IMPACT AND PROCESS EVALUATION OF 2011 (PY4) AMEREN ILLINOIS COMPANY BEHAVIORAL MODIFICATION PROGRAM

Final

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TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 1

2. INTRODUCTION 5

3. EVALUATION METHODS 6

3.1 Data Sources and Analytical Methods 6

4. RESULTS AND FINDINGS 13

4.1 Process Findings 13

4.2 Impact Results 15

4.3 Inputs for Future Program Planning 27

A. APPENDIX: EQUIVALENCY CHECK METHODOLOGY 30

B. APPENDIX: EQUIVALENCY CHECK ANALYSIS 33

C. APPENDIX: BILLING ANALYSIS DATA CLEANING RESULTS 46

D. APPENDIX: BILLING ANALYSIS MODEL COEFFICIENTS 54

E. APPENDIX: CHANNELING ANALYSIS SAVINGS ADJUSTMENTS 60

F. APPENDIX: IMPLEMENTATION MODEL 64

TABLE OF TABLES

Table 1. Planned Versus Actual Participation 2

Table 2. PY4 Behavioral Modification Program Net Impacts 2

Table 3. Summary of Evaluation Methods 6

Table 4. Participation Lift by Group - Electric 15

Table 5. Participation Lift by Group - Gas 15

Table 6. Summary of Demographic Analysis for All Treatment and Control Groups 17

Table 7. Comparison of Average Daily Consumption by Cohort, Treatment v. Control, Pre- v. Post-Participation--KWh 19

Table 8. Comparison of Average Daily Consumption by Cohort, Treatment v. Control, Pre- v. Post-Participation--Therms 19

Table 9. PY4 Behavioral Modification Program Impacts - Electric 20

Table 10. PY4 Behavioral Modification Program Impacts - Gas 21

Table 11. Per Household Savings (%) by Season - Electric 22

Table 12. Per Household Savings (%) by Season - Gas 23

Table 13. Per Household Savings (% & kWh) by Baseline Usage – Electric 24

Table 14. Per Household Savings (% & Therms) by Baseline Usage – Gas 25

Table 15. Behavioral Modification Program Impacts - Electric 26

Table 16. PY4 Behavioral Modification Program Total Savings - Electric 26

Table 17. Behavioral Modification Program Impacts - Gas 27

Table 18. PY4 Behavioral Modification Program Total Savings - Gas 27

Table 19. Number of Customers with Baseline Usage Data Before Data Cleaning 30

Table 20. Summary of Matching Secondary Data from Experian 31

Table 21. Data Cleaning Results: Original Group, Electric 46

Table 22. Data Cleaning Results: Expansion Group 1, Electric 47

Table 23. Data Cleaning Results: Expansion Group 2, Electric 48

Table 24. Data Cleaning Results: Original Group, Gas 49

Table 25. Data Cleaning Results: Expansion Group 1, Gas 50
Table 26. Data Cleaning Results: Expansion Group 2, Gas 51
Table 27. Data Cleaning Results: Expansion Group 3, Gas 52
Table 28. Billing Analysis Model Coefficients – Electric, Original Group (Winter) 54
Table 29. Billing Analysis Model Coefficients – Electric, Original Group (Spring) 54
Table 30. Billing Analysis Model Coefficients – Electric, Original Group (Fall) 54
Table 31. Billing Analysis Model Coefficients – Electric, Expansion Group 1 (Winter) 54
Table 32. Billing Analysis Model Coefficients – Electric, Expansion Group 1 (Summer) 55
Table 33. Billing Analysis Model Coefficients – Electric, Expansion Group 1 (Spring) 55
Table 34. Billing Analysis Model Coefficients – Electric, Expansion Group 1 (Fall) 55
Table 35. Billing Analysis Model Coefficients – Electric, Expansion Group 2 (Winter) 55
Table 36. Billing Analysis Model Coefficients – Electric, Expansion Group 2 (Spring) 56
Table 37. Billing Analysis Model Coefficients – Electric, Expansion Group 2 (Overall) 56
Table 38. Billing Analysis Model Coefficients – Gas, Original Group (Winter) 56
Table 39. Billing Analysis Model Coefficients – Gas, Original Group (Spring) 56
Table 40. Billing Analysis Model Coefficients – Gas, Original Group (Fall) 57
Table 41. Billing Analysis Model Coefficients – Gas, Expansion Group 1 (Winter) 57
Table 42. Billing Analysis Model Coefficients – Gas, Expansion Group 1 (Summer) 57
Table 43. Billing Analysis Model Coefficients – Gas, Expansion Group 1 (Spring) 57
Table 44. Billing Analysis Model Coefficients – Gas, Expansion Group 1 (Fall) 58
Table 45. Billing Analysis Model Coefficients – Gas, Expansion Group 2 (Winter) 58
Table 46. Billing Analysis Model Coefficients – Gas, Expansion Group 2 (Spring) 58
Table 47. Billing Analysis Model Coefficients – Gas, Expansion Group 2 (Overall) 58
Table 48. Billing Analysis Model Coefficients – Gas, Expansion Group 3 (Winter) 59
Table 49. Billing Analysis Model Coefficients – Gas, Expansion Group 3 (Spring) 59
Table 50. Billing Analysis Model Coefficients – Gas, Expansion Group 3 (Overall) 59
Table 51. Treatment and Control Group Sizes - Electric 60

Table 52. Treatment and Control Group Sizes - Gas 60
Table 53. Difference in Difference Estimator 60
Table 54. Modeled Baseline Usage 61
Table 55. Savings Adjustment – Electric, Original Group 61
Table 56. Savings Adjustment – Electric, Expansion Group 1 61
Table 57. Savings Adjustment – Electric, Expansion Group 2 61
Table 58. Savings Adjustment – Gas, Original Group 61
Table 59. Savings Adjustment – Gas, Expansion Group 1 62
Table 60. Savings Adjustment – Gas, Expansion Group 2 62
Table 61. Savings Adjustment – Gas, Expansion Group 3 62

TABLE OF FIGURES

Figure 1. Distribution of Average Daily Electricity Consumption in the Year before the Start of the Program [Original Group: Electric Customers, Comparison vs. Treatment Groups] 33

Figure 2. Distribution of Average Daily Electricity Consumption in the Year before the Start of the Program [Expansion Group 1: Electric Customers, Comparison vs. Treatment Groups] 34

Figure 3. Distribution of Average Daily Electricity Consumption in the Year before the Start of the Program [Expansion Group 2: Electric Customers, Comparison vs. Treatment Groups] 34

Figure 4. Distribution of Average Daily Gas Consumption in the Year before the Start of the Program [Original Group: Gas Customers, Comparison vs. Treatment Groups] 35

Figure 5. Distribution of Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 1: Gas Customers, Comparison vs. Treatment Groups] 35

Figure 6. Distribution of Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 2: Gas Customers, Comparison vs. Treatment Groups] 35

Figure 7. Distribution of Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 3: Gas Customers, Comparison vs. Treatment Groups] 37

Figure 8. Distribution of Winter Average Daily Electricity Consumption in the Year before the Start of the Program [Original Group: Electric Customers, Comparison vs. Treatment Groups] 37

Figure 9. Distribution of Winter Average Daily Electricity Consumption in the Year before the Start of the Program [Expansion Group 1: Electric Customers, Comparison vs. Treatment Groups] 38

Figure 10. Distribution of Winter Average Daily Electricity Consumption in the Year before the Start of the Program [Expansion Group 2: Electric Customers, Comparison vs. Treatment Groups] 39

Figure 11. Distribution of Winter Average Daily Gas Consumption in the Year before the Start of the Program [Original Group: Gas Customers, Comparison vs. Treatment Groups] 39

Figure 12. Distribution of Winter Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 1: Gas Customers, Comparison vs. Treatment Groups] 40

Figure 13. Distribution of Winter Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 2: Gas Customers, Comparison vs. Treatment Groups] 40

Figure 14. Distribution of Winter Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 3: Gas Customers, Comparison vs. Treatment Groups] 41

Figure 15. Distribution of Summer Average Daily Electricity Consumption in the Year before the Start of the Program [Original Group: Electric Customers, Comparison vs. Treatment Groups] 42

Figure 16. Distribution of Summer Average Daily Electricity Consumption in the Year before the Start of the Program [Expansion Group 1: Electric Customers, Comparison vs. Treatment Groups] 42

Figure 17. Distribution of Summer Average Daily Electricity Consumption in the Year before the Start of the Program [Expansion Group 2: Electric Customers, Comparison vs. Treatment Groups]..... 43

Figure 18. Distribution of Summer Average Daily Gas Consumption in the Year before the Start of the Program [Original Group: Electric Customers, Comparison vs. Treatment Groups] 43

Figure 19. Distribution of Summer Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 1: Gas Customers, Comparison vs. Treatment Groups]..... 44

Figure 20. Distribution of Summer Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 2: Gas Customers, Comparison vs. Treatment Groups]..... 44

Figure 21. Distribution of Summer Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 3: Gas Customers, Comparison vs. Treatment Groups]..... 45

1. EXECUTIVE SUMMARY

As a part of its residential portfolio, Ameren Illinois Company (AIC) administers a Behavioral Modification Program. The program began as a pilot in August of 2010, and was developed to reduce the energy consumption of its customers through encouraging energy efficient choices. Since then, it has expanded into a full program. In PY4 (June 1, 2011 through May 31, 2012), administration responsibilities shifted from AIC to Conservation Services Group (CSG), with Opower remaining as the implementer. Overall, the expected savings from this program were 7% of the overall PY4 portfolio of electric savings and 17% of PY4 portfolio therm savings.

The program's primary tool for encouraging energy efficient behaviors is the Home Energy Report (HER). A HER includes the following information:

- A comparison of the customer's current energy usage to past usage
- A comparison of the customer's energy usage to similar households in the same geographical area
- Tips for reducing energy consumption, tailored to the customer's home energy profile (e.g., type of home, square footage, number of occupants, etc.)

The program offers three different treatment types, including a HER that is mailed to the customer's home, an electronic copy that is emailed to the customer if Opower has an email address on file, and the online portal, which customers can access to view their report along with additional information.

The program treated dual fuel customers during the program pilot phase, targeting households with higher than average energy consumption. At the beginning of PY4, the program added another group of dual fuel customers, focusing on the next level of high-use customers. In November of 2011, two additional groups were added, including another group of dual fuel customers, and a group of gas-only customers. Table 1 provides further details about these groups.

To support the evaluation, we conducted a review of program materials, interviews with program staff, a treatment/control equivalency analysis, a blling analysis, and a channeling analysis.

Impact Results

- **The Behavioral Modification Program successfully reached its targeted number of participants for each of the program groups.** In total, the program treated 267,462 customers in PY4. Table 1 below compares the number of customers to whom the program planned to send HERs and the number of actual customers receiving the reports. Planned numbers differ from actual numbers for a variety of reasons. Opower always overselects the number of households in a program, with the expectation that some customers may need to be removed from treatment.

Table 1. Planned Versus Actual Participation

Group Name	Fuel Type	Planned Number of Treated Participants	Actual Treated Participants
Original Group	Electric	50,000	50,001
	Gas	50,000	50,001
Expansion Group 1	Electric	75,000	76,355
	Gas	75,000	76,355
Expansion Group 2	Electric	100,000	119,917
	Gas	100,000	119,917
Expansion Group 3	Gas	20,000	21,189
Total Participants	Electric	225,000	246,273
Total Participants	Gas	245,000	267,462

- **The Behavioral Modification Program exceeded its gas savings goal by 31% and achieved 84% of its electric savings goal.** In total, the program saved 22,412 MWh and 1.2 million therms in PY4. Table 2 details these findings.

Table 2. PY4 Behavioral Modification Program Net Impacts

Group Name	Fuel Type	Net Savings per H.H.%[a]	Adjusted Net Savings per H.H.%[a]	Total Evaluated Participants[b]	Total Program Savings: Evaluated Period[c]	Total Adjusted Program Savings: Evaluated Period[c]
Original Group	Electric	1.46%	1.46%	48,694	5,230	5,230
	Gas	1.14%	1.03%	48,695	351,820	319,370
Expansion Group 1	Electric	1.32%	1.29%	72,913	13,317	13,039
	Gas	0.85%	0.79%	72,893	665,710	620,980
Expansion Group 2	Electric	0.88%	0.87%	108,654	4,200	4,142
	Gas	0.35%	0.35%	108,171	173,940	173,940
Expansion Group 3	Gas	0.96%	0.96%	16,616	85,220	85,220

Group Name	Fuel Type	Net Savings per H.H.%[a]	Adjusted Net Savings per H.H.%[a]	Total Evaluated Participants[b]	Total Program Savings: Evaluated Period[c]	Total Adjusted Program Savings: Evaluated Period[c]
Overall	Electric	1.14%	1.13%	230,261	22,747	22,412
	Gas	0.70%	0.66%	246,375	1,276,690	1,199,510

[a] Total program savings are shown in MWh and therms. Adjusted net savings take into account or remove energy savings that resulted from customer participation in other AIC programs in PY4.

[b] The number of evaluated participants is less than the number of treated participants, as some customers were eliminated from the analysis. Please see Appendix C, which explains how the data was prepared for the billing analysis.

[c] Total savings for Expansion Groups 2 and 3 were calculated using a full model rather than summing across seasonal model results, as post-treatment data was only available for a portion of the year. For the remaining groups, total savings were determined by summing modeled seasonal savings per household by cohort.

- **The Original Group per-household savings in PY4 exceeded savings in PY3 for both electric and gas.** Electric savings in PY3 were 1.2% per household, compared with 1.46% in PY4, while gas savings were 0.7% per household in PY3 and 1.03% in PY4. This is consistent with prior evaluations of this program where the second program year sees savings higher than the first year.

- **The largest gas savings were found in the spring season for three of the groups.** The evaluation team compared customers by season. In the analysis for gas savings, all groups but one showed significant savings in the winter, but the largest gas savings were in the spring season. The analysis by season for electric savings showed that in two of the groups, the highest electric savings were in the winter season. However, summer months were not available in the evaluated post period for two of these groups.

- **As expected, the rate of electricity savings tends to increase with the level of baseline consumption, but this is not always true for gas savings.** The evaluation team compared customer response to the Home Energy Reports by baseline usage, and found that as baseline consumption increases, the rate of electric savings also tends to increase. However, on the gas side this is not always the case. Medium usage households saved slightly less (as a percentage of baseline) than lower usage households in one group, while high usage households saved less than medium usage households in another group.

Process Results

- **Overall, AIC, CSG, and Opower have found the Behavioral Modification Program to be straightforward to administer and have faced only a limited number of challenges.** Through in-depth interviews with AIC, CSG, and Opower, the evaluation team found that the program is fairly turn-key. According to AIC, customers are satisfied overall with the program, and AIC has been able to work with CSG and Opower to address any issues identified.

- **Behavioral Modification Program participants are more likely to participate in other AIC residential programs; however, the number of participants vary by program group and the types of other programs that customers participate in.** Our research indicates that the

Behavioral Modification Program led to an increase in overall participation in other programs. However, participation rates vary and are not always consistent. Within the gas Expansion Group 2, the control group customers had a higher rate of participation.

Recommendations

- **AIC and CSG might consider the Behavioral Modification Program as an avenue to boost savings in other programs through targeted marketing.** Overall, treated customers participate in more AIC programs than non-treated customers. If other AIC programs are behind on goal achievement, direct marketing could be targeted to these customers to increase program participation. However, it should be noted that energy savings achieved as a result of participation in other AIC programs would reduce total Behavioral Modification Program savings, as the savings can only be claimed once.
- **AIC, CSG, and Opower should continue to monitor the energy use of customers dropped from the program, specifically those in Expansion Groups 2 and 3.** This may give an indication of the persistence of the treatment after the treatment is terminated.

2. INTRODUCTION

As a part of its residential portfolio, AIC offers the Behavioral Modification Program. This program began as a pilot in August 2010, and has since expanded to a full program, treating over 260,000 customers in PY4. The specific goals of the program are to achieve the following:

- Reduce energy consumption by driving energy efficient behaviors
- Boost customer engagement and education by helping customers understand and save energy
- Educate customers about no-cost and low-cost energy savings measures and behaviors

Three different treatment types are offered, including a paper report that is mailed to the customer's billing address, an electronic copy if Opower has an email address on file, and the online portal, which customers can log onto to view their report and additional information. Customers may decide that they no longer want to receive paper reports mailed to them if they receive an email report, but Opower indicates that only a few customers have decided to not receive paper reports. Reports are sent to treated customers on a monthly basis for the first three months of program treatment. Following the first three months, reports are sent on a bimonthly basis. The frequency of reports may increase to a monthly basis to encourage energy savings during times of peak energy usage.

A Home Energy Report includes three key features, including a comparison of the customer's current energy usage to past usage, a comparison of the customer's energy usage to similar households in the area, and tips for decreasing energy consumption. Energy saving tips may include setting back thermostats, lowering the temperature of the water heater, replacing old appliances, etc.

The PY4 evaluation focuses on the period from June 2011 through May 2012. The expected energy savings from this program is 7% of the overall PY4 portfolio of electric savings and 17% of the PY4 portfolio of therm savings, which equates to 26,836 MWh and 912,632 therms.

3. EVALUATION METHODS

In this section, we detail the evaluation activities conducted for the PY4 Behavioral Modification Program, along with the methods that were used.

3.1 DATA SOURCES AND ANALYTICAL METHODS

Data sources for evaluating the Behavioral Modification Program include:

- Program tracking databases
- Information on key program efforts and dates gathered through stakeholder interviews
- Data from Experian on customer demographics, household characteristics, and psychographic characteristics
- Electric and gas billing usage data for treatment and control groups

Table 3 provides a summary of the evaluation methods used for the PY4 evaluation.

Table 3. Summary of Evaluation Methods

Activity	PY4 Impact	PY4 Process	Forward Looking	Details
Program Materials Review		√		Reviewed materials to assess program design, implementation, and operations.
Interviews with program managers and implementers		√		Interviewed program managers from AIC, CSG, and Opower to discuss program theory and implementation, and to collect process-related feedback.
Treatment/Control Equivalency Analysis	√			Because the evaluation team did not select the treatment and control groups, it conducted a formal review of the groups to ensure equivalency. This review ensures the study's internal validity and defensibility and examines the ability to extrapolate savings to a full targeted population.
Impact Evaluation Approach	√			Conducted a billing analysis to quantify the actions taken among the treatment and control group members. Also performed a channeling analysis to ensure that we do not double-count savings from participation in other AIC programs.

Future efforts will include: (1) a persistence analysis to estimate program savings over time and (2) a telephone survey in PY6 of treatment and control group customers to determine what actions treatment group participants take as compared to the control group, the proportion of actions that are reported to be equipment-based versus conservation behavior-based, and specifically which behaviors

are contributing to program savings.

3.1.1 PROCESS ANALYSIS

Process evaluation activities in PY4 were limited, as the primary evaluation task for this year was the billing analysis. The evaluation team conducted in-depth interviews with program managers, developed an implementation model, and performed a channeling analysis. We also performed a review of the data from Opower to identify any errors or inconsistencies.

In-depth Interviews

The evaluation team conducted three in-depth interviews with program managers from AIC, CSG, and Opower in PY4 to help uncover areas of success, challenges to success, and insight into the daily workings of the program. Interviews also identified program objectives, goals, and a review of roles and responsibilities for each stakeholder group.

Through these interviews and a review of program materials, we developed an implementation model of the program, which defines roles and responsibilities in program administration and design, marketing and outreach, and service delivery. Appendix F contains the implementation model along with additional details.

Data Review

The evaluation team performed a comprehensive review of the data received from Opower, which included running descriptive statistics for each variable for each of the four groups. In this review, we confirmed that the fields we requested in order to perform the billing and channeling analyses were provided for each group, and identified any errors or inconsistencies in the data. We also worked with Opower and CSG to verify variable definitions.

