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Great Energy Stewards Program
PY6 Evaluation Report

Final

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

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E. Executive Summary

This report presents a summary of the findings and results from the impact and limited process evaluation of the Great Energy Stewards program in Program Year 6 (PY6) [1]. The Great Energy Stewards (GES) program is a third-party behavioral energy efficiency (EE) program implemented by Shelton Solutions, Inc. (Shelton). GES is designed to generate energy savings by providing Commonwealth Edison (ComEd) residential customers with information on their energy usage and energy-saving tips through periodic postcards mailed to their homes, as well as small financial incentive payments for energy savings.[2]

The program's design called for Shelton to recruit participants primarily at Chicago-area churches through announcements and presentations at church services and events, articles in church bulletins, and similar efforts, and have interested customers sign up on the program's website, in person, or via mail or fax. Shelton experienced difficulties implementing this plan, however, and instead recruited the majority of the program's PY6 participants at events sponsored by a local community action agency, CEDA[3], for customers seeking assistance paying their utility bills through LIHEAP.[4] This led to a number of unanticipated changes to the program's design that adversely affected its performance. Notably, the program ended up targeting mainly low-income customers, whose energy usage tends to be lower than average and who, therefore, generally have less capacity for usage reduction than higher-use customers. Also, the alternative recruitment process was not put in place until after the major sign-up period for LIHEAP assistance, which contributed to the lower-than-anticipated recruitment rate.

At the conclusion of the Program Year, Shelton disbursed reward checks to 104 participants for whom "raw savings"[5] was reported by ComEd to be greater than 250 kWh. Another 67 participants had raw savings greater than zero, but less than the reward threshold of 250 kWh.

As a new program, GES began PY6 with no customers enrolled, and had 716 participants signed up by the end of the program year, short of the 3,000 to 4,000 participants that Shelton had expected to enroll during the program's first year. Because GES is an opt-in program[6], inducing customers to voluntarily take the steps necessary to enroll is critical for program success. Any inconvenience or complication

[1] PY6 began June 1, 2013 and ended May 31, 2014.
[2] "The Program will reward participants at a level 5 cents per kWh saved, up to $50." The 2013 Great Energy Stewards Program SCOPE OF WORK DOCUMENT final vers.pdf (June 3, 2013), p. 3.
[3] CEDA is the Community and Economic Development Association, the largest private, non-profit community action agency in Cook County (http://www.cedaorg.net/www2/index.htm).
[4] Low-Income Home Energy Assistance Program (http://www.cedaorg.net/www2/EnergyAssistance.html).
[5] "Raw savings" is defined as the year-over-year difference between a customer's energy usage in a given billing period in the program year and their usage in the same billing period in the previous year. Since it was not adjusted for differing numbers of days in the billing periods from year to year, nor for weather differences or other time-varying factors, "raw savings" does not represent actual program savings.
[6] By contrast, Home Energy Reports programs are typically opt-out, with customers randomly assigned to receive periodic reports providing energy-saving tips and information on their energy usage.

customers encounter during the recruitment process may discourage them from signing up. One of Shelton's difficulties with recruitment stemmed from their inability to satisfy the minimum information security measures required by ComEd of third-party contractors and other external entities before they are allowed to store, host or transmit electronic records containing customer personal identifying information (PII), including names, addresses, account numbers, and energy usage. This prevented Shelton from signing customers up for the program on their website, which, according to their plan document, was supposed to have been the primary method of acquiring participants.[7] Instead, customers were only able to sign up in person at recruitment events by providing their name, address, ComEd account number and other information, or by providing this information at a later time via phone, mail or fax. If customers did not know their ComEd account number or have a bill in their possession, which was typically the case[8], Shelton had to follow up with them later or rely on them to call back with the information before they could be enrolled. (One advantage of recruiting customers at LIHEAP-applicant events is customers typically bring a ComEd bill to the event since it is a requirement.)

The restrictions on use of participants' PII also prevented Shelton from monitoring participants' energy usage which was a key features of the program's strategy for tracking energy savings through behavior change.[9] As a partial solution, ComEd was able to provide Shelton with monthly reports showing the unadjusted change in each participant's monthly kWh consumption relative to the same bill period in the previous year ("raw savings"). However, Shelton's inability to view customers' monthly usage levels prevented them from gaining insights into their energy consumption patterns – for example, knowing which participants were using electric space heat in the winter or air conditioning in the summer – which inhibited their ability to tailor their energy-saving tips to individual customers.

