in rate of control participation from pre-program year	-1.72%	-	-	-
DID or POD statistic	-0.01%	0.01%	0.01%	-0.09%
Participant uplift	-1	1	1	-9
Statistically significant at the 90% confidence level?	No	No	No	No
Savings attributable to other programs (kWh)	-340.89	401.70	19,404.43	-2,899.38
Percentage change in EE program participation rate for HER participants	-0.58%	3.86%	149.67%	-7.95%

Source: ComEd data and Navigant team analysis.

Table 6-39. Estimates of Double-Counted Savings, Wave 4

	FFR	HEA	MESP	Rebate
Median program savings (annual kWh per participant)	592	497		169
Number of treatment customers	20,708	20,708	20,708	20,708
Treatment rate of participation, PY8	0.80%	0.36%	0.00%	1.01%
Change in rate of treatment participation from pre-program year	-1.26%	0.33%	-	-
Number of control customers	20,726	20,726	20,726	20,726
Control rate of participation, PY8	0.88%	0.30%	0.00%	0.87%
Change in rate of control participation from pre-program year	-1.05%	0.28%	-	-
DID or POD statistic	-0.20%	0.06%	0.00%	0.14%
Participant uplift	-42	12	-1	29
Statistically significant at the 90% confidence level?	Yes	No	No	No
Savings attributable to other programs (kWh)	-24,976.08	5,984.90	0	4,914.82
Percentage change in EE program participation rate for HER participants	-20.36%	19.45%	-100.00%	16.12%

Source: ComEd data and Navigant team analysis.

Table 6-40. Estimates of Double-Counted Savings, Wave 5

	FFR	HEA	MESP	Rebate
Median program savings (annual kWh per participant)	592	500	958	317
Number of treatment customers	9,945	9,945	9,945	9,945
Treatment rate of participation, PY8	0.41%	0.26%	0.00%	0.80%
Change in rate of treatment participation from pre-program year	-0.90%	0.20%	-0.05%	0.75%
Number of control customers	12,756	12,756	12,756	12,756
Control rate of participation, PY8	0.49%	0.34%	0.01%	0.67%
Change in rate of control participation from pre-program year	-0.98%	0.29%	-0.02%	0.61%
DID or POD statistic	0.07%	-0.09%	-0.03%	0.14%
Participant uplift	7	-9	-3	14
Statistically significant at the 90% confidence level?	No	No	No	No
Savings attributable to other programs (kWh)	4,412.85	-4,423.21	-2,549.06	4,494.81
Percentage change in EE program participation rate for HER participants	22.22%	-25.39%	-100.00%	21.56%

Source: ComEd data and Navigant team analysis.

Table 6-41. Estimates of Double-Counted Savings, Wave 6

	FFR	HEA	MESP	Rebate
Median program savings (annual kWh per participant)	592	500	397	317
Number of treatment customers	104,985	104,985	104,985	104,985
Treatment rate of participation, PY8	0.75%	0.32%	0.00%	0.96%
Change in rate of treatment participation from pre-program year	-0.76%	0.22%	-0.19%	0.67%
Number of control customers	31,497	31,497	31,497	31,497
Control rate of participation, PY8	0.75%	0.25%	0.00%	1.06%
Change in rate of control participation from pre-program year	-0.68%	0.17%	-0.17%	0.74%
DID or POD statistic	-0.08%	0.06%	-0.03%	-0.08%
Participant uplift	-84	63	-27	-81
Statistically significant at the 90% confidence level?	No	Yes	No	No
Savings attributable to other programs (kWh)	-49,945.54	31,337.46	-10,851.17	-25,648.22
Percentage change in EE program participation rate for HER participants	-9.66%	22.52%	-93.18%	-7.42%

Source: ComEd data and Navigant team analysis.

Table 6-42. Estimates of Double-Counted Savings, Wave 7 Low

	FFR	HEA	MESP	Rebate
Median program savings (annual kWh per participant)	592	410	130	201
Number of treatment customers	629,987	629,987	629,987	629,987
Treatment rate of participation, PY8	0.66%	0.49%	0.00%	0.65%
Change in rate of treatment participation from pre-program year	-0.49%	0.43%	-0.24%	0.38%
Number of control customers	52,500	52,500	52,500	52,500
Control rate of participation, PY8	0.69%	0.53%	0.01%	0.59%
Change in rate of control participation from pre-program year	-0.46%	0.49%	-0.24%	0.34%
DID or POD statistic	-0.04%	-0.06%	0.01%	0.04%
Participant uplift	-246	-393	36	237
Statistically significant at the 90% confidence level?	No	Yes	No	No
Savings attributable to other programs (kWh)	-145,667.04	-160,919.03	4,691.71	47,608.74
Percentage change in EE program participation rate for HER participants	-5.55%	-11.37%	-257.50%	6.11%

Source: ComEd data and Navigant team analysis.