Channeling Analysis

While no specific additional AIC programs were directly promoted though the Behavioral Modification Program, the savings tips provided in the reports could lead to additional program participation. If program materials were effective, we would expect to see a lift in participation in other AIC energy efficiency programs among program participants, or a higher rate of participation among the treatment group compared to the control. Increased participation in other AIC energy efficiency programs among the treatment participants would mean that some portion of savings from other programs may be counted by both the Behavioral Modification Program (through the billing analysis savings estimate) and other AIC programs (through deemed savings in their tracking databases). The purpose of a channeling analysis is to answer the following two questions:

- Does the Behavioral Modification Program treatment have an incremental effect on participation in other AIC energy efficiency programs? (Participation Lift)
- What portion of savings from Behavioral Modification Program treatment is double-counted by other AIC energy efficiency programs? (Savings Adjustment)

We provide a summary of the analysis undertaken to determine participation lift below. As the savings

adjustment directly affects program impacts, this is discussed separately in section 3.1.3. For more in-depth information on the channeling analysis, please see Appendix E.

Participation Lift Analysis

To determine whether behavioral program treatment generates lift in other energy efficiency programs, we calculated whether more treatment than control group members initiated participation in other AIC energy efficiency programs after the start of the Behavioral Modification Program. We cross-referenced the databases of the behavioral program—both treatment and control groups—with the databases of other residential energy efficiency programs available to the customer base targeted by the behavioral program. Other program databases cross-referenced include[1]:

- Appliance Recycling
- HVAC
- Residential Lighting (online platform only)[2]
- Home Energy Performance (Electric and Gas)
- Moderate Income (Electric and Gas)
- ENERGY STAR® New Homes (Electric and Gas)
- Residential Efficient Products (Electric and Gas)

Through this database crossing, we determined whether each program household (both treatment and control groups) participated in any program after the household received the first report through the Behavioral Modification Program. The difference in treatment and control participation rates is participation lift.

3.1.2 Impact Analysis

The main objective of this evaluation was to measure the energy savings impacts of the program, and determine whether the program leads to additional participation in other energy efficiency rebate programs administered by AIC. To address this, we conducted three primary evaluation tasks:

- Equivalency analysis to determine whether differences exist between the treatment and control groups. If groups are equivalent, then any differences between the treatment and control groups after receiving treatment is considered attributable to the treatment intervention.

- Billing analysis of program savings to determine program energy impacts. This analysis also includes a comparison of customer response to the treatment by season and by baseline energy usage.

[1] Multifamily program was not evaluated due to the structure of program tracking data. Since participation is tracked at a facility level, it is not possible to link measures to specific residential accounts.

[2] This includes participation through the webstore. Energy efficient lighting sold through stores was not captured in our analysis, as the upstream lighting program component does not collect customer information.

- Savings adjustment is calculated to determine what portion of net savings, as measured through the billing analysis, is captured in other program databases. This analysis helps to adjust net savings to reflect only direct savings obtained outside of other programs.

Equivalency Check

The evaluation team conducts equivalency checks as standard course for programs that rely on randomized control trial (RCT) designs to estimate impacts. Here we provide a summary of the methods taken to perform this equivalency check, and a more detailed methodology can be found in Appendix A of this report.

In an RCT, a target population is randomly assigned for treatment and comparison groups. Due to the randomization process, treatment and comparison group customers are theoretically "equivalent" and therefore any differences between the treatment and comparison groups after receiving treatment is considered attributable to the treatment intervention.

In cases where the third-party evaluators rely on, but did not set up the RCT, evaluators conduct equivalency analyses as due diligence. The evaluation team sought to determine if there are any systematic biases between the treatment and comparison group. To ensure that the two groups are equivalent, our team obtained data from Experian and examined the two populations for any differences in demographic and other household data, as well as differences in attitudes and beliefs.

To conduct the equivalency check, we examined the comparability of treatment and control groups using three methods. First, we examined average daily fuel consumption in the year before the start of the behavior program by looking at mean average daily consumption and the distribution of consumption for the 2011 billing period (see Appendix B). To compare average daily consumption between treatment and comparison groups before treatment, we analyzed only the usage data for the 12-month period prior to when the first reports were received. This varied for each program group (see Appendix A). Additionally, we excluded households with fewer than 9 billing periods and excluded records before occurring prior to 13 billing periods before customer receipt of the first report. This data cleaning removed less than 1% of customers. Second, we examined average daily fuel consumption by season (i.e., summer and winter) in the year before the start of the behavior program (see Appendix B). Summer was defined as June 1 through August 31 and winter was defined as December 15 through March 15.

Lastly, we examined differences in demographic, housing, and psychographic information between treatment and control groups to determine whether the control group provides an adequate point of comparison for the treatment group. Because we conducted this analysis on the entire population, we did not conduct statistical tests. To assess whether additional differences existed between the treatment and control groups within each of the program groups, we examined the distribution of each demographic, housing, and psychographic characteristic.

Billing Analysis

The evaluation team conducted a billing analysis to assess changes in energy consumption attributable to the Behavioral Modification Program. This section includes a summary of the methods used. This analysis relied upon a statistical analysis of monthly electricity billing data for all AIC customers that received a HER (the treatment group) and a randomly assigned sample of customers that did not

receive a HER (the control group).

The evaluation team used linear fixed effects regression (LFER) analysis to estimate program effects. We describe this analysis approach below. LFER analysis provides what is termed a Difference-in-Difference (DID) estimate of program savings.

The DID approach takes advantage of the presence of a randomly assigned control group for each of the cohorts who received reports in the AIC territory, and of the fact that we have multiple measures of energy consumption both pre- and post-participation. The fixed-effects modeling approach allows for the time-invariant, household-level factors affecting energy use to be accounted for without measuring those factors and entering them explicitly in the models. These factors are contained in a household-specific intercept or constant term in the equation.

Because of the experimental design, the treatment and control groups can be assumed to have experienced similar events with similar effects on energy use. In addition, they experience similar weather. This means that it is not important to measure or include weather in the DID models. Thus, the models estimated were very simple:

$$ADC_{it} = \alpha_i + \beta_1 Post_t + \beta_2 Treatment_i \cdot Post_t + \varepsilon_{it}$$

Where:

ADC_{it}= Average daily consumption (kWh or therms) for household i at time t

α_i= household-specific intercept

β_1= coefficient for the change in consumption between pre and post periods

β_2= coefficient for the change in consumption for the treatment group in the post period compared to the pre period and to the control group. This is the basis for the net savings estimate.

This model was estimated by season for all cohorts with sufficient elapsed time after receiving HER reports. Total program savings were calculated by summing the seasonal results except where noted.

Models were also estimated to test the effect of baseline consumption level on treatment impacts. This model, applied to all cohorts, is just an extension of the model above:

$$ADC_{it} = \alpha_i + \beta_1 Post_t + \beta_2 Treatment_i \cdot Post_t + \beta_3 Treatment_i \cdot Post_t \cdot Baseline + \varepsilon_{it}$$

Data Preparation

In this section, we provide a summary of how we prepared the data for the billing analysis. For a detailed accounting of the number and percent of accounts lost due to data cleaning, please see Appendix C. The data used in the billing analysis comes from two primary sources:

- Monthly billing data from July 2009 to June 2012, obtained directly from AIC
- Program launch date specific to each customer (treatment and control) from Opower

To develop the dataset used for the statistical analysis, the evaluation team conducted the following data processing steps:

- Separated out the electric and gas monthly billing data by each of the four program groups, i.e., Original Group, Expansion Group 1, Expansion Group 2, and Expansion Group 3
- Removed observations and customers based on the following criteria (details can be found in Appendix C):
    - Duplicate entries
    - Customers flagged as not being a part of the test group
    - Unavailable first report date
    - Out-of-range usage data
    - Insufficient pre-treatment or post-treatment usage data
    - Very low usage data
- Determined the usage on a calendar month basis for each customer based upon their read cycle
- Linked the usage with the customer-specific program start date

Estimating Program Savings

The first step in calculating average program savings was accomplished by using the coefficients from the estimating equation to estimate *ADC* under two conditions: the treatment group in the treatment period and the control group in the treatment period. This is done by evaluating the equation with the Treatment variable set to 0 (to represent non-participation), and the Post variable set to 1 to reflect the control group difference in consumption from pre- to post-periods. The equation was then evaluated with the Treatment variable set to 1 (to represent participation), and the Post variable remaining at 1, again to represent the post period. The difference between those two estimates constitutes the average daily savings per household.

Program savings as a percent reduction were calculated by dividing the average daily savings estimate described above by the estimate of *ADC* under the condition of non-participation.[3] To calculate average household savings attributable to the program for the evaluated period, the average, raw, per-household daily savings was multiplied by the average number of days in the evaluated period; i.e., the average number of days between receiving the first report and the end point of the post-participation billing periods. Models were estimated in this way for each season covered by the pre and post periods for all cohorts except the Electric Expansion Group 2 and Gas Expansion Groups 2 and 3. For these cohorts, there were only six months of post-treatment billing, covering winter and spring, and a small portion of the fall. This made it unfeasible to estimate a model for the fall, which, in turn, made it unfeasible to rely on summing the seasons to produce overall savings. So, for these three cohorts, program savings were estimated with a full model that covered the entire post-treatment period rather than summing across seasonal model results.

[3] This includes usage by the treatment group prior to participation and usage by the control group during the entire period before and after the treatment group's participation.

3.1.3 SAVINGS ADJUSTMENT

The Behavioral Modification Program participants can save energy directly—through conservation behaviors, or measures installed outside of an energy efficiency program—and indirectly, through measures installed as part of other utility energy efficiency programs (channeling). Though indirect savings through other energy efficiency programs may not have occurred in the absence of the behavioral program (e.g., if the Behavioral Modification Program induces participation), these savings will still be counted by other programs. The objective of the savings adjustment is to determine what portion of net savings, as measured through the billing analysis, is captured in other program databases, and then to adjust net savings to reflect only direct savings obtained outside of other programs so that savings will not be double counted.

The starting point of the savings adjustment analysis is program savings detected in the billing analysis. Billing analysis models assume that treatment and control are equivalent on all dimensions except behavioral program treatment. However, because treatment and control rates of participation in other energy efficiency programs may not be equivalent (discussed above), it is possible that some portion of savings detected in the billing analysis is not unique to the program. To estimate Direct Savings, we first (1) estimate total net program savings from the billing analysis, and then (2) estimate net channeled savings as the difference between savings from other programs achieved by the participant group, compared with the control group, to further refine our net savings estimates. We calculate channeled savings from other energy efficiency programs in the first program year using the following approach:

- Identify deemed net savings from all measures installed by accounts *prior to* each account's first report date within the programs
- Identify deemed net savings from all measures installed by accounts *after* each account's first report date within the programs
- Conduct difference of difference pre-post/treatment-control to estimate the resulting incremental channeled savings gained by the treatment group in excess of the control group from the pre-treatment period to the post-treatment period.

The result of this database crossing and calculation is a channeled savings estimate, which can be subtracted from the estimate of total program savings. Note that these channeled savings could be attributed to both the Behavioral Modification Program and other AIC programs, as they would not occur unless both programs were operating, but for accounting purposes, only one program can claim these savings.

Thus, the objective of the savings adjustment component of the channeling analysis is to determine what portion of savings detected in the billing analysis is also captured in other program databases, and adjust savings to reflect only the "unique" component of savings directly attributable to the Behavioral Modification Program.

4. RESULTS AND FINDINGS

4.1 PROCESS FINDINGS

Process evaluation efforts in PY4 were limited, as the primary task of the evaluation is to calculate energy savings through the billing analysis. The evaluation team reviewed the program tracking database and available program materials, such as sample Home Energy Reports, web portal content, and special marketing materials. We also conducted in-depth interviews with program managers from AIC, CSG, and Opower (n=3). In these interviews, we sought to uncover areas of success, challenges, and insights into the daily workings of the program. Additionally, we completed a channeling analysis to determine the frequency at which Behavioral Modification Program participants took part in other AIC residential programs versus customers in the control groups.

4.1.1 PROGRAM IMPLEMENTATION

AIC oversees the Behavioral Modification Program, and reviews and approves any program materials or changes that are made to the program during the year. CSG began administering the program for AIC in PY4, and directly holds the contract with Opower, which provides the software to produce and send out HERs and manage customer information. For further information on program roles, responsibilities, and service delivery, we provide an Implementation Model in Appendix F.

According to AIC, CSG, and Opower, overall, the program has run smoothly, and there have been few challenges. These three groups all noted that it is a fairly turn-key program and is straightforward to administer. In PY5, the program plans to implement three enhancements to the HER, as described below:

- Change "neighbor comparison" language to "similar homes." This change is being considered because many treated customers were confused by the term "neighbor," and thought their usage was being compared to their actual neighbors, who may differ from them in many ways. "Similar homes" is a more accurate description, as the comparison is based on homes and households with similar characteristics, such as square footage, type of home, number of occupants, and other factors.

- Make opt-out language more prominent in the report. This change is intended to make this option easier for customers who do not want to participate in the program.

- The following question, "Are we comparing you correctly?" will be included in each report to allow customer feedback and to address complaints from customers who do not think they are being correctly compared. A customer will be able to log onto the web portal and see how they are compared to similar homes based on square footage, number of occupants, and other factors. If the customer believes that any of these factors are inappropriate for their home or household, they can call the program so a change is made.

Among evaluation recommendations made in PY3 that have been implemented in PY4, Opower now reports to AIC on both a monthly and quarterly basis. Previously, savings numbers were only reported on a quarterly basis, which did not allow AIC the ability to track savings in a timely manner and make

changes as needed to meet goals.

4.1.2 Data Review

The evaluation team conducted a comprehensive review of the data to determine its completeness and to identify any errors or inconsistencies. The data were found to be sufficiently complete to allow us to carry out the billing and channeling analyses.

However, our review also revealed a few issues that we have brought to the attention of Opower. These issues are listed below.

- A report was never generated for 6.0% of the treatment group and 5.8% of the control group in Expansion Group 2. These percentages are substantially higher than the other cohorts, which ranged from 0.6% for the Original Group (both treatment and control) to 2.6% and 2.8% for the treatment and control groups in Expansion Group 3.

- The percentage of customer accounts without a first report date grew with each added cohort. In the Original Group, 0.8% of customer accounts did not have a first report date. This percentage grew to 2.3% for Expansion Group 1, and then to 3.2% for treated customers and 3.4% for controls in Expansion Group 2. Expansion Group 3 was the highest, with 9.5% of treated customers missing a first report date, and 10.2% of controls. If the first report date is unknown, the customer cannot be included in the billing analysis.

Opower explained that a report may have never been generated as a result of undeliverable addresses, or if a household was an "outlier," having extraordinarily low or high energy consumption that made it uncomparable to similar homes. Opower noted that these "outliers" are now excluded prior to selection. Opower also stated that as they incorporate additional groups into the program, they must include a higher percentage of homes that may have data issues which could prevent generating a report. This may include gaps or overlaps in billing data, extraordinarily low or high energy consumption, failure to find at least 80 comparable homes in the area, among other reasons. To account for these issues, Opower overselects the number of households at the outset of the program.

4.1.3 Channeling Analysis

The evaluation team cross-referenced the databases of the behavioral program—both treatment and control groups—with the databases of other residential energy efficiency programs available to the customer base targeted by the behavioral program.

Through this database crossing, we determined that overall, the treatment group customers had a higher rate of participation than the control group customers and thus there is participation lift. Specifically, the increase in participation in the post period compared to the pre period is higher for the participant group than the control group. All three electric groups had higher participation rate increases than the control groups, as shown in Table 4. Please note that the impact results in section 4.2 are based on energy savings, not participation, and the following tables are solely presented to inform the program.

Table 4. Participation Lift by Group - Electric

Program Name	Original Group	Expansion Group 1	Expansion Group 2
Appliance Recycling	0.09%	0.22%	0.11%
HVAC	0.02%	0.08%	0.01%
Lighting (online platform only)*	0.01%	-0.01%	-0.003%
Residential Efficient Products	0.08%	-0.03%	-0.05%
Home Energy Performance - Audit	0.01%	0.19%	-0.02%
Home Energy Performance - Incentives	0.03%	0.09%	0.01%
Moderate Income - Audit	-0.01%	0.02%	0.00%
Moderate Income - Incentives	0.01%	0.00%	0.01%
Total	**0.24%**	**0.55%**	**0.06%**

*This includes participation in the online lighting platform only, as the upstream program does not collect customer information.

However, as shown in Table 5, higher rates of participation by the treatment groups are not always consistent on the gas side. Gas Expansion Group 2 shows that there is slightly higher participation from control group customers.

Table 5. Participation Lift by Group - Gas

Program Name	Original Group	Expansion Group 1	Expansion Group 2	Expansion Group 3
HVAC	0.10%	0.03%	-0.01%	-0.02%
Residential Efficient Products	0.12%	-0.01%	0.05%	0.14%
Home Energy Performance - Audit	0.04%	0.16%	-0.04%	0.09%
Home Energy Performance - Incentives	0.02%	0.10%	-0.01%	-0.03%
Moderate Income - Audit	-0.01%	0.01%	-0.002%	0.00%
Moderate Income - Incentives	0.01%	0.01%	0.01%	0.00%
Total	**0.28%**	**0.30%**	**-0.01%**	**0.18%**

4.2 IMPACT RESULTS

The following sections include the results of the equivalency analysis between the treatment and control groups and the billing analysis for each of the four groups, by fuel type. In the final section, the results of the billing analysis and channeling analysis are combined to produce final adjusted net program savings.

4.2.1 EQUIVALENCY ANALYSIS

Past impact evaluations have demonstrated that baseline usage (usage patterns prior to treatment) is

associated with savings for behavioral programs. In particular, higher using households tend to save more energy as a percent of baseline usage than households that consume lower amounts of energy. For this reason, we include baseline usage in our equivalency check. Overall, *our findings confirm that the treatment and comparison groups are equivalent.* This is consistent with Opower's findings in their initial check of the data.

Electric Usage

For electric customers, the baseline usage analysis included 342,548 households after excluding households based on the data cleaning described previously. The analysis indicates that the distribution of average daily electricity consumption on an annual basis and by season is nearly identical for each participation group. The analysis figures can be found in Appendix B.

Gas Usage

We performed a similar analysis for gas customers. The baseline usage analysis includes 374,058 households after excluding program households based on the data cleaning described. The analysis indicates that the distribution of average daily gas consumption on an annual basis and by summer and winter for each participation group is nearly identical. The analysis figures can be found in Appendix B.

DEMOGRAPHIC, HOUSING, AND PSYCHOGRAPHIC CHARACTERISTICS

In addition to usage, previous studies have shown that demographics, housing, and psychographic characteristics may have an impact on savings among treated customers. For this reason, the evaluation team evaluated the equivalency across groups on a number of demographics, housing, and psychographic characteristics. Overall, the demographic, housing, and psychographic characteristics of treatment and comparison households are similar.

In all program groups, the treatment and control groups had less than one percentage point difference on the key demographic and psychographic comparisons. Only two entries had more than one percentage point of difference, and these were both in Expansion Group 3. The table below summarizes the demographics, housing, and psychographic equivalency analysis.

