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Behavioral Energy Savings Programs
GPY3 Evaluation Report

Final
Energy Efficiency Plan:
Gas Plan Year 3
(06/1/2013-05/31/2014)

Presented to
Nicor Gas

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E. Executive Summary

E.1. Program Description

The Nicor Gas Behavioral Energy Savings Programs (BESP) consists of two programs: the Home Energy Report program and the ENERGYBUZZ program. The Home Energy Report (HER) program is an opt-out program designed to generate natural gas savings by providing residential customers with information about their specific gas use and related conservation suggestions and tips. The information is provided in the form of reports that illustrate: a) how customers' recent gas use compares to their use in the past; b) tips on how the customers can reduce gas consumption, some of which are tailored to each customer's unique circumstances; and c) information on how the customers' gas use compares to that of neighbors with similar homes. In other studies, this type of information has stimulated customers to reduce their gas use, creating average savings of around 1%, depending on local gas use patterns.

ENERGYBUZZ gave participants access to a variety of tools and ongoing communications via an online platform at NicorGasEnergyBuzz.com. The website was promoted by the program implementer using a variety of tactics including online advertising through Google AdWords and other outlets, bill inserts, alignment with other Nicor Gas program marketing efforts, event attendance, speaking engagements, and direct mail. After enrolling on the site and linking their account with their Nicor Gas online billing account, participants received monthly email summaries of their energy use. Participants also have access to online tools via the web portal. These tools showed participants how to save energy, win rewards, and compare their savings with those of other customers. Overall, the ENERGYBUZZ web portal intended to encourage Nicor Gas customers to save energy through behavior change and participation in other Nicor Gas energy efficiency programs. The program was soft launched in August 2012 (during GPY2); originally, the pilot phase was set to last for three years but due to low participation and complexities in linking gas accounts to the online portal this program was discontinued on November 30th, 2013.

E.2. Program Savings

Table E-1 summarizes the gas savings from the HER program during its first year. The HER program implementer began sending reports in late September 2013 and this report evaluates savings in the period from October 1, 2013 to September 30, 2014. Navigant estimates program savings both with and without uplift into other energy efficiency (EE) programs. Uplift occurs when the HER program drives participants to join other EE programs at a higher rate than controls. If the HER program affects participation rates in other EE programs, then savings across all programs are lower than indicated by the simple summation of savings in the HER and EE programs. For instance, if the HER program increases participation in other EE programs, the increase in savings may be allocated to either the HER program or the EE program, but should not be allocated to both programs simultaneously.

Table E-1. HER Total Program Gas Savings during its First Year

Savings Category	Savings (Therms)
Net Savings Goal	3,327,435
Ex Ante Net Savings*	4,140,321
Verified Net Savings, Before Uplift Adjustment	4,264,371
Verified Net Savings, After Uplift Adjustment	4,111,100

Source: Nicor Gas billing data, Opower implementation data, and Navigant analysis.
* Savings results reported by Opower through October 31, 2014.

Table E-2 summarizes the gas savings from the ENERGYBUZZ program in GPY3.[1]

Table E-2. ENERGYBUZZ Total Program Gas Savings for GPY3

Savings Category	Savings (Therms)
Net Savings Goal	40,470
Ex Ante Net Savings	16,440
Verified Net Savings	28,496

Source: Nicor Gas tracking data and Navigant analysis.

E.3. Key Findings and Recommendations

This section summarizes the key impact findings and recommendations.

Finding 1. The HER program generated verified net savings of 4,111,100 therms in GPY3, its first year, after accounting for uplift. These savings correspond to a 0.78% reduction in usage for program participants, which is typical for first year savings for residential gas HER programs.

Finding 2. Navigant found that 153,271 therms or 3.6% of HER program savings were due to uplift into other energy efficiency programs including the Home Energy Efficiency Rebates (HEER) program, the Energy Saving Kits (ESK) program, the Home Energy Savings (HES) program, and the Multi-family Comprehensive Energy Efficiency Program (MCEEP). The uplift varied across the four programs with ESK having the highest increase in participation (compared to the control group) of 0.65% and MCEEP having the lowest with no increase. The double counted savings estimate of 3.6% is relatively high for an HER program where double counting typically accounts for less than 1% of the savings. Therefore, this HER program is doing a relatively good job of channeling HER recipients into other Nicor Gas energy efficiency programs.

[1] GPY3 began June 1, 2013, and ended May 31, 2014.

Finding 3. The ENERGYBUZZ program generated verified net savings of 28,496 therms in GPY3. Enrollment continues to lag behind original program goals (50,000 customers enrolled by end of GPY2) with just 299 participants enrolling in GPY3.

Understanding that the HER program was discontinued in October 2014, Navigant has the following recommendation:

Recommendation 1. Estimate persistence savings for the HER participants after they stopped receiving reports. **Typical** estimates of savings decay are 20% for customers who have been receiving HERs for two years. Even if the savings decay is somewhat higher for the Nicor Gas HER participants since they had only been in the program for one year, it is possible that significant savings will be found because the group of dropped participants is so large. If the savings rate decayed by 50% (to 0.39% per customer), which is a high estimate of decay, the claimed savings in the year after reports were stopped could be two million therms.