The program is administered through the Illinois Power Agency (IPA), so any reported savings for the program would accrue to the IPA portfolio designated by Illinois law rather than the Energy Efficiency portfolio.

E.1 Program Savings

The evaluation team calculated energy savings for the GES program using regression analysis of monthly billing data for participants. Table E-1. summarizes the electricity savings from the GES program. While the program appears to have generated negative savings, they are not statistically significant and, thus, are not distinguishable from zero. Hence, our primary finding is that the program achieved no verified energy savings in PY6.

[7] The 2013 Great Energy Stewards Program SCOPE OF WORK DOCUMENT, loc. cit. It should be noted that while Shelton Solutions, Inc. does have a website (http://www.shelton-solutions.com/), it does not appear to contain any links specific to the Great Energy Stewards program.
[8] Kelly Shelton, personal communication, January 15, 2014.
[9] 2013 Great Energy Stewards SCOPE OF WORK DOCUMENT, loc. cit.

Table E-1. PY6 Total Program IPA Electric Savings

Savings Category	Energy Savings (MWh)
As Calculated Verified Net Savings Prior to Uplift Adjustment †	-18,592‡
As Calculated Verified Net Savings	-18,594‡
Final Verified Net Savings	0

Source: ComEd billing data, GES tracking data, and Navigant team analysis.
†The uplift adjustment reflects savings that are jointly produced by the program and other EE programs.
‡Not statistically significant

E.2 Key Findings and Recommendations

The GES Program operated in PY6 using monthly updates on participants' year-over-year changes in energy consumption. This was based upon the assumption that these values represented program savings. On that basis, Shelton's analysis showed that 171 participants saved a total of 105,240 kWh. However, Navigant's evaluation, which considered the energy usage patterns of all participants and adjusted for weather and other time-varying factors, found that the GES Program generated no verified energy savings in PY6. We identified several probable reasons for this result, including difficulties with recruitment and targeting, and a limited response to the messaging and marketing provided by the implementer.

Program Participation and Targeting

Finding 1a. The GES Program struggled with recruitment and did not meet its enrollment target of 3,000 to 4,000 customers, only managing to sign up 716 customers by the end of PY6.

Finding 1b. The program experienced particular recruitment problems early on when its recruitment efforts were focused on local churches. Roughly 90 percent of participants signed up in the latter half of the program year.

Finding 1c. The GES Program envisioned recruiting its participants by targeting local church congregations in the greater Chicago area. However, this proved less fruitful than anticipated, and most participants were recruited in other venues, mainly events targeting low-income or financially stressed households while they were seeking assistance paying their utility bills.

Recommendation 1. ComEd should identify and address the barriers that prevented Shelton from recruiting participants effectively in targeted area churches. Navigant identified the restrictions placed on Shelton's use of customer data to be one such barrier, as detailed in Finding 2 below. However, we note that this restriction is a basic requirement of customer privacy protection that ComEd applies to all of its implementers. It is also a common best practice of utilities and most large companies. To understand the extent to which other factors contributed to the program's difficulties with recruiting, ComEd should consider conducting process research, including a review of the program's marketing materials, interviews with program managers, implementer staff, and leaders at targeted churches, as well as surveys of participant and non-participant members at targeted churches.

Finding 2. The implementer failed to satisfy ComEd's information security requirements for third-party contractors wishing to host, process or store customer personal identifying information (PII). To comply with ComEd's PII security standards, Shelton would have had to implement significant computer hardware and software upgrades as well as purchase supplementary liability insurance[10]. Thus, Shelton could not store customer names, addresses, account numbers and monthly energy usage values electronically, which prevented them from implementing one of its key intended recruitment strategies: enrolling customers on a dedicated program website.

Recommendation 2a. It appears Shelton assumed that it would have access to customer data[11] and did not foresee the difficulties in accessing customer data at a large public utility. Shelton should consider making the necessary investments if they plan to continue serving as a third-party implementer of customer-facing energy efficiency programs in the future.

Recommendation 2b. ComEd should provide detail in their Request for Proposals (RFPs) for third-party EE programs describing all relevant customer data privacy/ security requirements (if this is not done today). ComEd should also consider making satisfaction of its customer data security standards a prerequisite for responding to its RFPs, when appropriate.

Program Response

Finding 3a. The GES Program failed to achieve significant energy savings among participants.