Table 6. Summary of Demographic Analysis for All Treatment and Control Groups

Category		Original Group		Expansion Group 1		Expansion Group 2		Expansion Group 3	
		Treatment (n=50,001)*	Control (n=49,999)	Treatment (n=76,355)	Control (n=25,452)	Treatment (n=119,917)	Control (n=20,799)	Treatment (n=21,189)	Control (n=10,400)
Location	Out-of-state addresses	2%	2%	1%	1%	1%	1%	1%	1%
Household	Homeowner listed as deceased**	1%	1%	1%	1%	1%	1%	1%	1%
Demographics									
Age	Under 35	8%	9%	11%	11%	13%	12%	9%	9%
	35-54	39%	38%	40%	40%	33%	34%	38%	38%
	55+	49%	49%	44%	44%	49%	49%	50%	50%
Household size	Avg. number of Adults***	2.7	2.7	2.7	2.7	2.4	2.4	2.7	2.7
Children in household	At least 1 child <18 yrs	31%	30%	32%	32%	23%	23%	28%	28%
Education of respondent	Less than High School Diploma	9%	8%	10%	9%	11%	11%	9%	9%
	High School Diploma	33%	33%	32%	33%	38%	38%	31%	31%
	Some College	26%	26%	27%	27%	26%	26%	26%	26%
	Bachelor Degree	16%	16%	16%	16%	13%	13%	18%	18%
	Graduate Degree	11%	11%	11%	11%	7%	8%	12%	11%
Household Income	under $50K	34%	34%	35%	36%	46%	46%	34%	34%
	$50-$100K	42%	42%	41%	41%	38%	38%	38%	39%
	$100-$200K	19%	20%	19%	19%	13%	13%	23%	23%
	$200K or higher	4%	4%	4%	4%	2%	2%	4%	4%
Gender	Female	37%	37%	38%	37%	43%	43%	40%	39%
Housing									
Homeownership	Own	85%	86%	81%	82%	78%	78%	86%	87%
Housing type	Single-family detached	88%	89%	84%	84%	83%	83%	91%	91%
Home size	Home square footage of 100-4,999	46%	47%	26%	26%	29%	29%	27%	25%
Age of house	Before 1960	22%	23%	15%	15%	15%	16%	8%	8%
	1960-1990	42%	41%	39%	39%	42%	41%	38%	40%

Category		Original Group		Expansion Group 1		Expansion Group 2		Expansion Group 3	
		Treatment (n=50,001)*	Control (n=49,999)	Treatment (n=76,355)	Control (n=25,452)	Treatment (n=119,917)	Control (n=20,799)	Treatment (n=21,189)	Control (n=10,400)
	1990 or later	26%	27%	32%	32%	28%	29%	45%	45%

Psychographic									
Social Causes	Internet Online Subscriber	63%	63%	62%	62%	52%	52%	61%	61%
	Animal Welfare	8%	8%	7%	7%	7%	7%	7%	7%
	Environment Wildlife	7%	7%	6%	6%	7%	7%	7%	6%
	Political - Conservative	3%	3%	3%	3%	2%	3%	3%	3%
	Political - Liberal	2%	2%	1%	1%	1%	1%	1%	1%
	Religious	12%	12%	11%	11%	11%	11%	12%	12%
	Children	12%	12%	10%	11%	10%	10%	11%	10%
	Veterans	9%	9%	8%	8%	10%	10%	9%	9%
	Health	13%	14%	12%	12%	13%	13%	13%	13%
	Other Social Cause	16%	16%	14%	14%	15%	15%	16%	16%
	Volunteer Work	0%	0%	0%	0%	0%	0%	0%	0%

*Note: VIPs from PY1 were not included in PY2 data

**Indicated where "number of adults in household" variable is equal to 0

***Note: Does not count households where homeowner listed as deceased (number of adults in home = 0).

4.2.2 BILLING ANALYSIS

The following tables show the results of the billing analysis by group and fuel type. Customer response is also explored by season and by three baseline usage groups (tertiles). These savings are not adjusted to account for savings resulting from participation in other AIC programs. First, raw daily usage figures are shown for treatment and control, pre- and post-participation. This provides a context from which to view the billing analysis results.

Table 7 reveals slight decreases in average daily consumption in the treatment group compared to the control group in each cohort when we look at the pre- and post-mean values. This result foreshadows the statistical analysis that follows.

Table 7. Comparison of Average Daily Consumption by Cohort, Treatment v. Control, Pre- v. Post-Participation--KWh

Period	Statistic	Original Cohort		Expansion 1		Expansion 2	
		Treatment	Control	Treatment	Control	Treatment	Control
	N	48,694	49,083	72,913	24,406	108,072	18,801
Pre	Mean	35.85	35.82	38.04	38.18	25.89	25.87
	SD	19.79	19.74	23.42	23.68	15.44	15.45
Post	Mean	27.89	28.32	36.84	37.46	22.08	22.26
	SD	15.19	15.63	24.08	24.56	12.48	12.79

Table 8 shows a similar pattern for gas customers in the Original Group and Expansion Group 1 that we see above for electric customers. However, in Expansion Groups 2 and 3, there is a slight increase in consumption from pre- to post-period for both groups, but slightly more in the control group.

Table 8. Comparison of Average Daily Consumption by Cohort, Treatment v. Control, Pre- v. Post-Participation--Therms

Period	Statistic	Original Cohort		Expansion 1		Expansion 2		Expansion3	
		Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
	N	48,695	49,063	72,893	24,397	108,171	18,825	16,616	8,112
Pre	Mean	2.58	2.57	3.11	3.10	1.89	1.90	2.24	2.24
	SD	2.69	2.69	3.12	3.12	1.89	1.89	2.31	2.31
Post	Mean	2.67	2.69	2.45	2.47	2.32	2.33	2.70	2.72
	SD	2.15	2.16	2.39	2.41	1.67	1.67	2.01	2.04

As noted in Table 9, in PY4, the Original Group had net program savings of 1.46% per household, which is an increase over PY3 first-year savings of 1.2%. Expansion Group 1 had net first-year savings of 1.32% per household, and Expansion Group 2 had net first-year savings of 0.88% per household. Expansion Group 3 pertained only to gas customers and therefore was not evaluated for electric savings. These savings figures do not account for cross-program participation.

Table 9. PY4 Behavioral Modification Program Impacts - Electric[4]

Group Name	Original Group*	Expansion Group 1	Expansion Group 2
First Report Date (Earliest)	July 28, 2010	May 25, 2011	November 15, 2011
Month when Savings Begin to Accrue (Modal)	September 2010	July 2011	December 2011
Total Evaluated Participants	48,694	72,913	108,654
Net Program Savings (% per HH)	1.46%	1.32%	0.88%
90% Confidence Interval Lower Bound	1.27%	1.16%	0.50%
90% Confidence Interval Upper Bound	1.64%	1.47%	1.26%

* Includes Year 2 savings only because Year 1 savings have already been reported for this cohort

The table below displays gas savings by group. The Original Group experienced savings of 1.14% per household, an increase over the reported PY3 savings of 0.7%. Expansion Group 1 had first-year savings of 0.85% per household, Expansion Group 2 had first-year savings of 0.35% per household, and Expansion Group 3 experienced first-year savings of 0.96% per household.

[4] These savings do not account for cross-program participation.

Table 10. PY4 Behavioral Modification Program Impacts - Gas[5]

Group Name	Original Group	Expansion Group 1	Expansion Group 2	Expansion Group 3
First Report Date (Earliest)	July 28, 2010	May 25, 2011	November 15, 2011	November 15, 2011
Month when Savings Begin to Accrue (Modal)	September 2010	July 2011	December 2011	December 2011
Total Evaluated Participants	48,695	72,893	108,171	16,616
Net Program Savings (% per HH)	1.14%	0.85%	0.35%	0.96%
90% Confidence Interval Lower Bound	0.95%	0.71%	0.12%	0.58%
90% Confidence Interval Upper Bound	1.32%	0.99%	0.58%	1.34%

Customer Response by Season

The evaluation team performed an additional analysis to determine how customer response to the treatment varied by season. Table 11 shows the average electricity savings per customer by each of the four seasons. First-year savings were assessed for the original cohort during the last evaluation cycle, so this period was removed from the current evaluation. This resulted in the ability to estimate savings for the winter, spring, and fall seasons, but not summer. The post period for Expansion Group 2 also did not cover the summer season.

Interestingly, in two of the electric cohorts, the highest savings were in the winter season. The savings estimated for each cohort for each season were statistically significant.

[5] These savings do not account for cross-program participation.

Table 11. Per Household Savings (%) by Season - Electric

Group Name	Statistic	Overall		Winter		Summer		Spring		Fall	
		Estimate		Estimate		Estimate		Estimate		Estimate	
		Std Error		Std Error		Std Error		Std Error		Std Error	
Original Group	Average % Savings	1.46%	*	1.64%	*	†		1.40%	*	1.33%	*
		0.11%		0.22%		†		0.18%		0.18%	
	Average Savings Per Customer	36.1		46		†		30		32	
		2.8		6.1		†		3.8		4	
Expansion Group 1	Average % Savings	1.32%	*	1.18%	*	1.18%	*	1.70%	*	1.23%	*
		0.09%		0.24%		0.14%		0.19%		0.18%	
	Average Savings Per Customer	45.7		37		65		46		34	
		3.3		7.3		7.8		5.3		5.2	
Expansion Group 2**	Average % Savings	0.88%	*	0.92%	*	†		0.88%	*	†	
		0.23%		0.28%		†		0.23%		†	
	Average Savings Per Customer	38.7		19		†		15		†	
		10.1		5.9		†		3.9		†	

† Summer Months were not available during the evaluated post period

*Statistically significant at least at the .10 level

** Overall per-household savings were calculated using a full model covering all available seasons and partial seasons rather than summing seasonal models because this group did not have sufficient summer or fall months during the evaluation post period

As would be expected, Table 12 shows that gas savings were not statistically significant for any cohorts during the summer. All cohorts but one showed significant savings in the winter. The largest percent savings were in the spring season for three of the groups, even in Expansion Group 2 where the spring savings are not statistically significant.

Table 12. Per Household Savings (%) by Season - Gas

Group Name	Statistic	Overall		Winter		Summer		Spring		Fall	
		Estimate		Estimate		Estimate		Estimate		Estimate	
		Std Error		Std Error		Std Error		Std Error		Std Error	
Original Group	Average % Savings	1.14%	*	0.85%	*	†		1.24%	*	1.34%	*
		0.11%		0.14%		†		0.24%		0.19%	
	Average Savings Per Customer	2.5		3.6		†		1.3		2.3	
		0.2		0.6		†		0.2		0.3	
Expansion Group 1	Average % Savings	0.85%	*	1.08%	*	-0.04%		1.23%	*	1.14%	*
		0.09%		0.15%		0.32%		0.28%		0.19%	
	Average Savings Per Customer	2.2		5.4		0.0		1.6		2.1	
		0.2		0.7		0.2		0.4		0.3	
Expansion Group 2**	Average % Savings	0.35%	*	0.13%		†		0.73%		†	
		0.14%		0.15%		†		0.27%		†	
	Average Savings Per Customer	1.6		0.5		†		0.6		†	
		0.6		0.5		†		0.2		†	
Expansion Group 3**	Average % Savings	0.96%	*	0.85%	*	†		0.85%	*	†	
		0.23%		0.25%		†		0.47%		†	
	Average Savings Per Customer	5.1		3.3		†		0.8		†	
		1.2		1.0		†		0.4		†	

† Sufficient months were not available during the evaluated post period

*Statistically significant at least at the .10 level

** Overall per-household savings were calculated using a full model covering all available seasons and partial seasons rather than summing seasonal models because these groups did not have sufficient summer or fall months during the evaluation post period.

Customer Response by Baseline Usage

The evaluation team also performed an analysis to determine whether customer response to the treatment varied by baseline usage. Three equal-sized groups were identified based on pre-program (baseline) usage. As expected, the rate of electricity savings shown in Table 13 tends to increase with the level of baseline consumption. Please note that because overall savings values in this section were calculated using a full model covering all available seasons and partial seasons, overall savings values for the Original Group and Expansion Group 1 do not exactly match the overall savings values presented in the previous section, which were calculated by summing the seasonal models. This information is presented to inform the program.

Table 13. Per Household Savings (% & kWh) by Baseline Usage – Electric

Group Name	Statistic	Overall		Low Usage		Medium Usage		High Usage	
		Estimate		Estimate		Estimate		Estimate	
		Std Error		Std Error		Std Error		Std Error	
Original Group	Average % Savings	1.82%	*	0.59%		0.64%	*	2.69%	*
		0.17%		0.33%		0.28%		0.27%	
	Average Savings Per Customer	127		26		41		258	
		11.6		14.8		17.6		25.9	
Expansion Group 1	Average % Savings	1.34%	*	1.05%	*	1.25%	*	1.48%	*
		0.13%		0.26%		0.22%		0.22%	
	Average Savings Per Customer	185		86		159		292	
		18.0		21.4		27.7		43.8	
Expansion Group 2	Average % Savings	0.88%	*	0.50%		1.01%	*	1.03%	*
		0.23%		0.44%		0.38%		0.35%	
	Average Savings Per Customer	38.7		13		42		66	
		10.1		11.8		15.5		22.3	

*Statistically significant at least at the .10 level

In contrast, gas savings (in percentage terms) do not always increase with the level of baseline consumption. Gas savings are slightly lower in the middle tertile than the lower tertile for the Original Group, as shown in Table 14. Additionally, gas savings are higher in the middle tertile for Expansion Group 3 than the higher tertile. As we might expect, the low-usage group does not always show statistically significant savings. However, all other usage groups over all cohorts experienced statistically significant savings.

Table 14. Per Household Savings (% & Therms) by Baseline Usage – Gas

Group Name	Statistic	Overall		Low Usage		Medium Usage		High Usage	
		Estimate		Estimate		Estimate		Estimate	
		Std Error		Std Error		Std Error		Std Error	
Original Group	Average % Savings	0.90%	*	0.65%	*	0.63%	*	1.17%	*
		0.10%		0.21%		0.18%		0.20%	
	Average Savings Per Customer	5.6		2.8		3.9		10.5	
		0.7		0.9		1.1		1.8	
Expansion Group 1	Average % Savings	1.07%	*	0.38%		1.17%	*	1.28%	*
		0.13%		0.21%		0.19%		0.23%	
	Average Savings Per Customer	9.8		2.4		10.0		15.4	
		1.2		1.4		1.6		2.7	
Expansion Group 2	Average % Savings	0.35%	*	-0.04%		0.40%	*	0.53%	*
		0.14%		0.28%		0.22%		0.23%	
	Average Savings Per Customer	1.6		-0.1		1.8		3.0	
		0.6		1.0		1.0		1.3	
Expansion Group 3	Average % Savings	0.96%	*	-0.07%		1.34%	*	1.22%	*
		0.23%		0.39%		0.35%		0.38%	
	Average Savings Per Customer	5.1		-0.3		6.7		8.8	
		1.2		1.5		1.8		2.8	

*Statistically significant at least at the .10 level

4.2.3 Adjusted Net Program Savings

To determine the net savings adjustment component of the channeling analysis, the evaluation team applied the net deemed savings values for each of the AIC programs to the treatment and control group customers who participated in other programs. The net deemed savings values were applied at the unit level (per measure, per program).

Applying the adjusted savings to the customer response by season savings, in PY4, the Original Group had final adjusted net electric program savings of 1.46% per household, Expansion Group 1 had final adjusted net program savings of 1.29% per household, and Expansion Group 2 had final adjusted net program savings of 0.87% per household (see Table 15). Expansion Group 3 pertained only to gas customers and therefore is not included in the electric analysis.

Table 15. Behavioral Modification Program Impacts - Electric

Group Name	Original Group*	Expansion Group 1	Expansion Group 2
First Report Date (Earliest)	July 28, 2010	May 25, 2011	November 15, 2011
Month when Savings Begin to Accrue (Modal)	September 2010	July 2011	December 2011
Total Evaluated Participants	48,694	72,913	108,654
Net Program Savings (% per HH)	1.46%	1.32%	0.88%
90% Confidence Interval Lower Bound	1.27%	1.16%	0.50%
90% Confidence Interval Upper Bound	1.64%	1.47%	1.26%
Incremental Savings from Other Programs (% per HH)	0%**	0.028%	0.012%
Final Adjusted Net Savings (% per HH)	1.46%	1.29%	0.87%

* Includes Year 2 savings only because Year 1 savings have already been reported for this cohort
** Given that the overall savings adjustment was negative, the incremental savings adjustment was set to 0.

In total, the program saved 22,412 MWh, meeting 84% of its electric goal, as shown in Table 16. Total savings for Electric Expansion Group 2 was calculated using a full model rather than summing across seasonal model results, as post-treatment data was only available for a portion of the year. For the remaining groups, total savings were determined by summing modeled seasonal savings per household by cohort.

Table 16. PY4 Behavioral Modification Program Total Savings - Electric

Group Name	Original Group	Expansion Group 1	Expansion Group 2	Total
Final Adjusted Net Program Savings (MWh)	5,230	13,039	4,142	**22,412**
90% Confidence Interval Lower Bound (MWh)	4,553	11,479	2,362	18,394
90% Confidence Interval Upper Bound (MWh)	6,790	14,599	5,922	27,311

Similarly, for the gas customers, the Original Group had final adjusted net program savings of 1.03% per household, Expansion Group 1 had final adjusted net program savings of 0.79% per household, and Expansion Group 2 had final adjusted net program savings of 0.35% per household and Expansion Group 3 had final adjusted net program savings of 0.96% per household.

Table 17. Behavioral Modification Program Impacts - Gas

Group Name	Original Group*	Expansion Group 1	Expansion Group 2	Expansion Group 3
First Report Date (Earliest)	July 28, 2010	May 25, 2011	November 15, 2011	November 15, 2011
Month when Savings Begin to Accrue (Modal)	September 2010	July 2011	December 2011	December 2011
Total Evaluated Participants	48,695	72,893	108,171	16,616
Net Program Savings (% per HH)	1.14%	0.85%	0.35%	0.96%
90% Confidence Interval Lower Bound	0.95%	0.71%	0.12%	0.58%
90% Confidence Interval Upper Bound	1.32%	0.99%	0.58%	1.34%
Incremental Savings from Other Programs (% per HH)	0.11%	0.06%	0%**	0%**
Final Adjusted Net Savings (% per HH)	1.03%	0.79%	0.35%	0.96%

* Includes Year 2 savings only because Year 1 savings have already been reported for this cohort
** Given that the overall savings adjustment was negative, the incremental savings adjustment was set to 0.

As shown in Table 18, in total the program saved 1.2 million therms, exceeding its gas goal by 31%. Total savings for Gas Expansion Groups 2 and 3 were calculated using a full model rather than summing across seasonal model results, as post-treatment data was only available for a portion of the year. For the remaining groups, total savings were determined by summing modeled seasonal savings per household by cohort.

Table 18. PY4 Behavioral Modification Program Total Savings - Gas

Group Name	Original Group	Expansion Group 1	Expansion Group 2	Expansion Group 3	Total
Final Adjusted Net Program Savings (therms)	319,370	620,980	173,940	85,220	**1,199,510**
90% Confidence Interval Lower Bound (therms)	262,170	511,300	58,970	51,670	884,110
90% Confidence Interval Upper Bound (therms)	376,560	730,660	288,910	118,780	1,514,910

4.3 INPUTS FOR FUTURE PROGRAM PLANNING

In the following section we discuss potential inputs for future program planning and evaluation

activities in PY5 and PY6.

4.3.1 Future Planning and Goal Setting

For future program planning purposes and goal setting, AIC, CSG, and Opower might consider using the average savings estimates for kWh and therms over the evaluated period[6], which are 97.3 kWh and 4.87 therms per household. These figures were calculated by dividing the total adjusted program savings for the evaluated period by the total number of evaluated participants for electricity and gas, respectively. Theoretically, AIC could multiply these averages by the planned number of future participants and produce estimates of the next program year's anticipated electric and gas savings.