1. Introduction

1.1 Program Description

1.1.1 Home Energy Report Program Description

The Home Energy Report (HER) program is designed to generate gas savings by providing residential customers with sets of information about their specific gas use and related conservation suggestions and tips. The information is provided in the form of reports that give customers various types of information, including: a) how their recent gas use compares to their use in the past; b) tips on how to reduce consumption, some of which are tailored to the customer's circumstances; and c) information on how their gas use compares to that of neighbors with similar homes. This set of information has been shown in other studies to stimulate customers to reduce their gas use, creating average savings around 1%, depending on local gas use patterns.

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

Table 1-1 provides a synopsis of the program's targeted and actual numbers of participants and controls. The targeted numbers are Nicor Gas's original targets for program participation. The actual numbers are the number of participants and controls who were assigned a first report date and were not marked for exclusion by the program implementer.

Table 1-1. HER Program Participants and Controls

Month of First Report*	Evaluation Period	Targeted Number of Participants	Targeted Number of Controls	Actual Number of Participants	Actual Number of Controls
September 2013	October 1, 2013 – September 30, 2014	333,500	30,000	341,301	29,090

Source: Nicor Gas billing data, Opower implementation data, and Navigant analysis.
* This is the month of the "first generated date" in the Opower dataset when a wave is initiated. Participants likely received their first report approximately one month later than this date.

1.1.2 ENERGYBUZZ Description

ENERGYBUZZ gave participants access to a variety of tools and ongoing communications via an online platform at NicorGasEnergyBuzz.com. The website was promoted by the program implementer using a variety of tactics including online advertising through Google AdWords and other outlets, bill inserts, alignment with other Nicor Gas program marketing efforts, event attendance, speaking engagements, and direct mail. After enrolling on the site and linking their account with their Nicor Gas online billing account, participants received monthly email summaries of their energy use. Participants also have access to online tools via the web portal. These tools showed participants how to save energy, win rewards, and compare their savings with those of other customers. Overall, the ENERGYBUZZ web portal intended to encourage Nicor Gas customers to save energy through behavior change and participation in other Nicor Gas energy efficiency

programs. The program was soft launched in August 2012 (during GPY2); originally, the pilot phase was set to last for three years but due to low participation and complexities in linking gas accounts to the online portal this program was discontinued on November 30th, 2013.

In GPY3, 898 accounts were created for the ENERGYBUZZ program. Of these, 299 accounts were linked back to the enrollees' Nicor Gas account. Table 1-2 summarizes enrollment in the ENERGYBUZZ program. A discussion of the use of all participants, those who enrolled during and before PY3, is included in Section 2.2.

Table 1-2. ENERGYBUZZ Program Enrollment

Participants Enrolled Prior to GPY3	Participants Enrolled During GPY3	Total Participants used in GPY3 Evaluation
797	299	1,096

Source: Nicor Gas tracking data

1.2 Evaluation Objectives

The primary evaluation objective for the HER program is to determine the extent to which participants in the program reduced their energy consumption in the first year of the program due to the HERs. A secondary objective is to determine the uplift in other Nicor Gas energy efficiency programs due to the HER program.

The primary evaluation objective for the ENERGYBUZZ program is to estimate savings due to the program in GPY3 by applying the gross realization rate determined in GPY2 to GPY3 participant gross savings.

2. Evaluation Approach

2.1 Home Energy Report Program Evaluation Approach

The evaluation approach for the HER program relies on statistical analysis appropriate for a RCT. In this section, Navigant presents the evaluation approach for the following:

1. **Validation of Randomization** identifies the approach used to confirm the program was implemented as a RCT,
2. **Statistical Models used in the Impact Evaluation** identifies the model specifications used to estimate program impacts,
3. **Accounting for Uplift** identifies the method used to estimate savings that may be double-counted due to increased participation in other energy efficiency programs as a result of the HER program, and
4. **Data** describes the data used in the evaluation. This section walks through the data we received from Nicor Gas, the verified number of participants and controls, and how we created the cleaned sample from these verified customers that is used in the impact analysis described in Section 2.1.2.

2.1.1 Validation of Randomization

The HER program was implemented by the program implementer, Opower, as a RCT. The study group for the HER program was selected from Nicor Gas's residential customer base by Opower using their proprietary algorithm to determine customers with the highest potential to save, the primary driver being high usage. The customers in this study group were then randomly assigned to a treatment (participant) group and a control (non-participant) group. If the allocation of the households across the treatment and control groups is truly random, the two groups should have the same distribution of energy usage for each of the 12 months before the start of the program. For this analysis Navigant compared mean energy usage for the treatment and control groups for each of the 12 months before the start of the program (September 2012 through August 2013). Navigant conducted this analysis before the start of the HER program, and the results, showing that the assignment of customers was consistent with an RCT, were delivered to Nicor Gas via memo on September 20th, 2013. For reference, this memo is provided in Appendix 5.1

2.1.2 Statistical Models used in the Impact Evaluation

Navigant estimates program impacts using two approaches applied to monthly billing data: a linear fixed effects regression (LFER) analysis and a simple post-program regression (PPR) analysis with lagged controls. We run both models as a robustness check. Although the two models are structurally very different, both generate unbiased estimates of program savings in a RCT, and assuming the RCT is well balanced with respect to the drivers of energy use, in a single sample the models generate very similar estimates of program savings.