Finding 3b. No statistically significant difference in savings was detected between participants who were recruited through local churches and those who were recruited in other venues.

Finding 3c. Shelton's failure to satisfy ComEd's data security requirements prevented them from monitoring participants' post-enrollment energy usage. While Shelton did have access to participants' "raw savings" information provided by ComEd, the lack of participants' monthly energy usage levels prevented Shelton from using this information to gain insights into participants' basic usage patterns. Shelton could have used this detail to tailor their energy-savings tips more closely to participants' particular situations.

[10] We understand that Shelton did purchase the required insurance in August 2013, the third month of PY6. However, ComEd did not allow them to host customer PII because Shelton's servers were determined to represent an unreasonable risk to customer data privacy. Shelton chose not to invest in the necessary IT upgrades at that time, opting instead to wait for the results of the PY6 evaluation. They were concerned that the increased security might cost them more than the contract was worth, and hoped that the verified savings would correlate closely enough with their "raw savings" results to allow them to avoid having to expend the additional resources. Personal communications, ComEd program managers, November 20, 2014 and March 27, 2015.

[11] ComEd notified all RFP bidders that any data requests would have to comply with ComEd's data protection policies.

1. Introduction

1.1 Program Description

The Great Energy Stewards (GES) program is a third-party behavioral energy efficiency (EE) program implemented by Shelton Solutions, Inc. (Shelton) that is based on the hypothesis that local church congregations comprise a receptive audience for behavioral EE programs.[12] The program planned to enroll 3,000 to 4,000 participants in PY6, to whom they would provide information on their energy consumption, energy-saving tips, and small monetary incentives to reward energy savings. Participants were asked to agree to save at least 250 kWh per year. The GES plan document indicates that they hoped to save a total of 1,860,465 kWh, or an average of 465 to 620 kWh per participant. This anticipated savings is 2 to 3 times greater than the 1-3 percent savings rate that is commonly reported for other behavioral EE programs.[13]

The program's plan document indicates that Shelton intended to recruit participants primarily at Chicago-area churches "through church announcements, bulletins, and direct contact with church and community leaders."[14] Shelton was unable to effectively implement this plan to meet GES stated goals. Instead, GES recruited the majority of the program's PY6 participants at Community and Economic Development Association (CEDA-sponsored events for low-income or financially distressed customers seeking assistance paying their utility bills. CEDA is not a church-affiliated organization.