However, these numbers should be used with caution. First, for electric savings there may be significant variation in the composition of the three evaluated groups and their housing and occupancy characteristics, in addition to the geographical and weather-related features of their residence locations. As previously illustrated in Table 11, the average per-household savings varies across the three evaluation groups even within the same season (e.g. winter). The highest average winter savings was 46 kWh and the lowest was 19 kWh. A new program year and new customer or residence types may not necessarily produce the same level of savings. Another factor that may affect this estimate is the seasons that were analyzed for each group. For example, only one of the three groups, Electric Expansion Group 1, was evaluated for a full year after customers received their first report. For the other two groups, the summer season could not be included in the analysis, and for Electric Expansion Group 3 (the largest group) only winter and spring were included. It is therefore likely that the 97.3 kWh figure is an under-estimate of annual savings for this set of participants because of the missing summer months, and a missing fall season for the largest group.

Caution should also be exercised in using the gas savings estimate of 4.87 therms per household per year for future planning purposes. However, there is less concern about missing seasons that are most important for gas programs, as all four groups had evaluated savings for the winter season. Two of the four groups did not have data for the fall season, and as a result 4.87 therms may be an under-estimate of annual savings, though as noted this is not a significant concern.

4.3.2 Evaluation Activities in PY5 and PY6

The evaluation team plans to carry out the same tasks in PY5 as it did in PY4, including conducting interviews with AIC, CSG, and Opower; completing a comparison of the treatment and control groups for any future cohorts; and performing a channeling analysis and billing analysis to determine the net impacts of the program. In PY6, we also plan to conduct the following activities as the budget allows:

- A quantitative survey of: (1) participants who have been in the program 2+ years, and (2) participants who stopped receiving HERs (e.g., interrupted groups). We will couple this analysis with a billing analysis comparing these two populations to help understand both savings estimates over time, and persistence of savings.

[6] Note that certain groups did not have sufficient data for all seasons during the evaluation post period (refer to Tables 11 and 12). Therefore, these average per household savings estimates likely underestimate annual savings potential.

- A treatment and control group quantitative survey to provide additional process and impact insights regarding energy savings actions taken.
- A persistence analysis of all participants still receiving HERs. This analysis will allow us to understand savings estimates for the program over the three years.

A. Appendix: Equivalency Check Methodology

To conduct the equivalency check, the evaluation team used two primary data sources: (1) baseline usage for treatment and comparison customers and (2) secondary demographic, housing, and psychographic data from Experian appended at the household level. Below we provide additional detail on each data source.

Baseline Usage Data

Table 19. Number of Customers with Baseline Usage Data Before Data Cleaning

	Number of Customers
Total Unique Customers	374,112
Original Group	
Electric Customers	
Comparison	49,999
Treatment	50,001
Total	100,000
Gas Customers	
Comparison	49,999
Treatment	50,001
Total	100,000
Expansion Group 1	
Electric Customers	
Comparison	25,452
Treatment	76,355
Total	101,807
Gas Customers	
Comparison	25,452
Treatment	76,355
Total	101,807
Expansion Group 2	
Electric Customers	
Comparison	20,799
Treatment	119,917
Total	140,716
Gas Customers	
Comparison	20,799
Treatment	119,917
Total	140,716
Expansion Group 3	

	Number of Customers
Gas Customers	
Comparison	10,400
Treatment	21,189
Total	31,589

The pre-period dates for treatment and comparison customers varied for each program group. The databases contained usage information for customers from 2009 to 2011. To compare average daily consumption between treatment and comparison groups before treatment, we analyzed only the usage data for the 12-month period prior to when the first reports were received. This varied for each program group. Additionally, we excluded households with fewer than 9 and greater than 13 billing periods before customer receipt of the first report. This data cleaning removed less than one percent of customers.

Secondary Demographic and Psychographic Data

We obtained secondary data for demographic, housing, and psychographic characteristics for the treatment and comparison groups through Experian. Experian's CONSUMERVIEW Database is the foundation for their consumer marketing lists, data enhancement, and data licensing services. It includes compiled, self-reported, and modeled data that is built using over 3,500 original public and proprietary sources including: white pages, census data, public records, both state and local, product registrations and surveys (self-reported), property/realty records such as property deeds, mail order transactions, and other proprietary sources. The data points obtained from Experian, with their match rates are listed in the table below.

Table 20. Summary of Matching Secondary Data from Experian

Data Type	Description of Data	Match Rate
Total Number of Customers Sent to Experian		374,112
Total Matches		374,112
Overall Match Rate		100%
Demographic Data		
Household Income	Income is the total estimated income for a living unit, and incorporates several highly predictive individual, household, and geographical level variables including Summarized Credit Statistics.	100%
Number of Adults in Household	Number of Adults in Household is calculated from the number of records in a household. An adult is anyone 19 years old or older living in a household.	100%
Gender	Gender information is applied during the convert prior to enhancement. Records coded as gender both include those with prefixes of Mr. & Mrs. and/or first names.	100%
Occupation - Group	Information is compiled from self-reported surveys, derived from state licensing agencies, or calculated through the application of predictive models.	100%

Data Type	Description of Data	Match Rate
Education	Information is compiled from self-reported surveys, derived based on occupational information, or calculated through the application of predictive models.	100%
Age	Date of Birth is acquired from public and proprietary files. These sources provide, at a minimum, the year of birth. The birth month is provided where available.	96%
Number of Children (18 or Less)	Number of Children in Household information is calculated from the number of records in a household that indicate children whose age is 18 or younger.	100%
Housing Data		
Dwelling Type	Each household is assigned a dwelling type code based on United States Postal Service (USPS) information.	96%
Homeownership	Homeowner information indicates the likelihood of a consumer owning a home, and is received from tax assessor and deed information. Renter status is derived from self-reported data. Unit numbers are not used to infer rented status because units may be owner condominium/coop.	96%
Year Home Built	Year built is based on country assessor's records, the year the residence was built or through the application of a predictive model.	88%
Home Square Footage Ranges	The square footage of any buildings associated with the home determined from Grant/Warranty Deed information recorded or other legal documents filed at the county recorder's office in the county where the property is located.	96%
Psychographic Data		
Internet/Online Subscriber	Internet online subscriber indicates a household has self-reported being an internet/online subscriber. BehaviorBank® Household Indicators groups similar self-reported elements into slightly broader categories.	96%
Other Social Causes and Concerns	Activities and Interests/Social Causes and Concerns – are derived from direct reported survey data that represents a household's interest in each of the social cause/concern	62%
Religious Social Causes and Concerns		62%
Health Social Causes and Concerns		62%
Children Social Causes and Concerns		62%
Veterans Social Causes and Concerns		62%
Animal Welfare Social Causes and Concerns		62%
Environment/Wildlife Social Causes and Concerns		62%
Political-Conservative Social Causes and Concerns		62%
Political-Liberal Social Causes and Concerns		62%

Data Type	Description of Data	Match Rate
Volunteer Work		62%

B. APPENDIX: EQUIVALENCY CHECK ANALYSIS

Annual Usage

Figure 1. Distribution of Average Daily Electricity Consumption in the Year before the Start of the Program [Original Group: Electric Customers, Comparison vs. Treatment Groups]

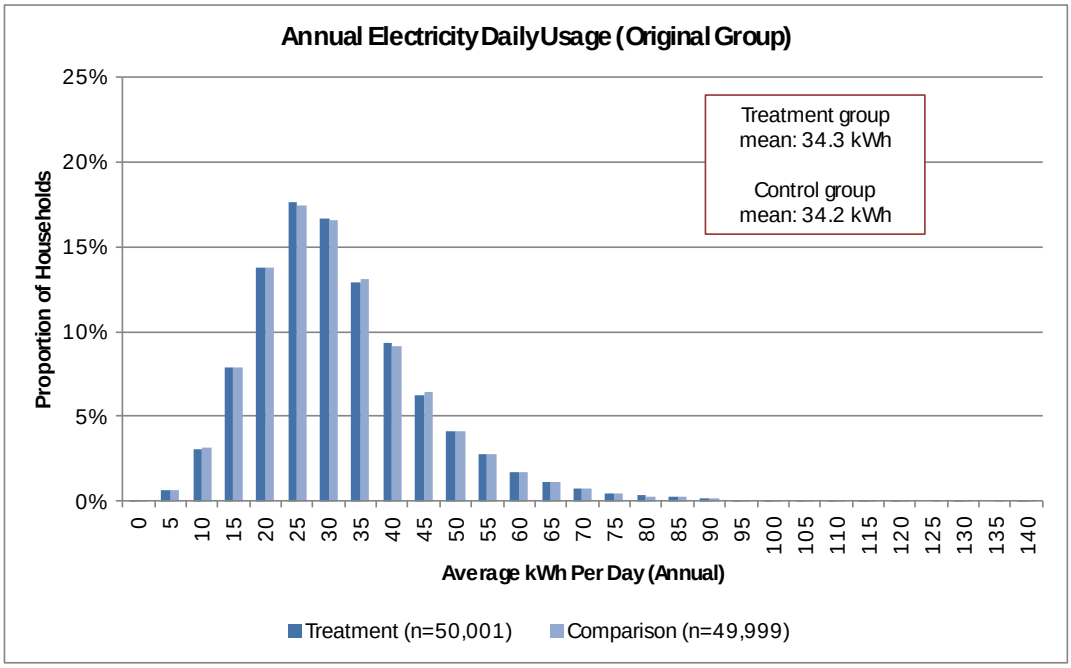


Figure 2. Distribution of Average Daily Electricity Consumption in the Year before the Start of the Program [Expansion Group 1: Electric Customers, Comparison vs. Treatment Groups]

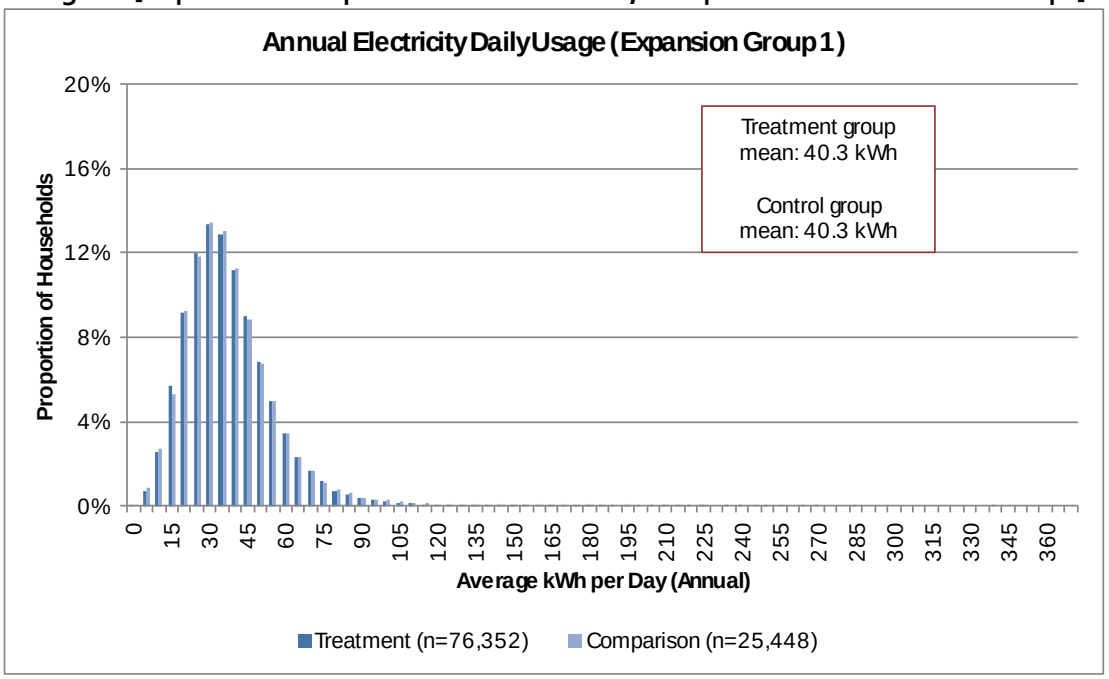


Figure 3. Distribution of Average Daily Electricity Consumption in the Year before the Start of the Program [Expansion Group 2: Electric Customers, Comparison vs. Treatment Groups]

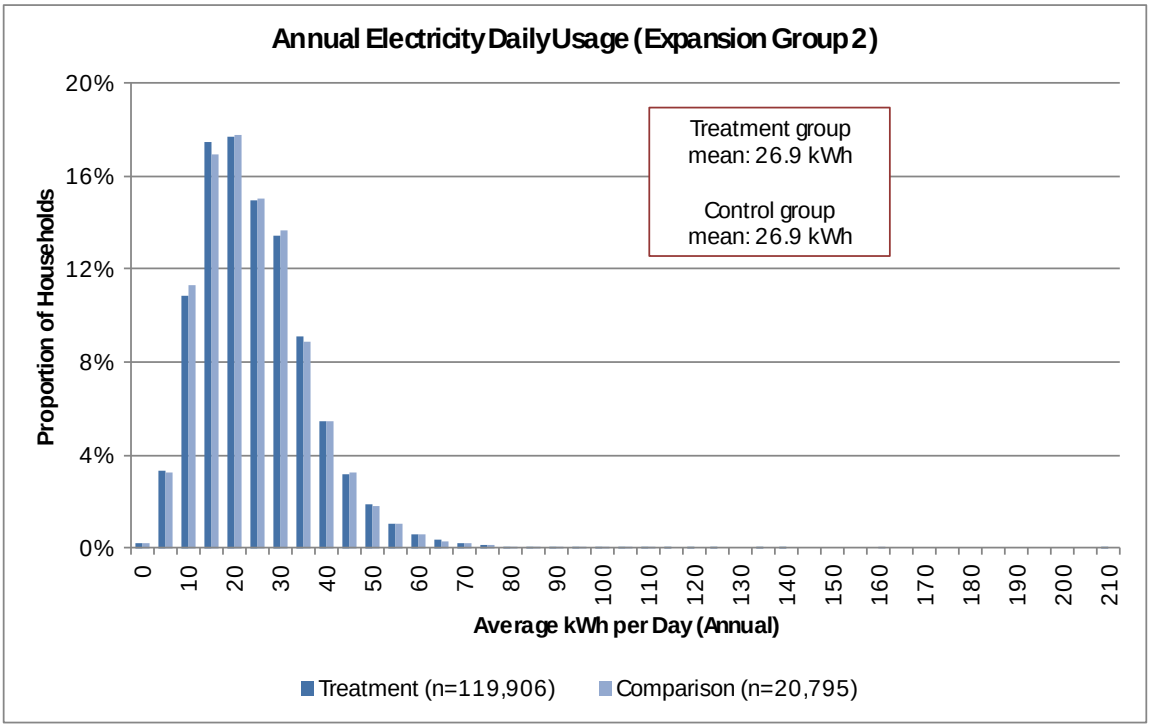


Figure 4. Distribution of Average Daily Gas Consumption in the Year before the Start of the Program [Original Group: Gas Customers, Comparison vs. Treatment Groups]

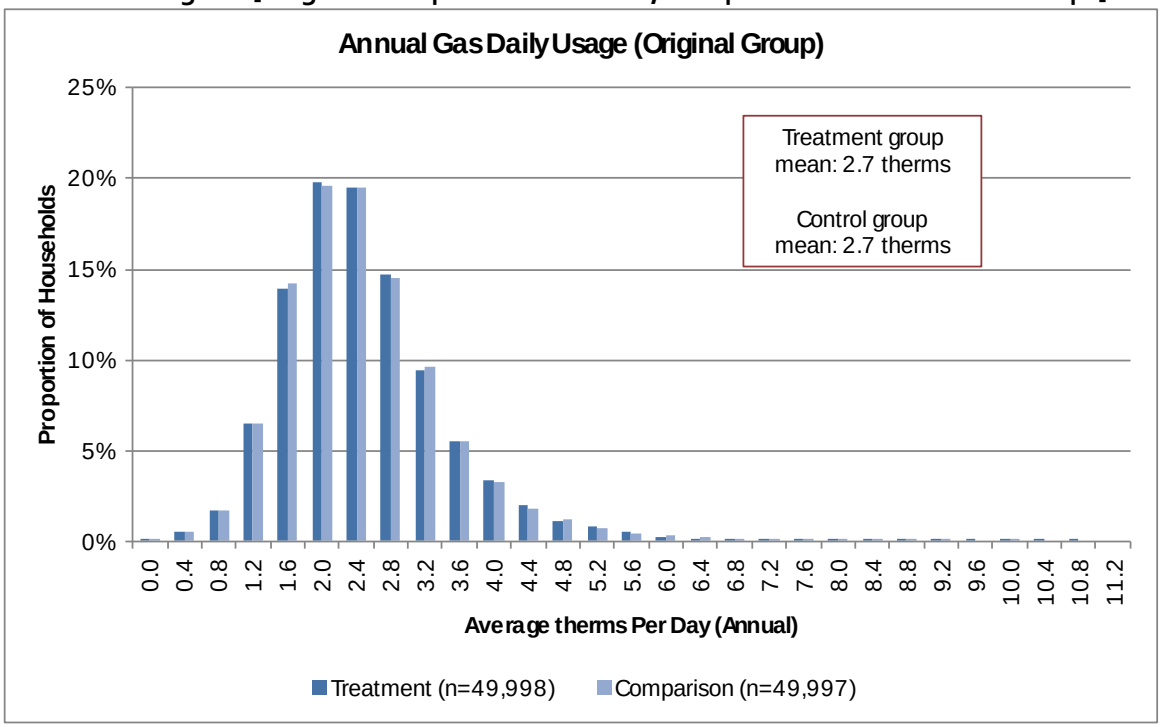


Figure 5. Distribution of Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 1: Gas Customers, Comparison vs. Treatment Groups]

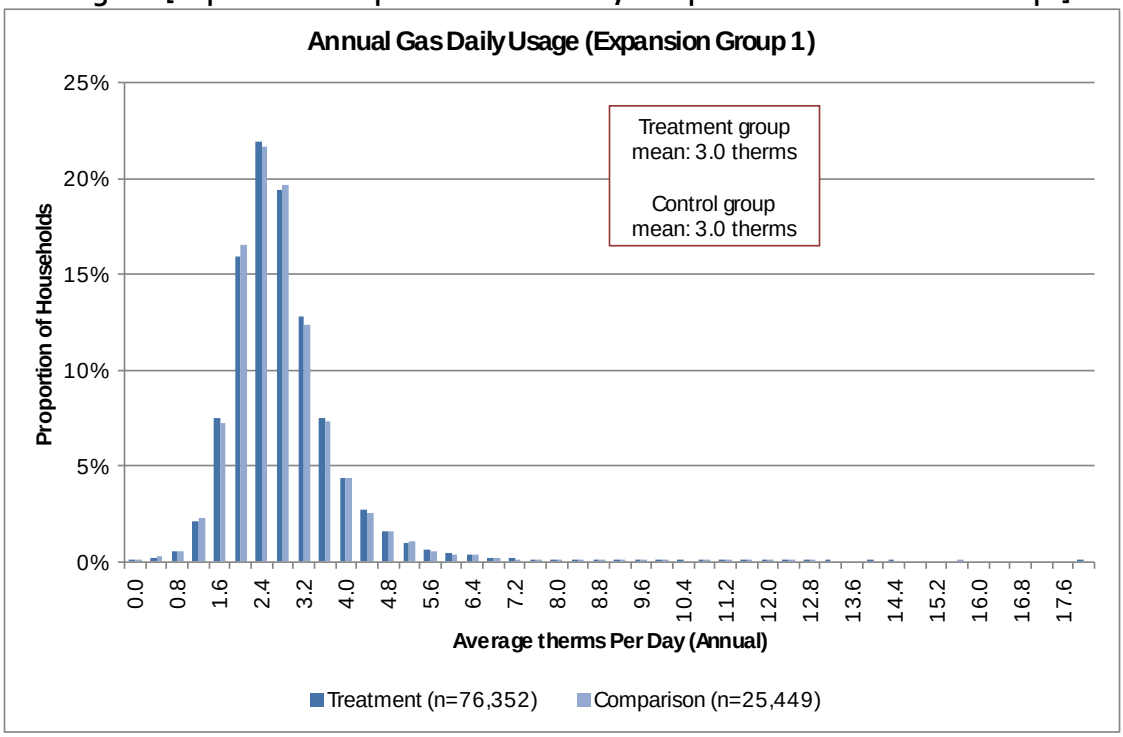


Figure 6. Distribution of Average Daily Gas Consumption in the Year before the Start of the