2.1.2.1 LFER model

The simplest version of an LFER model convenient for exposition is one in which average daily consumption of therms by household *k* in bill period t, denoted by ADC_{kt}, is a function of the binary

variable $Post_t$, taking a value of 0 if month t is in the pre-treatment period, and 1 if in the post-treatment period and the interaction of $Post_t$ with the binary variable $Treatment_k$, taking a value of 0 if household k is assigned to the control group, and 1 if assigned to the treatment group. The interaction $Post_t \cdot Treatment_k$ takes a value of 1 when both $Post_t$ and $Treatment_k$ equal 1, and 0 otherwise. Formally,

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

Three observations about this specification deserve comment. First, the coefficient a_{0k} captures **all** household-specific effects on energy use that do not change over time, including those that are unobservable. Examples include the square footage of a residence, the presence of a pool, and the shell characteristics. Second, a_1 captures the average effect *across all households* of being in the post-treatment period. Third, the effect of being both in the treatment group and in the post period –the effect directly attributable to the program—is captured by the coefficient a_2. In other words, whereas the coefficient a_1 captures the change in average daily therms use across the pre- and post-treatment for the *control* group, the sum $a_1 + a_2$ captures this change for the treatment group, and so a_2 is the estimate of average daily therms savings due to the program in its first year of implementation.

2.1.2.2 PPR Model

Whereas the LFER model controls for non-treatment differences in energy use between treatment and control customers using the customer-specific fixed effect, the PPR model controls for these differences using lagged energy use as an explanatory variable. In particular, energy use in calendar month m of the post-program period is framed as a function of the treatment variable, a set of monthly fixed effects, and the monthly fixed effects interacted with energy use in the same calendar month of the pre-program period. The underlying logic is that systematic differences between control and treatment customers will be reflected in differences in their past energy use, which is highly correlated with their current energy use. Formally, the model is,

$$ADC_{kt} = b_0 + \sum_j b_{1j} Month_{jt} + \sum_j b_{2j} Month_{jt} \times ADClag_{kt} + b_3 Treatment_k + e_{kt},$$

Where $Month_{jt}$ is a binary variable taking a value of 1 when j=t and 0 otherwise[2] and $ADClag_{kt}$ is customer k's energy use in the same calendar month of the pre-program year as the calendar month of month t. In this model, b_3 is the estimate of average daily therms savings due to the program in its first year of implementation.

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

2.1.3 Accounting for Uplift

The HERs include energy saving tips, some of which encourage participants to enroll in other Nicor Gas energy efficiency programs. Uplift occurs when the HER program causes participants to enroll in other energy efficiency (EE) programs at a higher rate than they otherwise would have. If participation rates in other EE programs are the same for HER participants and controls, the savings estimates from the regression analysis are not attributable to other programs and there is no uplift, as this indicates the HER program had no effect on participation in the other EE programs. However, uplift occurs if the HER program affects participation rates in other energy efficiency programs, then savings across all programs are lower than indicated by the simple summation of savings in the HER and EE programs. For instance, if the HER program increases participation in other EE programs, the increase in savings may be allocated to either the HER program or the EE program, but cannot be allocated to both programs simultaneously.

As data permitted, Navigant used a difference-in-difference (DID) statistic to estimate uplift in other EE programs, in which the change in the participation rate in another EE program between the first year of the program (October 2013-September 2014) and the pre-program year (September 2012-August 2013) for the control group was subtracted from the same change for the treatment group. For instance, if the rate of participation in an EE program during the first year of the program is 5% for the treatment group and 3% for the control group, and the rate of participation during the year before the start of the HER program is 2% for the treatment group and 1% for the control group, then the rate of uplift due to the HER program is 1%, which is reflected the calculation (5%-2%)-(3%-1%) =1%. The DID statistic generates an unbiased estimate of uplift when the baseline average rate of participation is the same for the treatment and control groups, or when they are different due only to differences between the two groups in time-invariant factors, such as the square footage of the residence.

Multiplying the DID statistic by the number of program households produces the "uplift" in the EE program generated by the HER program. Multiplying this uplift by deemed savings for the EE program generates the savings that must be subtracted from either the HER program or the EE program to avoid double-counting of savings. In line with industry standard practice, this evaluation subtracts the double counted savings from the HER program, rather than from the other EE programs.