1.2 Evaluation Objective

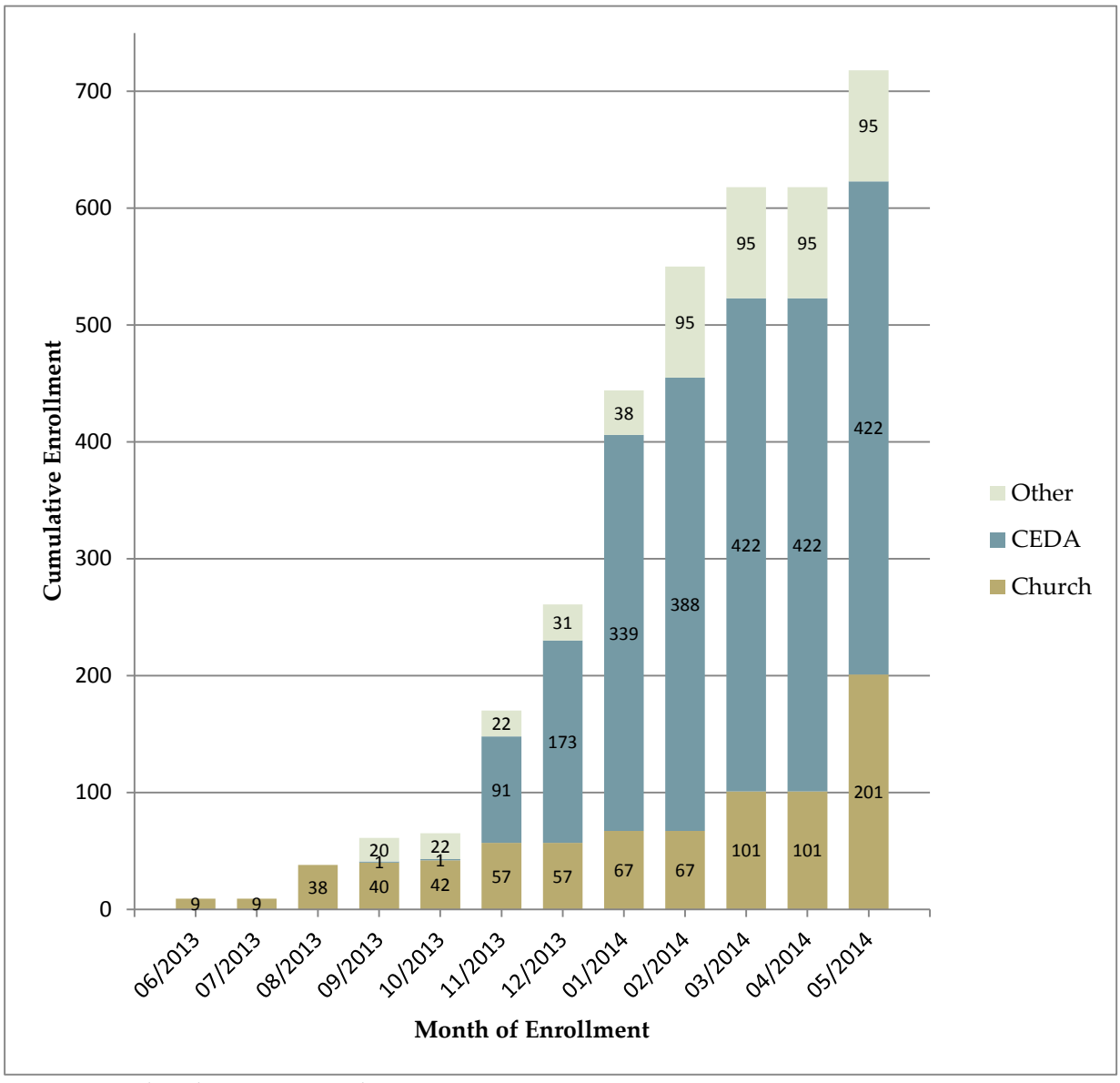
The sole objective of the analysis in this report is to determine the PY6 energy savings generated by the GES program. Due to the difficulties the implementer experienced with recruiting participants, we also undertook limited process evaluation related to that issue.

Figure 1-1 presents monthly cumulative enrollment since the program's inception, showing the type of venue where customers were recruited. During the first 5 months of the program year (June 2013 – October 2013), GES experienced very slow enrollment. It was not until November 2013, when the program began actively recruiting at CEDA-sponsored LIHEAP events, that enrollment began to

[12] "This program hinges on the fact that information disseminated via faith-based avenues is typically well-received and acted upon." The 2013 Great Energy Stewards Program SCOPE OF WORK DOCUMENT, loc. cit.
[13] Opower reports "consistent and sustained savings of 1.5% to 2.5% across all geographies" on their website (http://www.opower.com/results). They reported a 1.5 percent average savings rate for a home energy reports program in Massachusetts in a 2012 report ("Successful Behavioral EE Programs," Opower White Paper No. 3 https://opower.com/uploads/files/BEE_Whitepaper.pdf, downloaded 10/29/2014). Tendril cited savings of 1-3 percent for similar programs in a 2014 article ("Tendril Is Back: Could Nest and SolarCity Benefit from its Microtargeting Model?" http://www.greentechmedia.com/articles/read/tendril-models-and-micro-targets-the-home-energy-consumer, downloaded 12/11/2014). Based on Navigant's analysis of participant billing records, the average GES participant used roughly 8,160 kWh per year. An average of 465-620 kWh of savings would thus represent 5.7 to 7.6 percent of annual usage.
[14] The 2013 Great Energy Stewards Program SCOPE OF WORK DOCUMENT, loc. cit.

accelerate. Approximately 90 percent of program enrollment occurred between November 2013 and May 2014.