Program [Expansion Group 2: Gas Customers, Comparison vs. Treatment Groups]

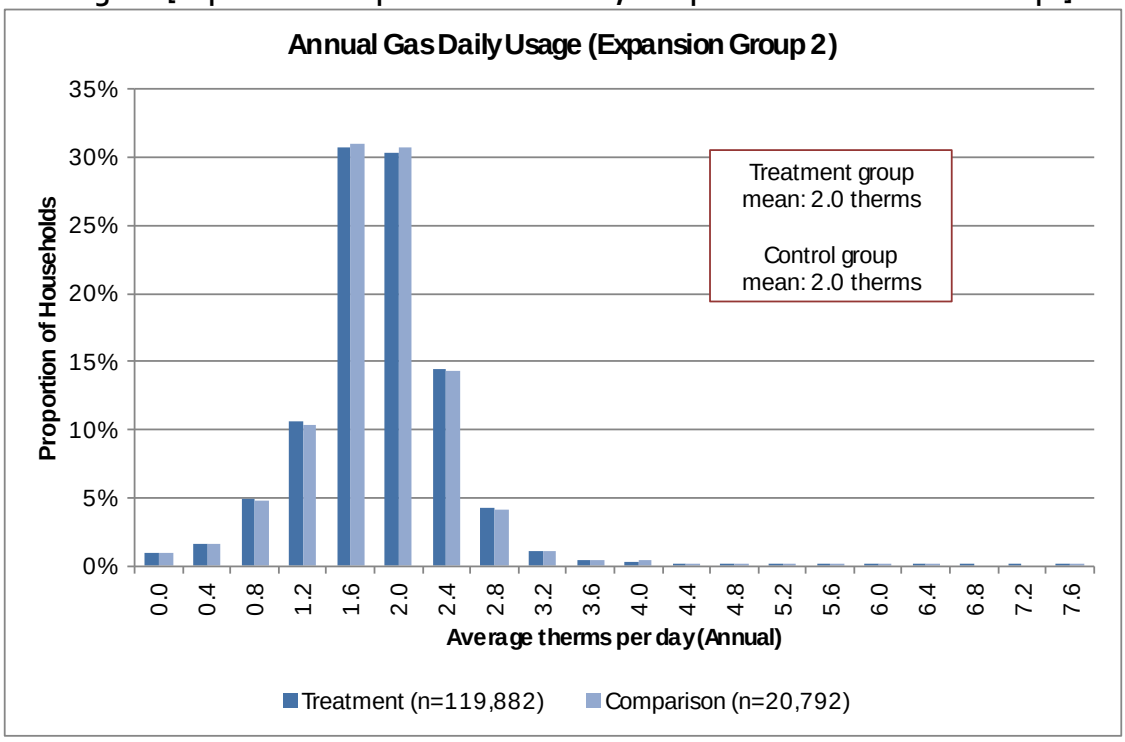
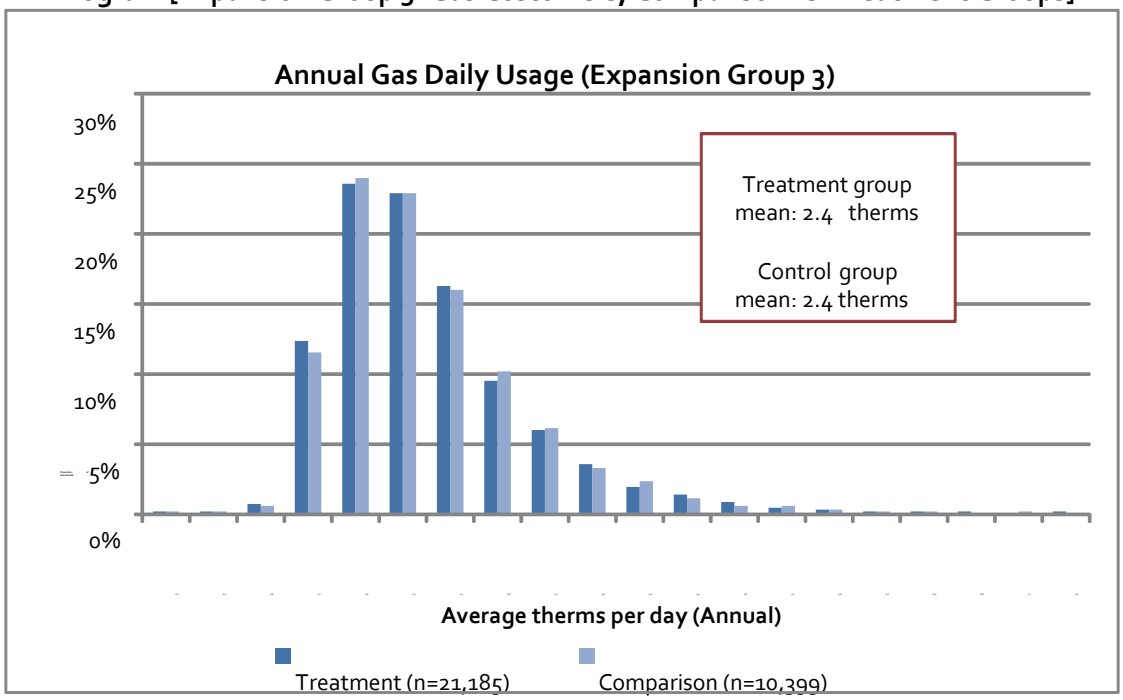


Figure 7. Distribution of Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 3: Gas Customers, Comparison vs. Treatment Groups]



Winter Usage

Figure 8. Distribution of Winter Average Daily Electricity Consumption in the Year before the Start of the Program [Original Group: Electric Customers, Comparison vs. Treatment Groups]

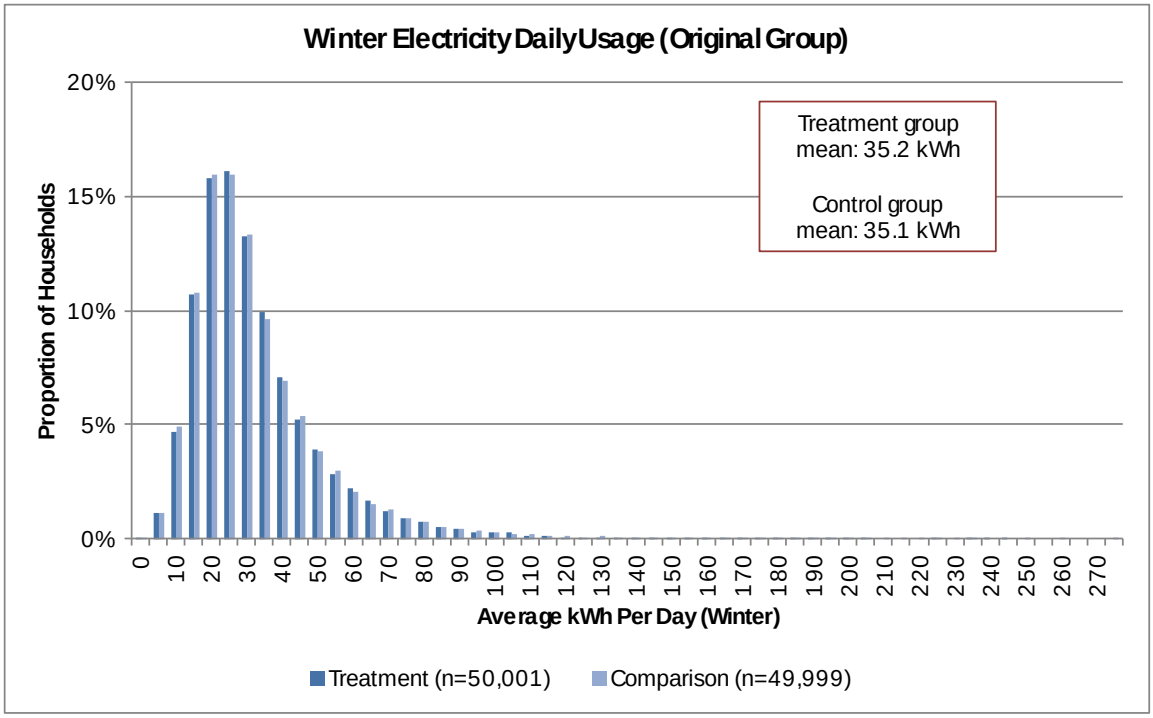


Figure 9. Distribution of Winter Average Daily Electricity Consumption in the Year before the Start of the Program [Expansion Group 1: Electric Customers, Comparison vs. Treatment Groups]

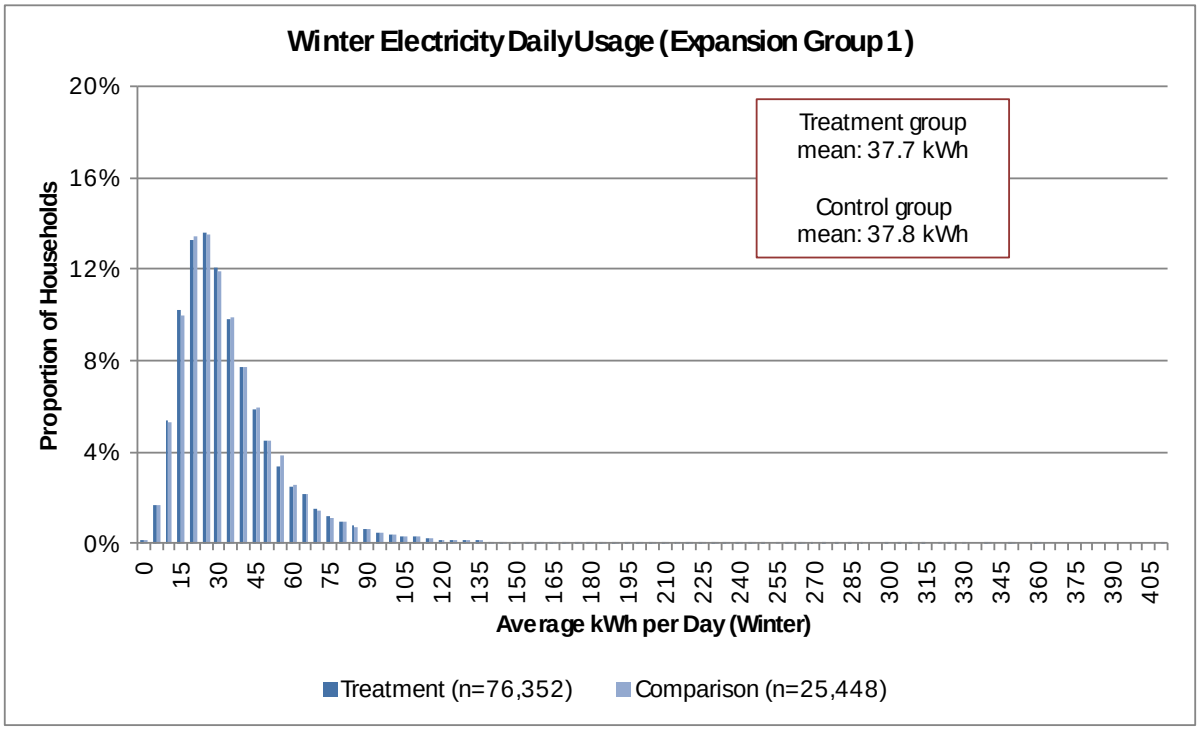


Figure 10. Distribution of Winter Average Daily Electricity Consumption in the Year before the Start of the Program [Expansion Group 2: Electric Customers, Comparison vs. Treatment Groups]

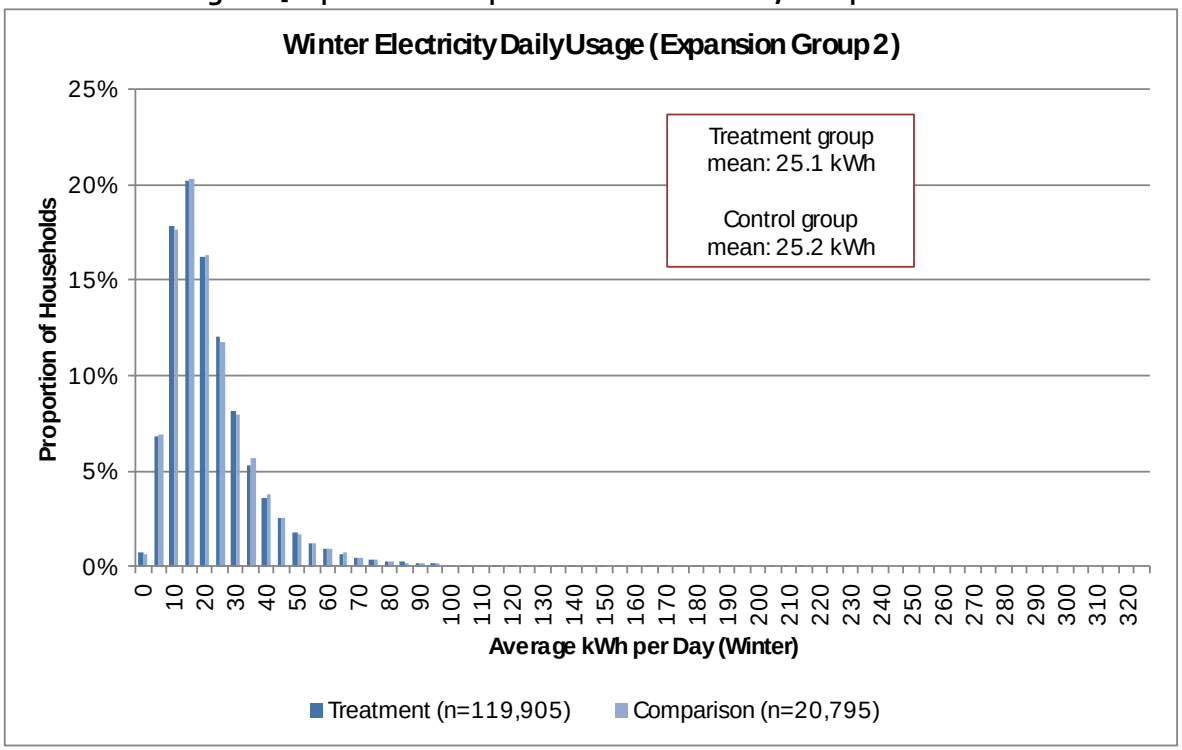


Figure 11. Distribution of Winter Average Daily Gas Consumption in the Year before the Start of the Program [Original Group: Gas Customers, Comparison vs. Treatment Groups]

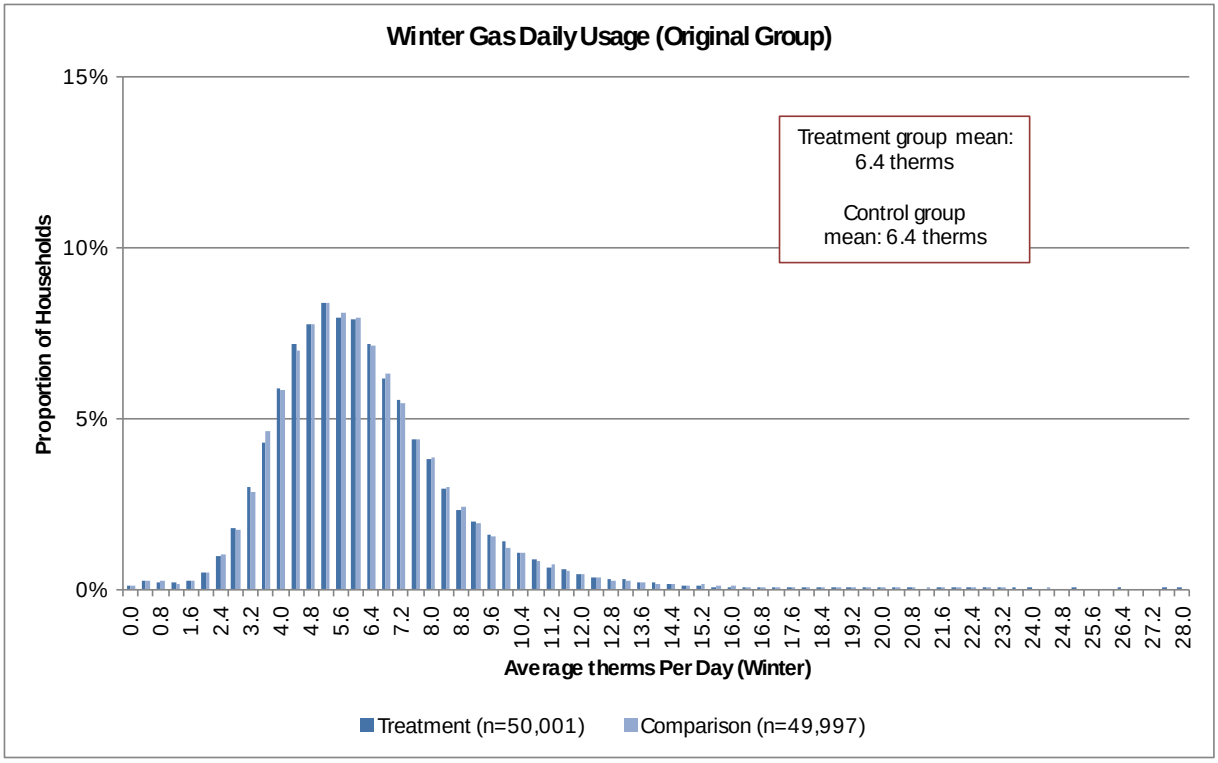


Figure 12. Distribution of Winter Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 1: Gas Customers, Comparison vs. Treatment Groups]

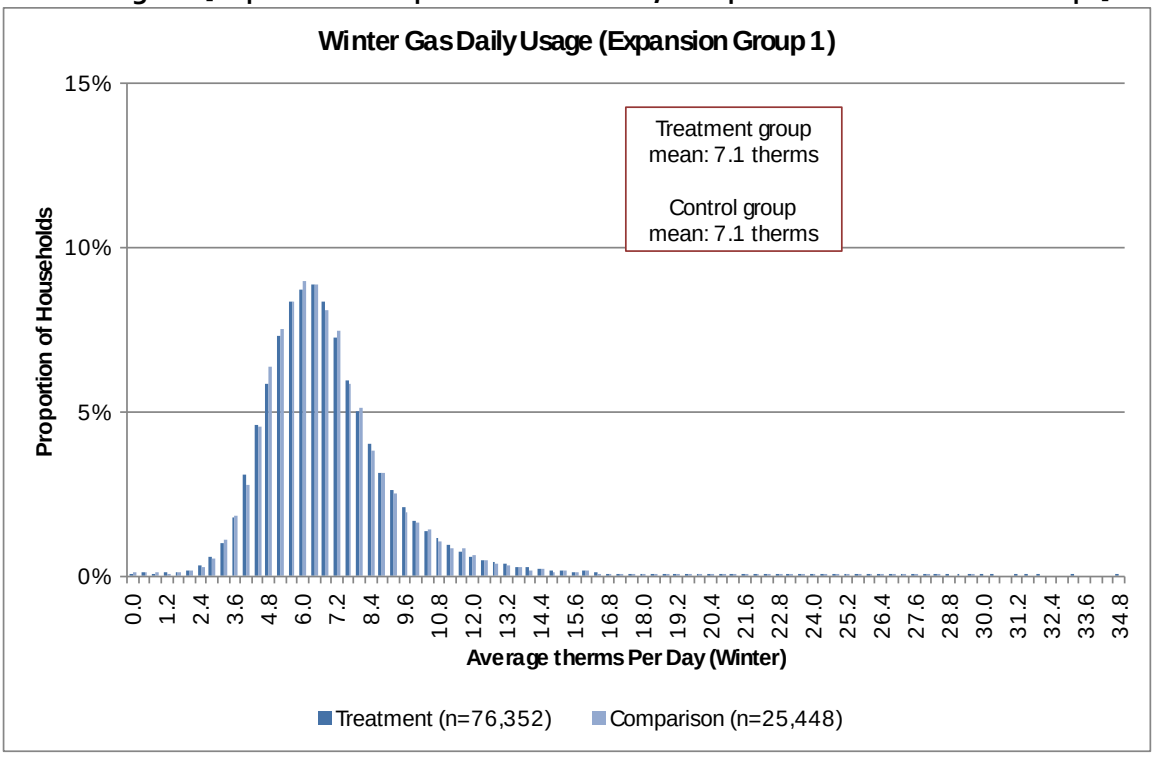


Figure 13. Distribution of Winter Average Daily Gas Consumption in the Year before the Start of

the Program [Expansion Group 2: Gas Customers, Comparison vs. Treatment Groups]