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

Navigant examined the uplift associated with Nicor Gas' other residential energy efficiency programs: the Home Energy Efficiency Rebates (HEER) program, the Energy Saving Kits (ESK) program, the Home Energy Savings (HES) program, and the Multi-family Comprehensive Energy Efficiency Program (MCEEP). The HEER program provides rebates to single family households for the purchase and installation of energy efficient measures such as furnaces and boilers. The ESK program provides households with free kits containing energy saving equipment such as low-flow showerheads and faucet aerators. The HES program provides single-family homeowners with a comprehensive home energy assessment including combustion safety testing, direct installation of

selected energy efficiency and water-saving measures, and incentives for installing a recommended package of weatherization measures. The MCEEP offers direct installation of low-cost efficiency measures, such as water efficiency measures at eligible multifamily residences. The DID statistic was used to estimate uplift for the HEER and HES programs, while the POD statistic was used for the ESK program and the MCEEP.

2.1.4 Data

Navigant received program tracking data from Opower, the program implementer, and monthly billing data from Nicor Gas, covering the period of September 2012 to September 2014. In particular, Navigant received data for 351,845 participants and 30,000 controls. Nicor Gas customers typically have their meters read every other month, with estimated reads between meter readings. For this reason, Navigant combined the estimated read with the following actual read to create an extended bill that represents actual usage for the impact analysis. This means that the average bill length is 60 days and about half of the customers have a bill ending in any given month.

To find the number of verified participants and controls, Navigant removed the following customers from the data received:

- Customers marked for exclusion by the program implementer[3]
- Customers with no first report generation date[4]

This results in 341,301 verified participants and 29,090 verified controls.

To create a cleaned sample for the impact analysis, Navigant removed the following customers and data points from the analysis:

- Customers with a delayed first report generation date[5]
- Observations with less than 50 or more than 70 days in the billing cycle
- Observations missing billing usage data
- Observations outside the twelve month pre-program period or the evaluation period
- Outliers, defined as observations with average daily consumption more than one order of magnitude above the median usage in the heating season[6]
- For the PPR model, observations in the evaluation period which did not have a corresponding value for the ADClag variable, described in Section 2.1.2.2

[3] In addition to the randomly selected program participants, the program implementer typically sends HERs to a select group of households who specifically ask to receive the report. These households are typically those of utility employees who wish to receive the report experience. Since these customers are not randomly assigned to the treatment group they are not included in the program savings estimates. For Nicor Gas, only 3 participants were marked for exclusion.

[4] The program implementer assigns both treatment and control households a first report generation date. Households are missing this value if they never met generation eligibility, as defined by the program implementer, or if their account went inactive prior to the start of the program. For Nicor Gas, 10,537 participants and 910 controls (approximately 3% of each group) was missing a first report generation date.

[5] Just under 99% of participants receive their first report on or before October 9th, 2013. After that customers' first reports are delayed from a few weeks up to several months.

[6] The median usage from September through April was 6.089 therms per day. Observations with usage values greater than 60.89 therms per day were excluded from the analysis.

This results in a cleaned sample for the impact analysis containing 320,400 treatment and 27,299 controls; all together the cleaned sample includes 94% of the verified participants and controls. The cleaned sample includes participants who opt-out and customers whose accounts become inactive up until the point of inactivation (meaning that if a customer's account closed in June, their billing data are included up until June). Including these two groups of participants in the analysis is in line with behavior-based program evaluation protocol. For opt-outs, the State and Local Energy Efficiency Action Network report explains that, "if the households that opt out are excluded from the treatment group…then the results will suffer from selection bias: the households in the control group are no longer the same types of households as those in the treatment group."[7] For accounts that become inactive, "it is unlikely that households move or close their accounts because of an efficiency program; thus, we can safely assume that account closures are random and occur at the same rate for both the control and treatment group."[8] We include customers whose accounts go inactive up until the inactive date to ensure that the results are not biased if certain types of customers are more likely to move than others (for example, if the younger population is more mobile).

The service territory for Nicor Gas overlaps with the Commonwealth Edison (ComEd) electric service territory. ComEd also runs a HER program for their electric customers. The service territory overlap means that some customers in the Nicor Gas HER program control and treatment groups receive electric HERs from ComEd, and vice versa. It is possible that the ComEd electric HERs create cross-fuel effects that lower gas usage for those who receive them. However, this does not affect the estimate of the effect of the gas HER program *conditional on the state of the world, which happens to include the electric program*. This is because, due to random assignment, the treatment group in the gas program is exposed to the electric program at the same rate as the control group for the gas program. Given that our evaluation objective is to estimate gas savings *due to the Nicor Gas HER program*, we do not need to remove customers receiving ComEd electric HERs, because the "all else equal" condition imposed by the RCT includes the fact that gas treatment and control customers are being exposed at equal rates to the electric treatment (and attendant spillovers to gas consumption) run by ComEd. Navigant verified this assumption by matching Nicor Gas and ComEd customers by name and address; we found that 8.7% of the Nicor Gas treatment group and 8.5% of the control group receives an electric HER from ComEd.