Table 6-43. Estimates of Double-Counted Savings, Wave 7 High

	FFR	HEA	MESP	Rebate
Median program savings (annual kWh per participant)	592	455	130	276
Number of treatment customers	629,989	629,989	629,989	629,989
Treatment rate of participation, PY8	0.89%	0.51%	0.00%	0.99%
Change in rate of treatment participation from pre-program year	-0.52%	0.43%	-0.10%	0.55%
Number of control customers	52,499	52,499	52,499	52,499
Control rate of participation, PY8	0.81%	0.46%	0.00%	0.96%
Change in rate of control participation from pre-program year	-0.63%	0.38%	-0.10%	0.50%
DID or POD statistic	0.12%	0.06%	-0.01%	0.05%
Participant uplift	740	347	-46	333
Statistically significant at the 90% confidence level?	Yes	Yes	No	No
Savings attributable to other programs (kWh)	438,083.76	157,727.14	-6,000.11	91,806.72
Percentage change in EE program participation rate for HER participants	15.16%	12.16%	-82.14%	5.64%

Source: ComEd data and Navigant team analysis.

Table 6-44. Estimates of Double-Counted Savings, New Mover Wave Full

	FFR	HEA	MESP	Rebate
Median program savings (annual kWh per participant)	592	305	137	169
Number of treatment customers	103,056	103,056	103,056	103,056
Treatment rate of participation, PY8	0.41%	0.40%	0.00%	0.83%
Change in rate of treatment participation from pre-program year	0.01%	0.32%	-0.01%	0.80%
Number of control customers	25,764	25,764	25,764	25,764
Control rate of participation, PY8	0.35%	0.32%	0.00%	0.85%
Change in rate of control participation from pre-program year	-0.08%	0.24%	-0.02%	0.82%
DID or POD statistic	0.09%	0.07%	0.01%	-0.02%
Participant uplift	90	76	11	-17
Statistically significant at the 90% confidence level?	Yes	Yes	No	No
Savings attributable to other programs (kWh)	53,280.00	23,196.34	1,507.55	-2,865.57
Percentage change in EE program participation rate for HER participants	26.79%	22.35%	-137.50%	-1.96%

Source: ComEd data and Navigant team analysis.

Table 6-45. Estimates of Double-Counted Savings, New Mover Wave Partial

	FFR	HEA	MESP	Rebate
Median program savings (annual kWh per participant)	912	487	1016	158
Number of treatment customers	135,600	135,600	135,600	135,600
Treatment rate of participation, PY8	0.28%	0.38%	0.00%	1.56%
Change in rate of treatment participation from pre-program year	0.28%	0.00%	0.00%	1.56%
Number of control customers	33,900	33,900	33,900	33,900
Control rate of participation, PY8	0.24%	0.33%	0.01%	1.58%
Change in rate of control participation from pre-program year	0.23%	0.00%	0.00%	1.58%
DID or POD statistic	0.05%	0.05%	0.00%	-0.01%
Participant uplift	64	70	-4	-20
Statistically significant at the 90% confidence level?	No	No	No	No
Savings attributable to other programs (kWh)	58,374.14	34,121.89	-4,062.28	-3,167.90
Percentage change in EE program participation rate for HER participants	19.94%	15.77%	-50.00%	-0.94%

Source: ComEd data and Navigant team analysis.

Table 6-46. Estimates of Double-Counted Savings, Wave 8

	FFR	HEA	MESP	Rebate
Median program savings (annual kWh per participant)	592	336	148	169
Number of treatment customers	81,724	81,724	81,724	81,724
Treatment rate of participation, PY8	0.48%	0.39%	0.01%	0.91%
Change in rate of treatment participation from pre-program year	-0.42%	0.26%	-0.03%	0.84%
Number of control customers	10,898	10,898	10,898	10,898
Control rate of participation, PY8	0.49%	0.35%	0.01%	0.96%
Change in rate of control participation from pre-program year	-0.42%	0.23%	-0.04%	0.86%
DID or POD statistic	0.00%	0.03%	0.01%	-0.02%
Participant uplift	-2	27	8	-19
Statistically significant at the 90% confidence level?	No	No	No	No
Savings attributable to other programs (kWh)	-1,211.49	8,914.18	1,182.64	-3,186.70
Percentage change in EE program participation rate for HER participants	-0.52%	9.01%	-400.61%	-2.48%

Source: ComEd data and Navigant team analysis.

6.5.2 Legacy Uplift

In PY4, Navigant considered double-counted savings for the following PY4 programs: FFRR, and the CACES and SFHP programs.²⁷ The measure lives for PY4 programs were taken from the PY4 total resource cost report.²⁸ Table 6-47 shows the double counted savings (kWh) from each program in PY4. According to the PY4 evaluation report, none of the Wave 2 participant or control customers participated in any of these other EE programs, and so there is no uplift for Wave 2. This table shows estimates of

²⁷ Navigant Consulting, Inc. 2013. *Energy Efficiency / Demand Response Plan: Plan Year 4 (6/1/2011-5/31/2012); Evaluation Report: Home Energy Reports*. Presented to Commonwealth Edison Company.