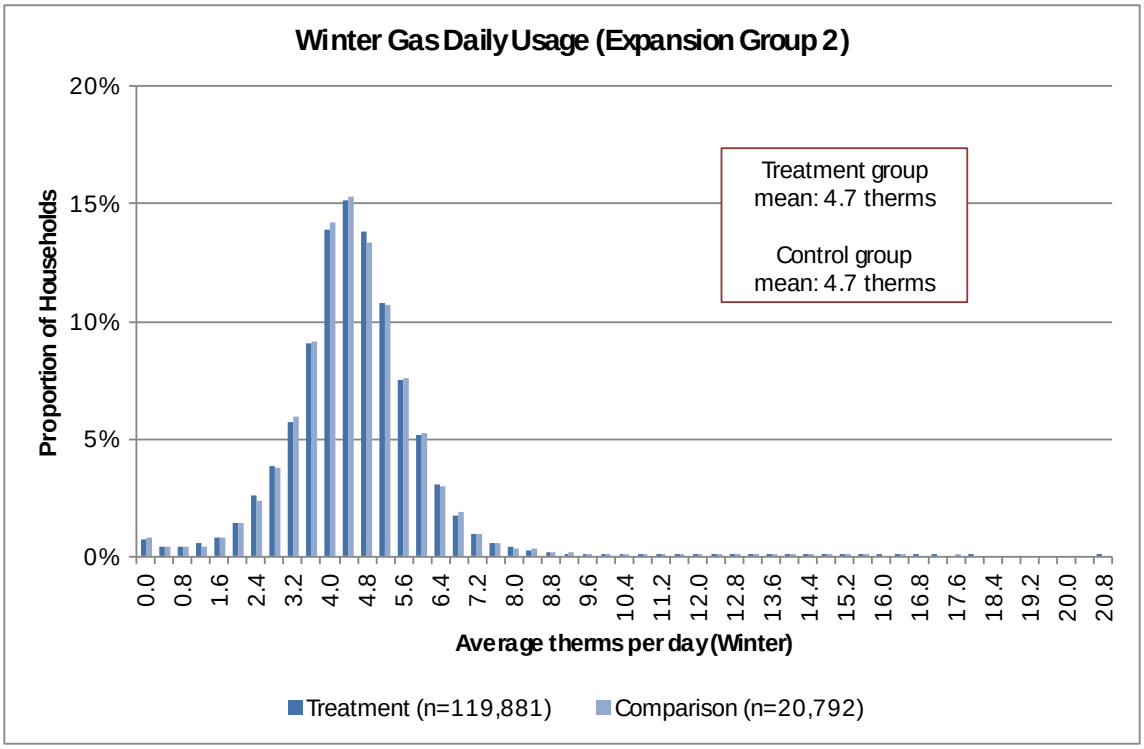
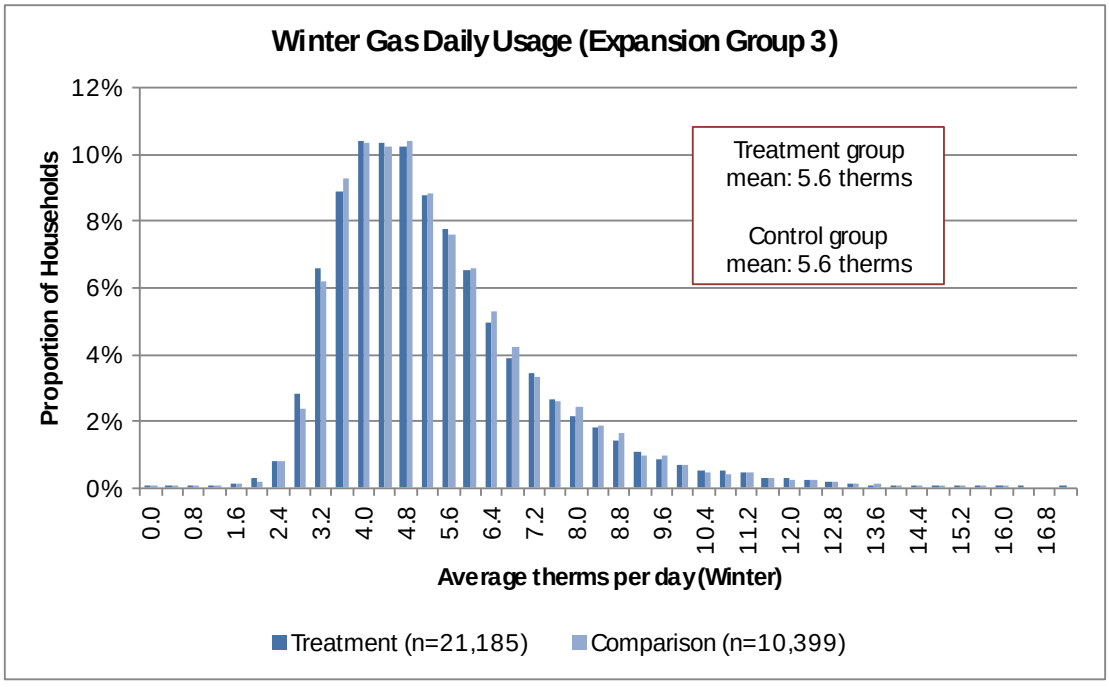


Figure 14. Distribution of Winter Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 3: Gas Customers, Comparison vs. Treatment Groups]



Summer Usage

Figure 15. Distribution of Summer Average Daily Electricity Consumption in the Year before the Start of the Program [Original Group: Electric Customers, Comparison vs. Treatment Groups]

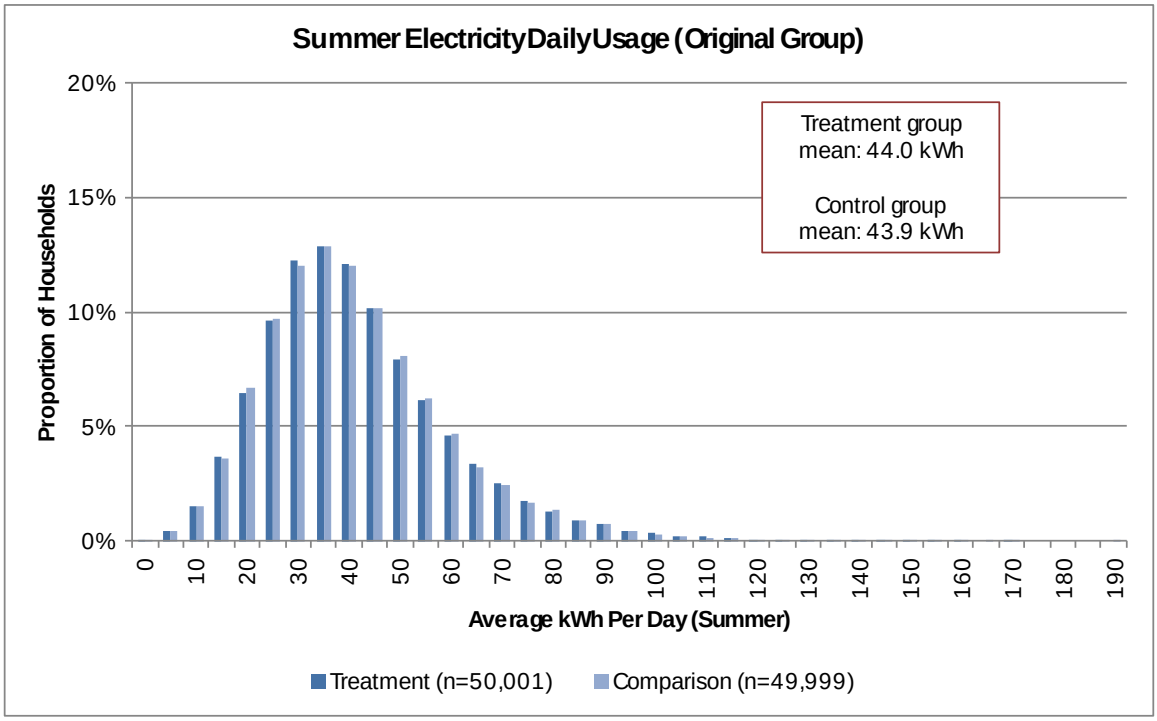


Figure 16. Distribution of Summer Average Daily Electricity Consumption in the Year before the Start of the Program [Expansion Group 1: Electric Customers, Comparison vs. Treatment Groups]

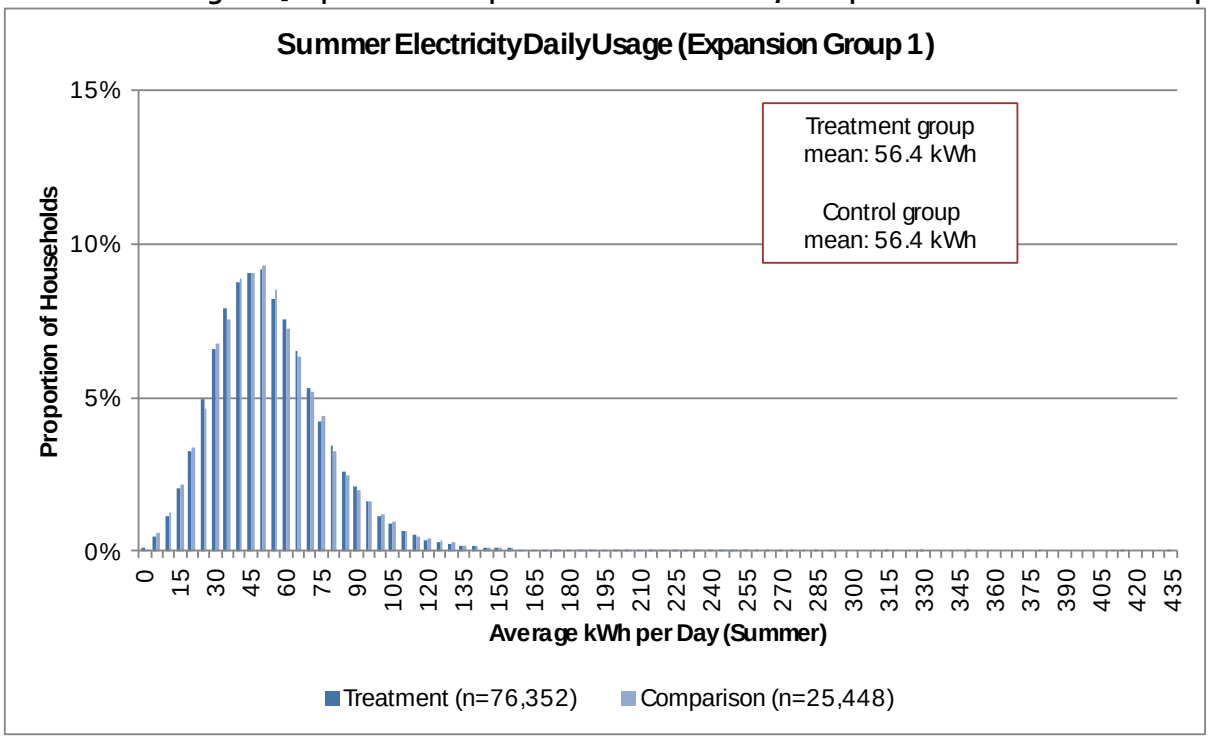


Figure 17. Distribution of Summer Average Daily Electricity Consumption in the Year before the Start of the Program [Expansion Group 2: Electric Customers, Comparison vs. Treatment Groups]

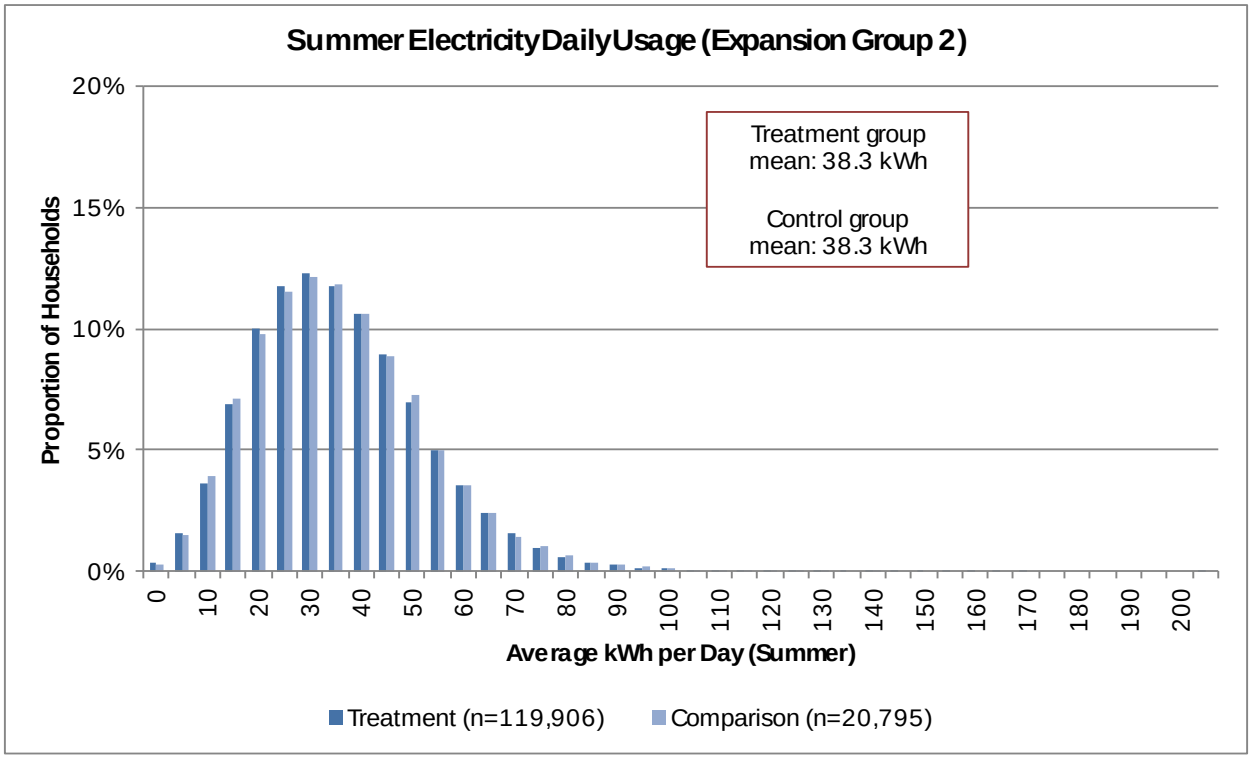


Figure 18. Distribution of Summer Average Daily Gas Consumption in the Year before the Start of the Program [Original Group: Electric Customers, Comparison vs. Treatment Groups]

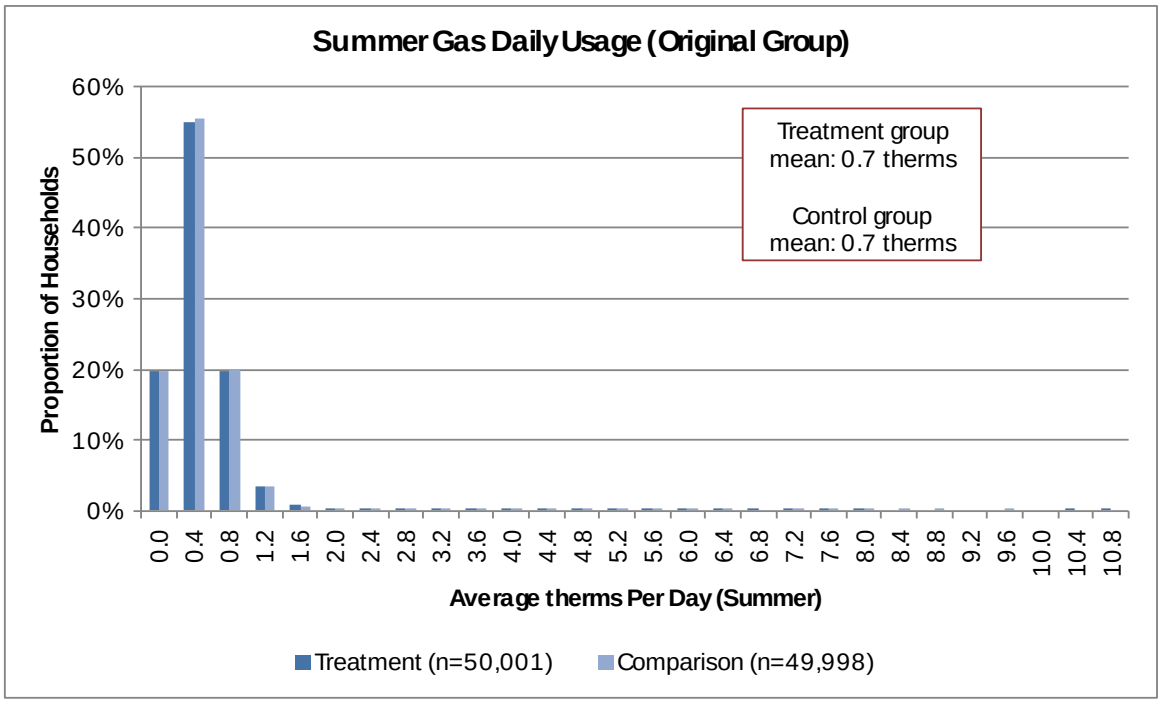


Figure 19. Distribution of Summer Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 1: Gas Customers, Comparison vs. Treatment Groups]