In addition to the HER program tracking and billing data, Navigant received program tracking data for the HEER program, the ESK program, the HES program, and the MCEEP to conduct the uplift analysis described in Section 2.1.3. The tracking data for these programs only goes through May 2014; for this reason, Navigant calculated the DID or POD statistic for the uplift analysis using the post period of October 2013 to May 2014 and the corresponding pre-period of October 2012 to May 2013. The estimates of program uplift and double counted savings are then pro-rated for a full year.

A summary of the data and data sources used in the evaluation are provided in Table 2-1.

[7] State and Local Energy Efficiency Action Network. 2012. *Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations*. Prepared by A. Todd, E. Stuart, S. Schiller, and C. Goldman, Lawrence Berkeley National Laboratory. http://behavioranalytics.lbl.gov. Page 13.
[8] Ibid. Page 30.

Table 2-1. Data Sources

Data	Source	Time Period Covered	Description
Billing Data	Nicor	September 2012 – September 2014	HER program participants and controls during the pre- and post-period.
Tracking Data	Opower	September 2012 – September 2014	HER program participants and controls during the pre- and post-period.
Tracking Data for Other EE Programs	Nicor	October 2012 – May 2014	Participants in the Home Energy Efficiency Rebates (HEER) program, the Energy Saving Kits (ESK) program, the Home Energy Savings (HES) program, and the Multi-family Comprehensive Energy Efficiency Program (MCEEP) during the pre- and post-period.

2.2 ENERGYBUZZ Program Evaluation Approach

Navigant's GPY3 evaluation of the ENERGYBUZZ program builds on our GPY2 evaluation of the program. For the GPY2 evaluation, Navigant performed a literature review of existing behavioral program evaluations to assess the reasonableness of the ENERGYBUZZ program's ex-ante savings value of 15 therms per household.[9] As outlined in the GPY2 report, secondary sources provided a combined average annual net savings value of 2.3% per household. By comparison, the ex-ante net savings of 15 therms per household used by ENERGYBUZZ equaled 1.3% of the annual average residential usage in 2009.[10] Navigant applied this 2.3% average to Nicor Gas customers' 2009 annual usage of 1,136.5 therms per household for a revised value of 26 therms per household. Using this revised value, Navigant determined that GPY2 program activities resulted in 20,722 therms in net savings with a gross program realization rate of 1.7.

Building on the GPY2 research for the GPY3 evaluation, we assume that enrolled households save 26 therms each year they are in the program (i.e. a household that enrolled in GPY2 saved 26 therms in GPY2 and 26 therms in GPY3 because of the program). This approach requires us to assume that individuals who enrolled prior to GPY3 continue to engage with the ENERGYBUZZ program in GPY3. Specifically, we assume that all participants continued to receive email summaries of their energy use each month, regardless of their enrollment year.[11] This approach also aligns with how we

[9] "Nicor Gas Behavioral Energy Savings Program August 1st Fast Track Evaluation Memo." August 1, 2013. Prepared by Navigant Consulting, Inc.
[10] Bass & Company. (2010). Nicor Gas Market Potential Study Report.
[11] Recognizing that we do not have data on how individuals interact with the ENERGYBUZZ program, we feel this is a reasonable assumption based on our understanding of the intended program activities as outlined in the

would evaluate the program if we conducted a billing data analysis rather than just applying the GPY2 realization rate.[12] A billing data analysis was not conducted for the ENERGYBUZZ program due to the low enrollment and, therefore, small sample size.

GPY1 report. "Energy Efficiency Gas Plan Year 1 (6/1/2011-5/31/2012); Evaluation Report: Behavioral Energy Savings Pilot." January 2, 2013. Prepared by Navigant Consulting, Inc.

[12]The GPY1 ENERGYBUZZ evaluation report outlines our proposed approach for a billing analysis. "Energy Efficiency Gas Plan Year 1 (6/1/2011-5/31/2012); Evaluation Report: Behavioral Energy Savings Pilot." January 2, 2013. Prepared by Navigant Consulting, Inc.

3. Gross Impact Evaluation

3.1 Home Energy Report Impact Evaluation

As detailed below, the LFER and PPR models generate very similar results for program savings. We use PPR results for reporting total program savings for the first year of the program, given that gas usage is highly seasonal. Overall verified net program savings for the first year of the program were 4,264,371, prior to adjusting for savings uplift. Total therm savings, after accounting for uplift, were 4,111,100 therms.

3.1.1 Validation of Randomization

Prior to the start of the HER program, Navigant conducted a statistical analysis to determine whether the assignment of customers to the treatment and control group was statistically consistent with an RCT design. These results were delivered to Nicor Gas via memo on September 20th, 2013. The results of the analysis indicated that the differences in energy usage between the treatment and control groups in the pre-program period were not statistically significant. As a result, Navigant concluded that the HER program was implemented in a manner consistent with a RCT.

3.1.2 Savings Estimates

As discussed in Section 2.1.2, Navigant estimates savings of the HER program using both the LFER and PPR models. The savings estimates are based on data from the cleaned sample described in Section 2.1.4. Table 3-1 presents these results. Detailed results from both models are included in Appendix 5.2 Navigant reports savings from the PPR model; because gas usage is highly seasonal, the PPR likely does a better job of accounting for unobserved factors that cause slight average differences in gas usage between treatment and control customers over the course of a year.