²⁸ Navigant Consulting, Inc. 2014. *Review of EPY4 Total Resource Cost Test Assumptions*. Presented to Commonwealth Edison Company.

both positive and negative uplift, however, only positive uplift was used to adjust program savings for double-counting.

Table 6-47. Double Counted Savings (kWh) from PY4

	FFRR	CACES - DTUP	CACES - SEER 13	CACES - SEER 14+	SFHP
Measure Life	8	5	5	5	9
Wave 1, Group 1	36,842	-463	-2,026	-1,431	166
Wave 1, Group 2	5,293	1,596	712	-658	-2,598
Wave 1, Group 3	20,173	-884	-467	-41	248
Wave 2	0	0	0	0	0
Wave 3	267,281	22,411	-19,818	-8,975	33,467
Wave 4	2,620	212	-732	0	1,443
Total	332,209	22,872	-22,331	-11,105	32,726

Source: Navigant analysis

In PY5, Navigant considered double-counted savings for the following PY5 programs: FFRR, the CSR, the CW, the MF, and the SFHES programs. The measure lives for PY5 programs were taken from the PY5 total resource cost report.²⁹ The measure life for the SFHES program is a simple average of the three measures included in that program. Table 6-48 shows the double counted savings (kWh) from each program in PY5. This table shows estimates of both positive and negative uplift, however, only positive uplift was used to adjust program savings for double-counting.

Table 6-48. Double Counted Savings (kWh) from PY5

	FFRR	CSR	CW	MF	SFHES
Measure Life	8	18	14	5.42	12
Wave 1 CR	63,249	39,118	4,010	368	-3,960
Wave 1 LR	-2,297	-4,835	689	643	2,103
Wave 2	592	-769	-262	1,858	0
Wave 3 CR	123,088	113,512	2,260	-4,650	23,881
Wave 4	4,717	-2,977	-2,786	386	-1,815
Wave 5	-22,101	7,904	947	-2,915	1,804
Total	167,248	151,953	4,858	-4,310	22,013

Source: ComEd tracking data and Navigant team analysis.

In PY6, Navigant considered double-counted savings for the following PY6 programs: SFHES, CSR, FFRR programs, and MF. The measure lives for PY6 programs were taken from the PY6 total resource cost report.³⁰ The measure life for the SFHES and MF programs are the simple average of the measures included in that program. Table 6-49 shows the double counted savings (kWh) from each program in PY6. This table shows estimates of both positive and negative uplift, however, only positive uplift was used to adjust program savings for double-counting.

²⁹ Navigant Consulting, Inc. 2014. *Review of EPY5 Total Resource Cost Test Assumptions*. Presented to Commonwealth Edison Company.

³⁰ Navigant Consulting, Inc. 2016. *Review of EPY6 Total Resource Cost Test Assumptions*. Presented to Commonwealth Edison Company.

Table 6-49. Double Counted Savings (kWh) from PY6

	SFHES	CSR	FFRR	MF
Measure Life	8.4	18	8	4.67
Wave 1 CR	-1,229	-713	979	-2,195
Wave 1 LR	2,882	2,579	2,334	-340
Wave 2	500	6	-9,463	274
Wave 3 CR	16,467	-27,912	15,414	-6,069
Wave 3 LR	2,099	-1,669	8,423	163
Wave 4	1,515	-9,967	-3,639	1,637
Wave 5	1,105	6,180	14,743	-1,951
Wave 6	14,987	59,750	16,937	3,435
Total	38,326	28,254	45,728	-5,046

Source: ComEd tracking data and Navigant team analysis.

In PY7, Navigant considered double-counted savings for the following PY7 programs: FFR, HEA, MESP, and Rebate. The PY7 total resource cost report was not yet available at the time this report was written, so the program measure lives for PY7 were not included, but for the PY8 legacy uplift adjustment the reasonable assumption was made that each of these programs had a measure life of at least two years and should be deducted in PY8. Table 6-50 shows the double counted savings (kWh) from each program in PY7. This table shows estimates of both positive and negative uplift, however, only positive uplift was used to adjust program savings for double-counting.

Table 6-50. Double Counted Savings (kWh) from PY7

	FFR	HEA	MESP	Rebate
Measure Life	-	-	-	-
Wave 1 CR	7,741	2,502	-1,564	1,781
Wave 1 LR	134,125	6,789	2,133	6,284
Wave 2	-11,243	500	-261	0
Wave 3 CR	-28,068	21,248	3,694	20,246
Wave 3 LR	9,335	696	-52	-238
Wave 4	5,257	5,005	-782	-1,775
Wave 5	9,189	-2,390	433	1,317
Wave 6	7,490	-833	-10,264	22,141
Wave 7 High	363,489	19,000	-6,522	138,835
Wave 7 Low	90,570	-12,998	-786	-70,621
Total	587,885	39,519	-13,971	117,970

Source: ComEd tracking data and Navigant team analysis.