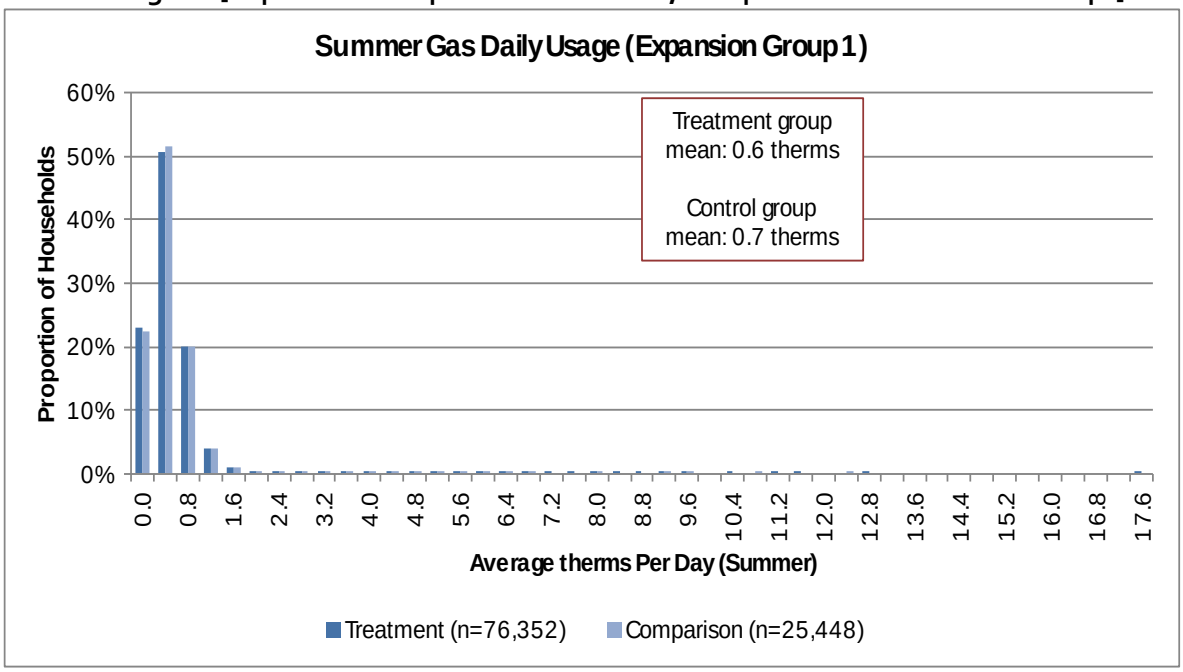


Figure 20. Distribution of Summer Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 2: Gas Customers, Comparison vs. Treatment Groups]

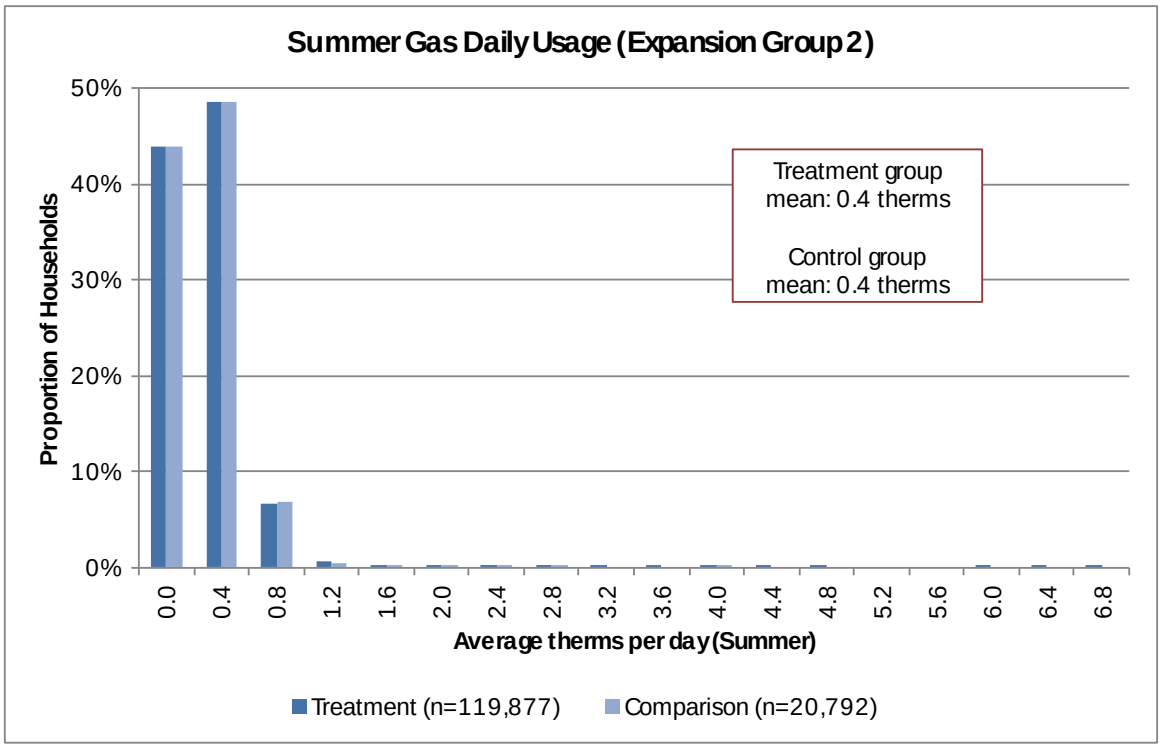
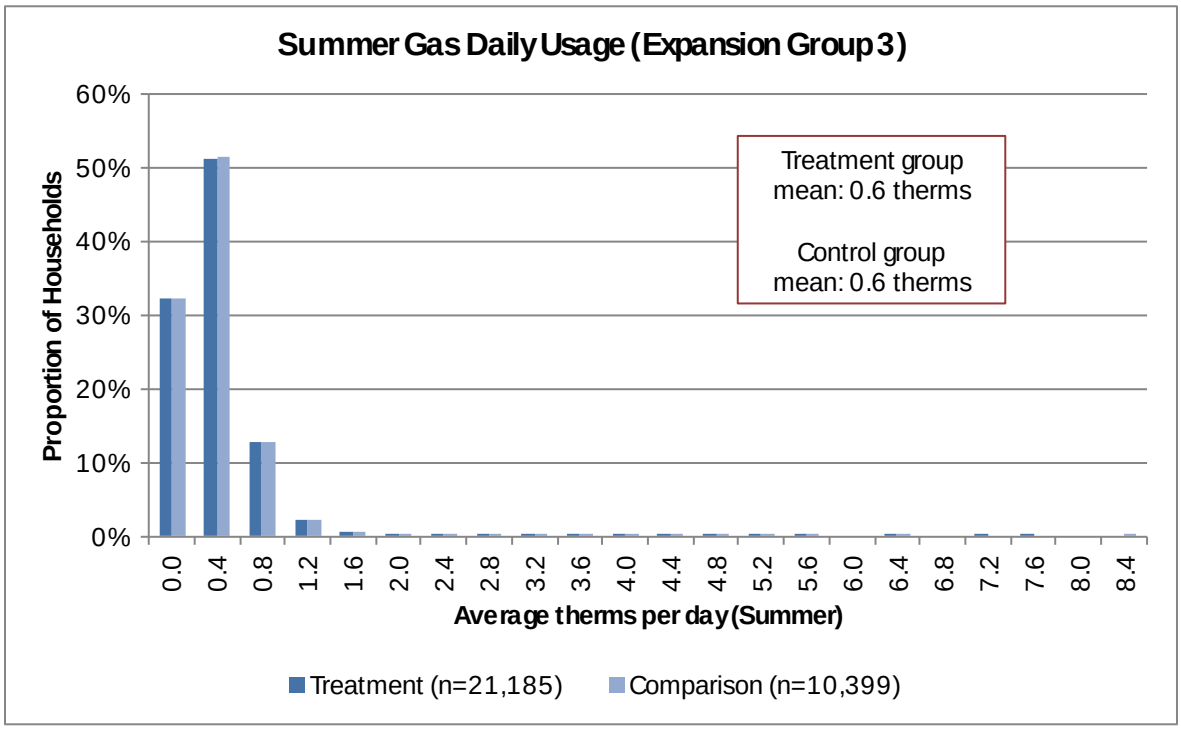


Figure 21. Distribution of Summer Average Daily Gas Consumption in the Year before the Start of the Program [Expansion Group 3: Gas Customers, Comparison vs. Treatment Groups]



C. Appendix: Billing Analysis Data Cleaning Results

The following tables show the results of the data cleaning effort for the billing analysis.

Table 21. Data Cleaning Results: Original Group, Electric

Electric – Original Group	Unique Customers			Observations		
	Total	Treatment	Control	Total	Treatment	Control
Initial #	100,001	50,001	49,999	9,330,091	4,665,074	4,665,017
# removed due to duplicates entries (i.e. entire records)	-	-	-	4,668,972	2,334,484	2,334,488
# after	100,001	50,001	49,999	4,661,119	2,330,590	2,330,529
# removed due to "N" -Not in test group because VIP (removed by Opower)	615	306	309	28,636	14,309	14,327
# after	99,386	49,695	49,691	4,632,483	2,316,281	2,316,202
# removed due to null first dates	803	397	406	36,555	18,074	18,481
# after	98,583	49,298	49,285	4,595,928	2,298,207	2,297,721
# removed due to first report date occurring after opt-out date	-	-	-	7,809	7,809	-
# after	98,583	49,298	49,285	4,588,119	2,290,398	2,297,721
# removed due to duplicate dates	-	-	-	172	85	87
# after	98,583	49,298	49,285	4,587,947	2,290,313	2,297,634
# removed due to insufficient pre-treatment billing data (365 days)	-	-	-	-	-	-
# after	98,583	49,298	49,285	4,587,947	2,290,313	2,297,634
# removed due to a report date occurring outside of bill date range	18	14	4	448	349	99
# after	98,565	49,284	49,281	4,587,499	2,289,964	2,297,535
# removed due to low usage (<2 kwh)	50	29	21	2,121	1,246	875
# after	98,515	49,255	49,260	4,585,378	2,288,718	2,296,660
# collapsed due to overlap in month variable	-	-	-	89,877	44,897	44,980

Electric – Original Group	Unique Customers			Observations		
# after	98,515	49,255	49,260	4,495,501	2,243,821	2,251,680
# removed due to too few months post participation (<10 or <4 for Exp Groups 3 & 4)	738	561	177	21,756	16,364	5,392
# after	97,777	48,694	49,083	4,473,745	2,227,457	2,246,288
Final #	**97,777**	**48,694**	**49,083**	**4,473,745**	**2,227,457**	**2,246,288**
% Removed	**2.2%**	**2.6%**	**1.8%**			

Table 22. Data Cleaning Results: Expansion Group 1, Electric

Electric – Expansion Group 1	Unique Customers			Observations		
	Total	Treatment	Control	Total	Treatment	Control
Initial #	101,807	76,355	25,452	9,148,600	6,859,232	2,289,368
# removed due to duplicates entries (i.e. entire records)	-	-	-	4,577,176	3,431,597	1,145,579
# after	101,807	76,355	25,452	4,571,424	3,427,635	1,143,789
# removed due to "N" -Not in test group because VIP (removed by Opower)	912	665	247	40,271	40,271	-
# after	100,895	75,690	25,205	4,531,153	3,387,364	1,143,789
# removed due to null first dates	2,325	1,733	592	93,921	59,134	34,787
# after	98,570	73,957	24,613	4,437,232	3,328,230	1,109,002
# removed due to first report date occurring after opt-out date	-	-	-	3,709	3,709	-
# after	98,570	73,957	24,613	4,433,523	3,324,521	1,109,002
# removed due to duplicate dates	-	-	-	146	93	53
# after	98,570	73,957	24,613	4,433,377	3,324,428	1,108,949
# removed due to insufficient pre-treatment billing data (365 days)	-	-	-	-	-	-
# after	98,570	73,957	24,613	4,433,377	3,324,428	1,108,949
# removed due to a report date occurring outside of bill date range	23	22	1	745	709	36
# after	98,547	73,935	24,612	4,432,632	3,323,719	1,108,913

Electric – Expansion Group 1	Unique Customers			Observations		
# removed due to low usage (<2 kwh)	77	64	13	3,217	2,686	531
# after	98,470	73,871	24,599	4,429,415	3,321,033	1,108,382
# collapsed due to overlap in month variable	-	-	-	89,488	67,216	22,272
# after	98,470	73,871	24,599	4,339,927	3,253,817	1,086,110
# removed due to too few months post participation (<10 or <4 for Exp Groups 3 & 4)	1,151	958	193	42,594	35,400	7,194
# after	97,319	72,913	24,406	4,297,333	3,218,417	1,078,916
Final #	**97,319**	**72,913**	**24,406**	**4,297,333**	**3,218,417**	**1,078,916**
% Removed	**4.4%**	**4.5%**	**4.1%**			

Table 23. Data Cleaning Results: Expansion Group 2, Electric

Electric – Expansion Group 2	Unique Customers			Observations		
	Total	Treatment	Control	Total	Treatment	Control
Initial #	140,717	119,917	20,800	12,776,360	10,886,760	1,889,600
# removed due to duplicates entries (i.e. entire records)	-	-	-	6,390,989	5,445,994	944,995
# after	140,717	119,917	20,800	6,385,371	5,440,766	944,605
# removed due to "N" -Not in test group because VIP (removed by Opower)	8,455	7,239	1,216	384,106	328,678	55,428
# after	132,262	112,678	19,584	6,001,265	5,112,088	889,177
# removed due to null first dates	4,517	3,815	702	199,244	168,278	30,966
# after	127,745	108,863	18,882	5,802,021	4,943,810	858,211
# removed due to first report date occurring after opt-out date	-	-	-	1,725	1,725	-
# after	127,745	108,863	18,882	5,800,296	4,942,085	858,211
# removed due to duplicate dates	-	-	-	71	60	11
# after	127,745	108,863	18,882	5,800,225	4,942,025	858,200

Electric – Expansion Group 2	Unique Customers			Observations		
# removed due to insufficient pre-treatment billing data (365 days)	3	2	1	45	28	17
# after	127,742	108,861	18,881	5,800,180	4,941,997	858,183
# removed due to a report date occurring outside of bill date range	41	36	5	1,573	1,369	204
# after	127,701	108,825	18,876	5,798,607	4,940,628	857,979
# removed due to low usage (<2 kwh)	196	171	25	8,680	7,553	1,127
# after	127,505	108,654	18,851	5,789,927	4,933,075	856,852
# collapsed due to overlap in month variable	-	-	-	119,338	101,247	18,091
# after	127,505	108,654	18,851	5,670,589	4,831,828	838,761
# removed due to too few months post participation (<10 or <4 for Exp Groups 3 & 4)	632	582	50	25,542	23,551	1,991
# after	126,873	108,072	18,801	5,645,047	4,808,277	836,770
Final #	**126,873**	**108,072**	**18,801**	**5,645,047**	**4,808,277**	**836,770**
% Removed	**9.8%**	**9.9%**	**9.6%**			

Table 24. Data Cleaning Results: Original Group, Gas

Gas – Original Group	Unique Customers			Observations		
	Total	Treatment	Control	Total	Treatment	Control
Initial #	100,001	50,001	50,000	9,324,698	4,662,634	4,662,064
# removed due to duplicates entries (i.e. entire records)	-	-	-	4,666,405	2,333,358	2,333,047
# after	100,001	50,001	50,000	4,658,293	2,329,230	2,329,063
# removed due to "N" (included in test analysis -- i.e. customer moved or no longer in Ameren's territory)	615	306	309	28,559	14,276	14,283
# after	99,386	49,695	49,691	4,629,734	2,314,954	2,314,780
# removed due to null first dates	803	397	406	36,290	17,894	18,396
# after	98,583	49,298	49,285	4,593,444	2,297,060	2,296,384

Gas – Original Group	Unique Customers			Observations		
# removed due to first report date occurring after opt-out date	-	-	-	7,811	7,811	-
# after	98,583	49,298	49,285	4,585,633	2,289,249	2,296,384
# removed due to duplicate dates	-	-	-	407	199	208
# after	98,583	49,298	49,285	4,585,226	2,289,050	2,296,176
# removed due to insufficient pre-treatment billing data (365 days)	-	-	-	-	-	-
# after	98,583	49,298	49,285	4,585,226	2,289,050	2,296,176
# removed due to a report date occurring outside of bill date range	20	16	4	500	400	100
# after	98,563	49,282	49,281	4,584,726	2,288,650	2,296,076
# collapsed due to overlap in month variable	-	-	-	89,529	44,721	44,808
# after	98,563	49,282	49,281	4,495,197	2,243,929	2,251,268
# removed due to too few months post participation (<10 or <4 for Exp Groups 3 & 4)	805	587	218	23,758	6,597	17,161
# after	97,758	48,695	49,063	4,471,439	2,237,332	2,234,107
Final #	**97,758**	**48,695**	**49,063**	**4,471,439**	**2,237,332**	**2,234,107**
% Removed	**2.2%**	**2.6%**	**1.9%**			

Table 25. Data Cleaning Results: Expansion Group 1, Gas

Gas – Expansion Group 1	Unique Customers			Observations		
	Total	Treatment	Control	Total	Treatment	Control
Initial #	101,807	76,355	25,452	9,143,234	6,855,361	2,287,873
# removed due to duplicates entries (i.e. entire records)	-	-	-	4,575,194	3,430,379	1,144,815
# after	101,807	76,355	25,452	4,568,040	3,424,982	1,143,058
# removed due to "N" (included in test analysis -- i.e. customer moved or no longer in Ameren's territory)	912	665	247	40,176	29,417	10,759
# after	100,895	75,690	25,205	4,527,864	3,395,565	1,132,299

Gas – Expansion Group 1	Unique Customers			Observations		
# removed due to null first dates	2,325	1,733	592	93,384	69,486	23,898
# after	98,570	73,957	24,613	4,434,480	3,326,079	1,108,401
# removed due to first report date occurring after opt-out date	-	-	-	3,708	3,708	-
# after	98,570	73,957	24,613	4,430,772	3,322,371	1,108,401
# removed due to duplicate dates	-	-	-	441	330	111
# after	98,570	73,957	24,613	4,430,331	3,322,041	1,108,290
# removed due to insufficient pre-treatment billing data (365 days)	-	-	-	-	-	-
# after	98,570	73,957	24,613	4,430,331	3,322,041	1,108,290
# removed due to a report date occurring outside of bill date range	21	20	1	690	654	36
# after	98,549	73,937	24,612	4,429,641	3,321,387	1,108,254
# collapsed due to overlap in month variable	-	-	-	90,354	67,871	22,483
# after	98,549	73,937	24,612	4,339,287	3,253,516	1,085,771
# removed due to too few months post participation (<10 or <4 for Exp Groups 3 & 4)	1,259	1,044	215	46,490	38,514	7,976
# after	97,290	72,893	24,397	4,292,797	3,215,002	1,077,795
Final #	**97,290**	**72,893**	**24,397**	**4,292,797**	**3,215,002**	**1,077,795**
% Removed	**4.4%**	**4.5%**	**4.1%**			

Table 26. Data Cleaning Results: Expansion Group 2, Gas

Gas – Expansion Group 2	Unique Customers			Observations		
	Total	Treatment	Control	Total	Treatment	Control
Initial #	140,717	119,917	20,800	12,768,669	10,879,614	1,889,055
# removed due to duplicates entries (i.e. entire records)	-	-	-	6,387,636	5,442,696	944,940
# after	140,717	119,917	20,800	6,381,033	5,436,918	944,115

Gas – Expansion Group 2	Unique Customers			Observations		
# removed due to "N" (included in test analysis -- i.e. customer moved or no longer in Ameren's territory)	8,455	7,239	1,216	383,184	327,982	55,202
# after	132,262	112,678	19,584	5,997,849	5,108,936	888,913
# removed due to null first dates	4,517	3,815	702	198,818	167,902	30,916
# after	127,745	108,863	18,882	5,799,031	4,941,034	857,997
# removed due to first report date occurring after opt-out date	-	-	-	1,723	1,723	-
# after	127,745	108,863	18,882	5,797,308	4,939,311	857,997
# removed due to duplicate dates	-	-	-	782	669	113
# after	127,745	108,863	18,882	5,796,526	4,938,642	857,884
# removed due to insufficient pre-treatment billing data (365 days)	24	23	1	398	382	16
# after	127,721	108,840	18,881	5,796,128	4,938,260	857,868
# removed due to a report date occurring outside of bill date range	41	35	6	1,564	1,322	242
# after	127,680	108,805	18,875	5,794,564	4,936,938	857,626
# collapsed due to overlap in month variable	-	-	-	120,580	102,274	18,306
# after	127,680	108,805	18,875	5,673,984	4,834,664	839,320
# removed due to too few months post participation (<10 or <4 for Exp Groups 3 & 4)	684	634	50	27,651	25,625	2,026
# after	126,996	108,171	18,825	5,646,333	4,809,039	837,294
Final #	**126,996**	**108,171**	**18,825**	**5,646,333**	**4,809,039**	**837,294**
% Removed	**9.8%**	**9.8%**	**9.5%**			