Table 3-1. Savings Estimates

	HER Savings Estimates	
	LFER	PPR
Percent Savings	0.772% *(0.11%)*	0.776% *(0.07%)*
Average Daily Therms Savings per Participant	0.0353 *(0.005)*	0.0351 *(0.003)*

Standard errors on the savings estimates are included in parentheses.
Source: Navigant analysis.

3.1.3 Uplift

The estimates of program savings include savings resulting from the uplift in participation in other EE programs caused by the HER program. The program did not have specific goals regarding uplift, but several programs (including HES, ESK, programmable thermostats, and general rebates) were marketed on the reports. To avoid double-counting of savings, program savings due to uplift must be counted towards either the HER program or the other EE programs, but not both programs.

The uplift in savings is 153,271 therms or 3.6% of total savings. Subtracting these savings from the HER savings estimate to avoid double counting results in total HER savings of 4,111,100 therms. To put this in perspective, the average HER percent savings is 0.78% - after accounting for uplift, savings is reduced to 0.75%. Table 3-2 presents the details of the calculation of the uplift in savings for each of the four energy efficiency programs considered in the analysis: HEER, ESK, HES, and MCEEP. The uplift analysis is conducted using the verified participants and controls described in Section 2.1.4. If the "Change in rate of participation from pre-program year" row is marked by a "-", then double counting for this program is estimated using the POD statistic, otherwise the DID statistic is used.

Table 3-2. Estimates of Double Counted Savings

	Program			
	HEER	HES	ESK	MF
Average program savings (annual therms per participant)	164	65	18	100
# HER Treatment Households	341,301	341,301	341,301	341,301
Rate of participation, GPY3 (%)	0.84%	0.15%	3.32%	0.00%
Change in rate of participation from pre-program Year (%)	0.02%	-0.02%	-	-
# HER control households	29,090	29,090	29,090	29,090
Rate of participation, GPY3 (%)	0.79%	0.15%	2.67%	0.00%
Change in rate of participation from pre-program Year (%)	-0.08%	-0.04%	-	-
DID/POD statistic	0.10%	0.03%	0.65%	0.00%
Change in program participation due to HER program	505	129	3,346	17
Statistically Significant at the 90% Confidence Level?	Yes	Yes	Yes	No
Savings attributable to other programs, Therms	**82,612**	**8,408**	**60,592**	**1,658**
Percent change in EE program participation rate for HER participants	13%	21%	24%	0%

Source: Nicor Gas billing data, Opower implementation data, and Navigant analysis.
*These estimates are generated using data from October to May and then pro-rated for a full year.

It is important to note that the estimate of double-counted savings is almost surely an *overestimate* because it presumes participation in the other EE programs occurs at the very start of the evaluation period. Under the more reasonable assumption that participation occurs at a uniform rate throughout the year, the estimate of double-counted savings would be approximately 76,635 therms, half the estimated value of 153,271 therms. In line with industry standard practice, we assume that savings occur at the beginning of the year because other EE programs typically allot a full-year of savings to the relevant program year even when participation occurs mid-year. Although this overestimate of the double counted savings slightly under credits the HER program's savings, it does not affect

Nicor's total portfolio savings because the other EE programs are fully credited for the savings being subtracted from the HER estimated savings.

3.1.4 Verified Net Program Impact Results

Table 3-3 presents verified net therms savings. After accounting for uplift, HER savings are 4,111,100 therms. The verified net savings are calculated by multiplying the daily therms savings per participant by the number of participant days for verified participants. The savings uplift is subtracted from this value to find the verified net savings after the uplift adjustment.

Table 3-3. HER Net Program Savings and Uplift of Savings in Other EE programs

Type of Statistic	Nicor Gas HER Program
Number of Verified Participants	341,301
Sample Size, Treatment	320,400
Sample Size, Control	27,299
Percent Savings	0.78%
Average Daily Savings per Participant, Therms	0.035
Verified Net Savings, Before Uplift Adjustment, Therms*	4,264,371
Savings Uplift in other EE programs, Therms	153,271
Verified Net Savings, After Uplift Adjustment, Therms**	4,111,100

Source: Nicor Gas billing data, Opower implementation data, and Navigant analysis.

* Total savings are pro-rated for participants that close their accounts during the evaluation year.

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

3.2 ENERGYBUZZ Impact Evaluation

Nicor Gas uses an ex-ante net savings value of 15 therms per household. Using this value, and the GPY2 gross realization rate of 1.7, Navigant calculated savings of 28,496 therms for the ENERGYBUZZ program in GPY3. As discussed in Section 2.2, Navigant calculates savings in GPY3 for all participants who enrolled before or during GPY3.

Table 3-4. ENERGYBUZZ Program Savings

Linked Accounts	Ex-Ante Net Therms Savings Value Per Household	Ex-Ante Net Therms Savings	Realization Rate	Verified Net Therms Saving Value Per Household	Verified Net Therms Savings
1,096	15	16,440	1.7	26	28,496

Source: Navigant analysis.

4. Findings and Recommendations

This section summarizes the key impact findings and recommendations.

Finding 1. The HER program generated verified net savings of 4,111,100 therms in GPY3, its first year, after accounting for uplift. These savings correspond to a 0.78% reduction in usage for program participants, which is typical for first year savings for residential gas HER programs.

Finding 2. Navigant found that 153,271 therms or 3.6% of HER program savings were due to uplift into other energy efficiency programs including the Home Energy Efficiency Rebates (HEER) program, the Energy Saving Kits (ESK) program, the Home Energy Savings (HES) program, and the Multi-family Comprehensive Energy Efficiency Program (MCEEP). The uplift varied across the four programs with ESK having the highest increase in participation (compared to the control group) of 0.65% and MCEEP having the lowest with no increase. The double counted savings estimate of 3.6% is relatively high for an HER program where double counting typically accounts for less than 1% of the savings. Therefore, this HER program is doing a relatively good job of channeling HER recipients into other Nicor Gas energy efficiency programs.

Finding 3. The ENERGYBUZZ program generated verified net savings of 28,496 therms in GPY3. Enrollment continues to lag behind original program goals (50,000 customers enrolled by end of GPY2) with just 299 participants enrolling in GPY3.

Understanding that the HER program was discontinued in October 2014, Navigant has the following recommendation.

Recommendation 1. Estimate persistence savings for the HER participants after they stopped receiving reports. Typical estimates of savings decay are 20% for customers who have been receiving HERs for two years. Even if the savings decay is somewhat higher for the Nicor Gas HER participants since they had only been in the program for one year, it is possible that significant savings will be found because the group of dropped participants is so large. If the savings rate decayed by 50% (to 0.39% per customer), which is a high estimate of decay, the claimed savings in the year after reports were stopped could be two million therms.

5. Appendix

5.1 RCT Memo

The following is a copy of the memo Navigant provided to Nicor Gas in September 2013 with the results of the RCT consistency check.

To: **Steve Grzenia; Nicor**
Gina Valo; Opower

From: **Bethany Glinsmann; Navigant**

Date: **September 20, 2013**

Re: **Validation of Control Group for Nicor Gas HER Program**

This memorandum addresses Navigant's validation of the random allocation of households to the treatment and control groups for the Nicor Gas Home Energy Report (HER) program.

Methodology

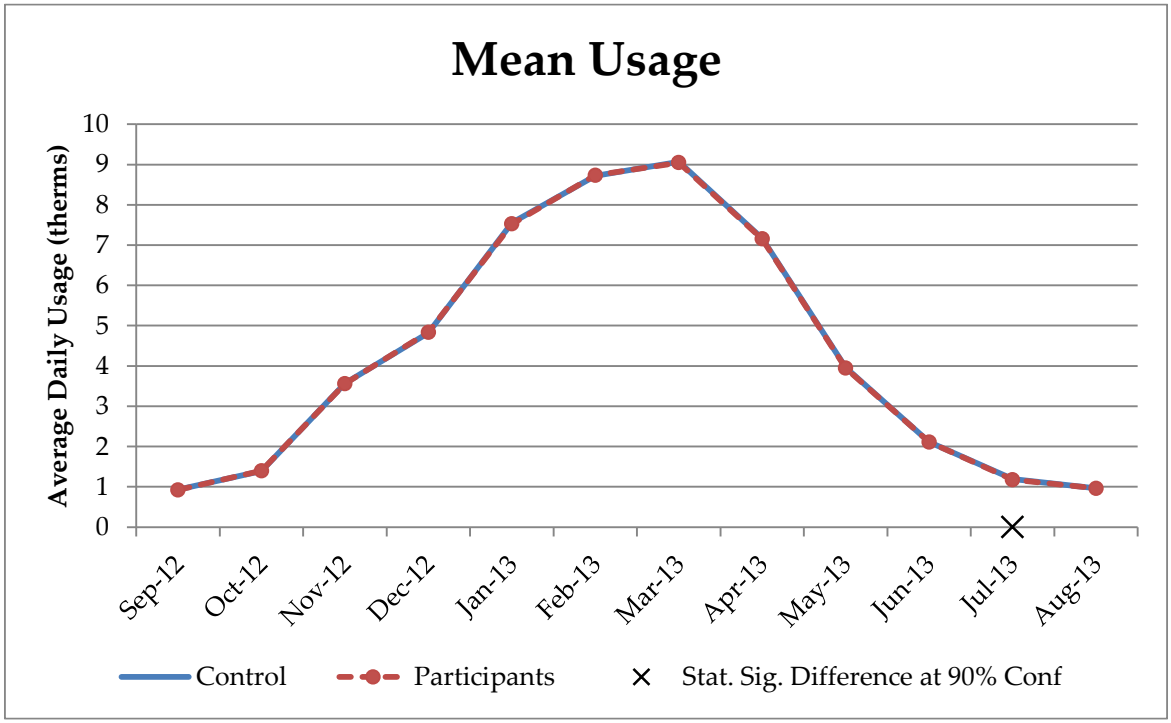
The HER program consists of 351,843 participants and 30,000 control households designated by the program implementer, Opower. Navigant compared the monthly energy usage of the treatment and control groups during the 12 month period prior to the start of the program (September 2012 through August 2013). If the allocation of the households across the treatment and control groups is truly random, the two groups should have the same distribution of energy usage for each of the 12 months before the start of the program. For this analysis, Navigant compared the mean usage for the two groups for each of the 12 months before the start of the program.