Table 27. Data Cleaning Results: Expansion Group 3, Gas

Gas – Expansion Group 3	Unique Customers			Observations		
	Total	Treatment	Control	Total	Treatment	Control
Initial #	31,589	21,189	10,400	1,414,196	949,207	464,989

Gas – Expansion Group 3	Unique Customers			Observations		
# removed due to duplicates entries (i.e. entire records)	-	-	-	3,394	2,556	838
# after	31,589	21,189	10,400	1,410,802	946,651	464,151
# removed due to "N" (included in test analysis -- i.e. customer moved or no longer in Ameren's territory)	848	557	291	36,729	24,170	12,559
# after	30,741	20,632	10,109	1,374,073	922,481	451,592
# removed due to null first dates	3,069	2,012	1,057	122,686	80,362	42,324
# after	27,672	18,620	9,052	1,251,387	842,119	409,268
# removed due to first report date occurring after opt-out date	-	-	-	389	389	-
# after	27,672	18,620	9,052	1,250,998	841,730	409,268
# removed due to duplicate dates	-	-	-	747	503	244
# after	27,672	18,620	9,052	1,250,251	841,227	409,024
# removed due to insufficient pre-treatment billing data (365 days)	-	-	-	-	-	-
# after	27,672	18,620	9,052	1,250,251	841,227	409,024
# removed due to a report date occurring outside of bill date range	627	417	210	24,751	16,489	8,262
# after	27,045	18,203	8,842	1,225,500	824,738	400,762
# collapsed due to overlap in month variable	-	-	-	18,935	12,729	6,206
# after	27,045	18,203	8,842	1,206,565	812,009	394,556
# removed due to too few months post participation (<10 or <4 for Exp Groups 3 & 4)	2,317	1,587	730	93,109	63,748	29,361
# after	24,728	16,616	8,112	1,113,456	748,261	365,195
Final #	**24,728**	**16,616**	**8,112**	**1,113,456**	**748,261**	**365,195**
% Removed	**21.7%**	**21.6%**	**22.0%**			

D. Appendix: Billing Analysis Model Coefficients

Table 28. Billing Analysis Model Coefficients – Electric, Original Group (Winter)

Variable	Coefficient	Robust Standard Error	t
Post	-3.63	0.056	-64.67
Post x Treatment	-0.50	0.080	-6.30
Constant	34.38	0.013	2,562.86

Table 29. Billing Analysis Model Coefficients – Electric, Original Group (Spring)

Variable	Coefficient	Robust Standard Error	t
Post	-0.14	0.040	-3.44
Post x Treatment	-0.39	0.057	-6.79
Constant	27.71	0.009	2,993.88

Table 30. Billing Analysis Model Coefficients – Electric, Original Group (Fall)

Variable	Coefficient	Robust Standard Error	t
Post	-3.26	0.039	-83.76
Post x Treatment	-0.35	0.056	-6.24
Constant	29.63	0.008	3,564.54

Table 31. Billing Analysis Model Coefficients – Electric, Expansion Group 1 (Winter)

Variable	Coefficient	Robust Standard Error	t
Post	-3.59	0.076	-47.25
Post x Treatment	-0.40	0.088	4.57
Constant	37.73	0.010	3,689.93

Table 32. Billing Analysis Model Coefficients – Electric, Expansion Group 1 (Summer)

Variable	Coefficient	Robust Standard Error	t
Post	8.13	0.080	101.20
Post x Treatment	-0.71	0.092	-7.73
Constant	52.43	0.009	6,128.86

Table 33. Billing Analysis Model Coefficients – Electric, Expansion Group 1 (Spring)

Variable	Coefficient	Robust Standard Error	t
Post	-0.26	0.056	-4.62
Post x Treatment	-0.52	0.065	-7.99
Constant	30.73	0.007	4,344.42

Table 34. Billing Analysis Model Coefficients – Electric, Expansion Group 1 (Fall)

Variable	Coefficient	Robust Standard Error	t
Post	-1.70	0.054	-31.42
Post x Treatment	-0.38	0.062	-6.06
Constant	32.37	0.007	4,631.17

Table 35. Billing Analysis Model Coefficients – Electric, Expansion Group 2 (Winter)

Variable	Coefficient	Robust Standard Error	t
Post	-1.11	0.064	-17.33
Post x Treatment	-0.21	0.069	-3.09
Constant	24.36	0.006	3,850.57

Table 36. Billing Analysis Model Coefficients – Electric, Expansion Group 2 (Spring)

Variable	Coefficient	Robust Standard Error	t
Post	0.72	0.049	14.81
Post x Treatment	-0.19	0.052	-3.55
Constant	20.55	0.005	4,452.36

Table 37. Billing Analysis Model Coefficients – Electric, Expansion Group 2 (Overall)

Variable	Coefficient	Robust Standard Error	t
Post	-3.65	0.05	-74.29
Post x Treatment	-0.20	0.05	-3.71
Constant	25.90	0.00	11,000.00

Table 38. Billing Analysis Model Coefficients – Gas, Original Group (Winter)

Variable	Coefficient	Robust Standard Error	t
Post	-1.58	0.005	-297.15
Post x Treatment	-0.04	0.008	-5.30
Constant	6.32	0.001	4,979.97

Table 39. Billing Analysis Model Coefficients – Gas, Original Group (Spring)

Variable	Coefficient	Robust Standard Error	t
Post	-0.77	0.003	-307.22
Post x Treatment	-0.02	0.004	-4.48
Constant	2.06	0.001	3,534.94

Table 40. Billing Analysis Model Coefficients – Gas, Original Group (Fall)

Variable	Coefficient	Robust Standard Error	t
Post	-0.06	0.003	-19.20
Post x Treatment	-0.03	0.004	-5.97
Constant	1.98	0.001	3,087.12

Table 41. Billing Analysis Model Coefficients – Gas, Expansion Group 1 (Winter)

Variable	Coefficient	Robust Standard Error	t
Post	-1.78	0.008	-231.78
Post x Treatment	-0.06	0.009	-6.65
Constant	7.23	0.001	7,052.87

Table 42. Billing Analysis Model Coefficients – Gas, Expansion Group 1 (Summer)

Variable	Coefficient	Robust Standard Error	t
Post	-0.06	0.002	-38.33
Post x Treatment	0.00	0.002	0.10
Constant	0.62	0.000	3,326.79

Table 43. Billing Analysis Model Coefficients – Gas, Expansion Group 1 (Spring)

Variable	Coefficient	Robust Standard Error	t
Post	-0.93	0.004	-251.60
Post x Treatment	-0.02	0.004	-4.06
Constant	2.36	0.000	4,966.56

Table 44. Billing Analysis Model Coefficients – Gas, Expansion Group 1 (Fall)

Variable	Coefficient	Robust Standard Error	t
Post	-0.18	0.004	-50.46
Post x Treatment	-0.02	0.004	-5.42
Constant	2.19	0.000	4,499.93

Table 45. Billing Analysis Model Coefficients – Gas, Expansion Group 2 (Winter)

Variable	Coefficient	Robust Standard Error	t
Post	-1.08	0.005	-198.49
Post x Treatment	-0.00	0.006	-0.84
Constant	4.75	0.001	8,610.20

Table 46. Billing Analysis Model Coefficients – Gas, Expansion Group 2 (Spring)

Variable	Coefficient	Robust Standard Error	t
Post	-0.60	0.003	-235.72
Post x Treatment	-0.01	0.003	-2.58
Constant	1.57	0.000	6,318.20

Table 47. Billing Analysis Model Coefficients – Gas, Expansion Group 2 (Overall)

Variable	Coefficient	Robust Standard Error	t
Post	0.43	0.00	138.17
Post x Treatment	-0.01	0.00	-2.41
Constant	1.89	0.00	12,000.00

Table 48. Billing Analysis Model Coefficients – Gas, Expansion Group 3 (Winter)

Variable	Coefficient	Robust Standard Error	t
Post	-1.34	0.010	-140.14
Post x Treatment	-0.04	0.012	-3.28
Constant	5.61	0.001	3,925.05

Table 49. Billing Analysis Model Coefficients – Gas, Expansion Group 3 (Spring)

Variable	Coefficient	Robust Standard Error	t
Post	-0.72	0.005	-143.94
Post x Treatment	-0.01	0.006	-1.60
Constant	1.88	0.001	2,590.92

Table 50. Billing Analysis Model Coefficients – Gas, Expansion Group 3 (Overall)

Variable	Coefficient	Robust Standard Error	t
Post	0.49	0.01	88.40
Post x Treatment	-0.03	0.01	-3.95
Constant	2.24	0.00	5,625.43

E. APPENDIX: CHANNELING ANALYSIS SAVINGS ADJUSTMENTS

For the evaluation group to be able to correctly compare the treatment and control groups given the difference in group sizes, the control group was normalized to the treatment group size. The table below shows the adjustments made.

Table 51. Treatment and Control Group Sizes - Electric

Electric	Treatment	Control	Adjustment Factor for Normalizing Control Group
Original Group	50,002	49,999	1.00
Expansion Group 1	76,355	25,452	3.00
Expansion Group 2	119,918	20,799	5.77

Table 52. Treatment and Control Group Sizes - Gas

Electric	Treatment	Control	Adjustment Factor for Normalizing Control Group
Original Group	50,002	49,999	1.00
Expansion Group 1	76,355	25,452	3.00
Expansion Group 2	119,918	20,799	5.77
Expansion Group 3	21,189	10,400	2.04

Using the difference-in-difference approach, the evaluation team used the net deemed savings for calculating the savings adjustments (see table below).

Table 53. Difference in Difference Estimator

	Pre	Post	Post-Pre Difference
Treatment	Yot	Y1t	Y1t-Yot
Control	Yoc	Y1c	Y1c-Yoc
T-C Difference	**Yot-Yoc**	**Y1t-Y1c**	**(Y1t-Y1c) - (Yot-Yoc)**

The savings adjustment values were then divided by the modeled baseline assumptions to get the household level adjustment values. The baseline usages values and the net adjustments per household are shown in the tables below.

Table 54. Modeled Baseline Usage

	Electric (kWh/year)	Gas (therm/year)
Original Group	7,704	732
Expansion Group 1	13,599	900
Expansion Group 2	4,381	459
Expansion Group 3	0	533

Table 55. Savings Adjustment – Electric, Original Group

Electric – Original Group	Pre-treatment	Post-treatment	Post-Pre Difference
Treatment	0.00	29.36	29.36
Control	0.00	30.47	30.47
T-C Difference	0.00	-1.11	**-0.01%**

Table 56. Savings Adjustment – Electric, Expansion Group 1

Electric – Expansion Group 1	Pre-treatment	Post-treatment	Post-Pre Difference
Treatment	0.39	30.13	29.73
Control	0.60	26.59	25.99
T-C Difference	-0.21	3.54	**0.03%**

Table 57. Savings Adjustment – Electric, Expansion Group 2

Electric – Expansion Group 2	Pre-treatment	Post-treatment	Post-Pre Difference
Treatment	13.59	10.60	-2.99
Control	13.38	9.86	-3.52
T-C Difference	0.21	0.74	**0.01%**

Table 58. Savings Adjustment – Gas, Original Group

Gas – Original Group	Pre-treatment	Post-treatment	Post-Pre Difference
Treatment	0.00	2.59	2.59
Control	0.00	1.82	1.82
T-C Difference	0.00	0.77	**0.11%**

Table 59. Savings Adjustment – Gas, Expansion Group 1

Gas – Expansion Group 1	Pre-treatment	Post-treatment	Post-Pre Difference
Treatment	0.02	2.42	2.40
Control	0.01	1.89	1.88
T-C Difference	0.01	0.52	**0.06%**

Table 60. Savings Adjustment – Gas, Expansion Group 2

Gas – Expansion Group 2	Pre-treatment	Post-treatment	Post-Pre Difference
Treatment	0.63	0.98	0.35
Control	0.49	0.85	0.36
T-C Difference	0.13	0.13	**-0.001%**

Table 61. Savings Adjustment – Gas, Expansion Group 3

Gas – Expansion Group 3	Pre-treatment	Post-treatment	Post-Pre Difference
Treatment	0.50	0.87	0.36
Control	0.39	0.94	0.55
T-C Difference	0.11	-0.08	**-0.04%**

F. APPENDIX: IMPLEMENTATION MODEL

The evaluation team created an implementation model for the Behavioral Modification Program evaluated in PY4. An implementation model is a graphic presentation of the intervention – what occurs and who undertakes the functional activities of the program. The model is displayed using a multi-level Visio document that has various functions in its rows, and key stakeholders and populations in the columns. We determined the functions, stakeholders, and processes through a review of the available program documentation and further refined them based on interviews with program staff. This model does not attempt to assess the effects of the program.

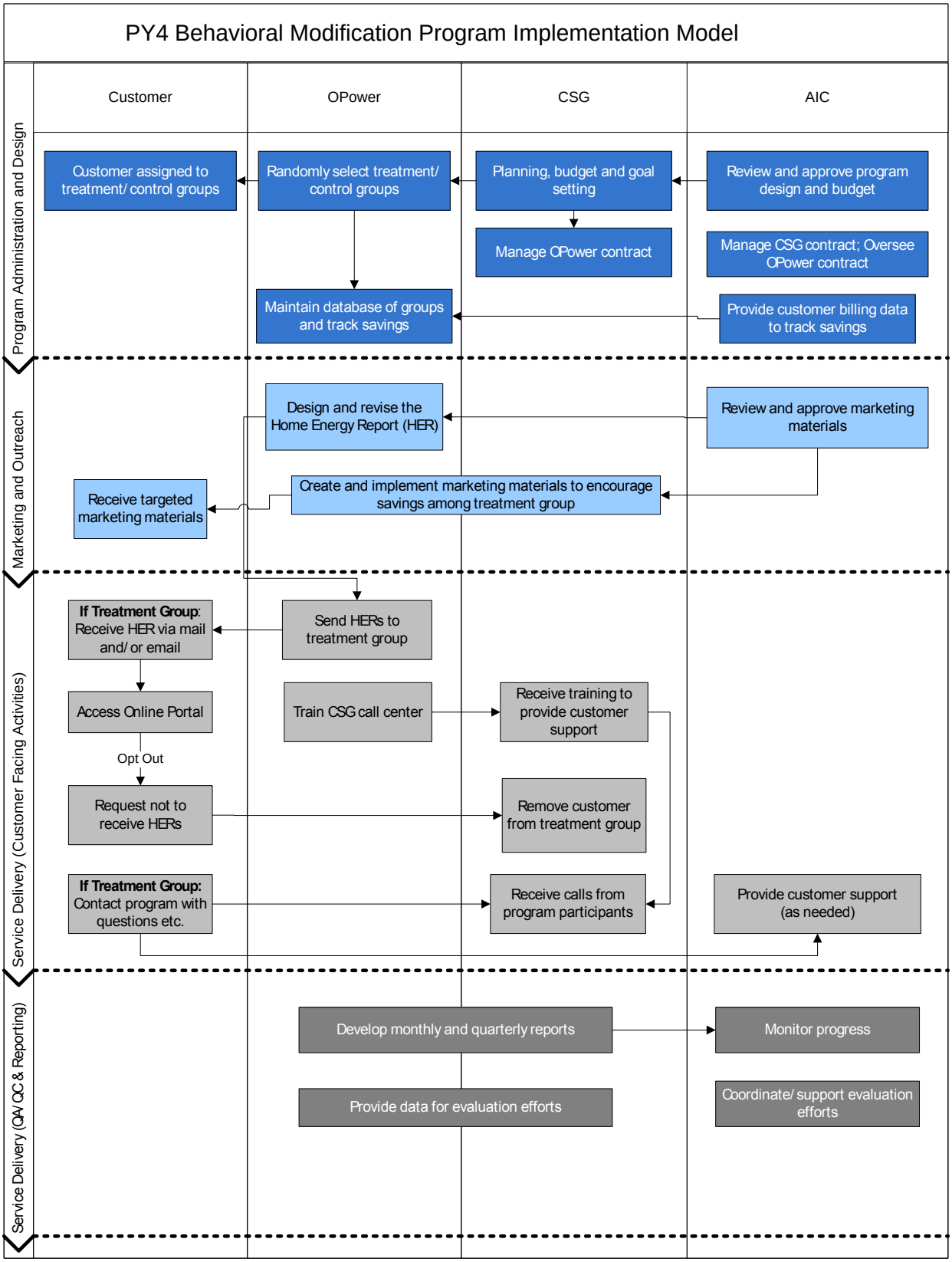
The model is organized by function and the stakeholders involved.

- Functions: These represent the discrete functions inherent to the program. These functions include program administration and design, marketing and outreach, service delivery (customer facing activities), and service delivery (QA/QC and reporting). Service delivery encompasses activities that are directed towards intervention recipients and, for these models, is a catchall for any activity not included in the other functions.
- Stakeholders: These include the various providers who are involved in program delivery or receive program services. Stakeholders include customers, Opower, CSG, AIC, and customers.

We also identified several key points within each of the program functions. These include:

- Program Administration and Design: As the program implementer, CSG is involved in program planning, and establishing budgets, and goals for the program. Based on planning objectives, CSG works with Opower to select the treatment and control groups. AIC manages CSG's contract, oversees Opower's contract, and reviews and approves the areas mentioned above. Opower maintains customer database with data provided by AIC to track program savings.
- Marketing & Outreach: AIC approves HER content, layout, and customer tips provided by Opower. CSG and Opower create special marketing pieces approved by AIC to encourage energy savings among the treatment groups.
- Service Delivery (customer facing activities): Opower sends HERs to treated customers via regular mail and email. Online access to HERs is also offered to treated customers. Treated customers may call CSG to opt out of the program. CSG provides customer support and Opower offers training to customer support specialists.
- Service Delivery (QA/QC and reporting): CSG and Opower provide to Ameren monthly reports on energy savings and quarterly reports on energy savings and other interest areas. Opower and CSG provide data and information to facilitate evaluation activities, and Ameren coordinates and supports evaluation efforts.

Below we provide the Behavioral Modification implementation model.


PY4 Behavioral Modification Program Implementation Model
Customer
OPower
CSG
AIC
Program Administration and Design
Customer assigned to treatment/ control groups
Randomly select treatment/ control groups
Planning, budget and goal setting
Review and approve program design and budget
Manage OPower contract
Manage CSG contract; Oversee OPower contract
Maintain database of groups and track savings
Provide customer billing data to track savings
Marketing and Outreach
Design and revise the Home Energy Report (HER)
Review and approve marketing materials
Receive targeted marketing materials
Create and implement marketing materials to encourage savings among treatment group
Service Delivery (Customer Facing Activities)
If Treatment Group: Receive HER via mail and/ or email
Send HERs to treatment group
Access Online Portal
Train CSG call center
Receive training to provide customer support
Opt Out
Request not to receive HERs
Remove customer from treatment group
If Treatment Group: Contact program with questions etc.
Receive calls from program participants
Provide customer support (as needed)
Service Delivery (QA/QC & Reporting)
Develop monthly and quarterly reports
Monitor progress
Provide data for evaluation efforts
Coordinate/ support evaluation efforts