Note that Nicor has bi-monthly meter readings. For this analysis Navigant combined estimated reads with the following actual read, creating a long bill with actual usage. Approximately half of the treatment customers and half of the control customers have a bill that ends in any given month.

Results

The results of the analysis validate that program households were randomly allocated across the treatment and control groups. Figure 1 below depicts the average energy usage for treatment and control households for the 12 months prior to the start of the HER program. The blue line indicates the average energy usage for the control group and the red dashed line indicates the average energy usage for the treatment group. The two lines are essentially identical, indicating no difference in average usage patterns for the treatment and control groups. Navigant conducted a statistical test on the difference in the mean energy usage for the two groups in each of the twelve months. In general Navigant found the difference to be statistically insignificant at the 90% confidence level, with the exception of one month.[13] The difference was statistically significantly at the 90% confidence level for July 2013. All differences were less than 0.03 therms in magnitude.

Figure 1. Mean Energy Usage for Treatment and Control Households, by Month



Source: Navigant analysis

[13] Note that using a 90% confidence interval we would expect on average one out of every ten months to have a statistically significant difference in average consumption, due to random chance. Here we found that one month had a statistically significant difference, but had we found that zero, two, or even three months had a statistically significant difference, we would still conclude that the treatment and control groups were determined via random assignment.

Conclusion

Given that the differences in average energy usage for the treatment and control groups were not statistically significant, Navigant concludes that HER program households were randomly allocated to the treatment and control groups.

5.2 Model Results

Table 5-1 shows the detailed model output for the PPR model.

Table 5-1. PPR Detailed Model Output

	Estimate	Std. Error	t value	Pr(>|t|)	Signif.
treatment	-0.0353	0.0032	-10.9495	0.0000	***
yrmo201310	0.0742	0.0117	6.3405	0.0000	***
yrmo201311	0.3738	0.0166	22.4682	0.0000	***
yrmo201312	0.4642	0.0155	30.0415	0.0000	***
yrmo201401	0.3387	0.0258	13.1203	0.0000	***
yrmo201402	0.4244	0.0209	20.3146	0.0000	***
yrmo201403	0.1820	0.0248	7.3428	0.0000	***
yrmo201404	0.0299	0.0180	1.6627	0.0964	*
yrmo201405	0.3843	0.0153	25.1566	0.0000	***
yrmo201406	0.4323	0.0104	41.5644	0.0000	***
yrmo201407	0.0578	0.0102	5.6414	0.0000	***
yrmo201408	0.1221	0.0070	17.4966	0.0000	***
yrmo201409	0.5525	0.1369	4.0345	0.0001	***
yrmo201310:pre.therms	0.7933	0.0082	96.4596	0.0000	***
yrmo201311:pre.therms	0.8666	0.0048	181.6324	0.0000	***
yrmo201312:pre.therms	1.1834	0.0032	364.9746	0.0000	***
yrmo201401:pre.therms	1.3058	0.0036	366.3730	0.0000	***
yrmo201402:pre.therms	1.2156	0.0025	491.7125	0.0000	***
yrmo201403:pre.therms	1.1273	0.0028	396.9658	0.0000	***
yrmo201404:pre.therms	1.0421	0.0026	396.7717	0.0000	***
yrmo201405:pre.therms	0.8566	0.0041	210.8828	0.0000	***
yrmo201406:pre.therms	0.7743	0.0050	155.0407	0.0000	***
yrmo201407:pre.therms	0.8874	0.0094	94.3321	0.0000	***
yrmo201408:pre.therms	0.8903	0.0075	118.9792	0.0000	***
yrmo201409:pre.therms	0.6979	0.1440	4.8452	0.0000	***

*Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Residual standard error: 0.9169 on 1710757 degrees of freedom

Multiple R-squared: 0.9816, Adjusted R-squared: 0.9816

F-statistic: 3.644e+06 on 25 and 1710757 DF, p-value: < 2.2e-16

Source: Navigant analysis

Table 5-2 shows the detailed model output for the LFER model.

Table 5-2. LFER Detailed Model Output

	Estimate	Std. Error	t value	Pr(>|t|)	Signif.
post	0.43073136	0.004965369	86.747099	0.00E+00	***
post.trt	-0.03511141	0.005170738	-6.790406	1.12E-11	***

*Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Total Sum of Squares: 51017000

Residual Sum of Squares: 50869000

R-Squared: 0.0029072, Adjusted R-Squared: 0.0026304

F-statistic: 5032.09 on 2 and 3451762 DF, p-value: < 2.22e-16

Source: Navigant analysis