Figure 1-1. GES PY6 Cumulative Enrollment by Month and Venue



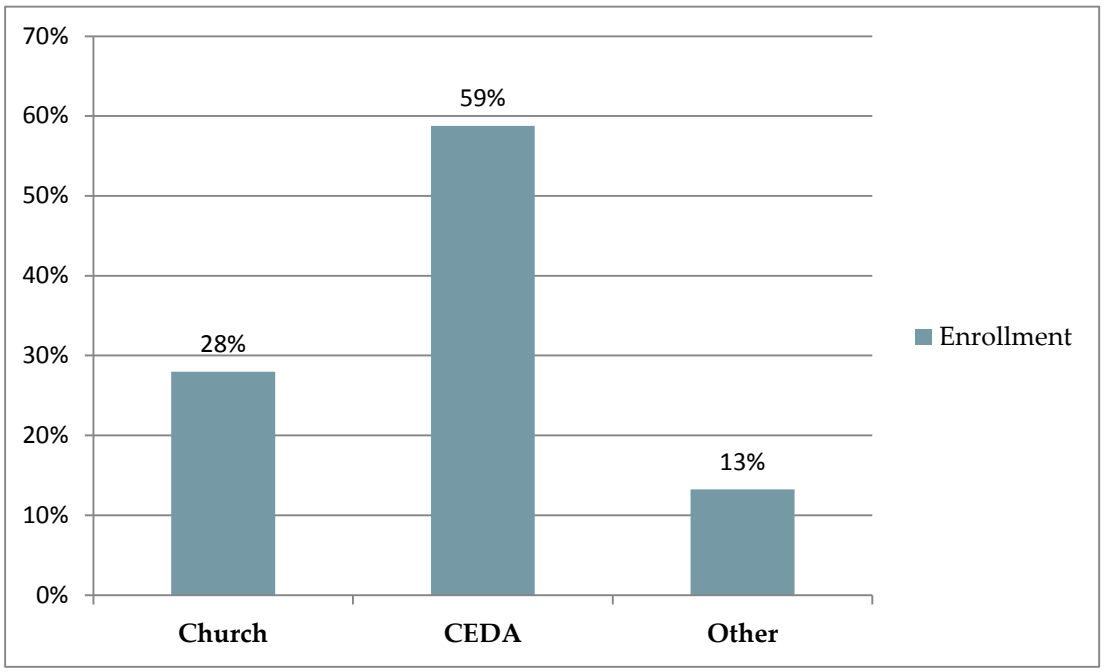
Source: GES tracking data, Navigant analysis.

Note: Customers were assigned to the "Church" category if they enrolled at venues whose names included one or more of the following terms: "AME," "Baptist," "Methodist," Bethel," or "Temple;" to the "CEDA" category if they enrolled at venues whose names include either "CEDA" or "DHS;" and to "Other" in all other cases.

Figure 1-2 summarizes the degree to which Shelton was able to implement its strategy of recruiting GES participants through local churches. It shows that only 28 percent of PY6 participants signed up at

church-related venues. The majority (72 percent) were recruited in non-church venues, mostly LIHEAP-related events.

Figure 1-2. GES PY6 Enrollment by Recruitment Venue



Source: GES tracking data, Navigant analysis

2. Evaluation Approach

Navigant used two evaluation approaches to quantify the energy savings induced by the GES program. The first is the variation-in-adoption (VIA) regression method used by Harding and Hsiaw.[15] The second is a matching method that compares energy usage of program enrollees to that of a set of closely-matched non-program customers. This method is known as regression with pre-program matching (RPPM) as described in Ho, Imai, King, and Stuart.[16] We present results for both methods in the appendix, but in reporting total savings we use results from the matching approach.

2.1 Overview of Data Collection Activities

Navigant received tracking data and monthly billing data for all program participants and control customers for the period of January 2012 to May 2014 from ComEd. Details are provided in Table 2-1.

Table 2-1. Primary Data Collection Activities

Data Source	Subject of Data	Quantity	Net Impact	Net Impact less Joint Impact with other EE Programs	Process
Interviews	ComEd and implementer program managers	2			X
Billing Data	Program participants and matches	All	X		NA
Tracking Data	Program participants and matches	All	X		NA
Tracking Data for Other Programs	Participants in Other Programs	All		X	NA

2.2 Sampling Plan

The VIA approach used data for 687 GES customers who were active at some time during the program year. The matching method used 582 program enrollees, and 574 unique matched customers, with the reduction in the number of program enrollees due to conditions necessary for proper matching.[17]

2.3 Matching Algorithm

The matching method relies on usage data from the bills of program participants, as well as from those of a set of matched comparison households, to estimate program savings. The pool of non-participant households available for matching consisted of 287,078 ComEd residential customers whose billing data were already accessible to Navigant.

[15] Harding, M. and A. Hsiaw, "Goal Setting and Energy Conservation," July 2013. Available at: http://www.stanford.edu/~mch/resources/Harding_Goals.pdf.

[16] Ho, Daniel E., Kosuke Imai, Gary King, and Elizabeth Stuart, 2007, "Matching as Nonparametric Preprocessing for Reducing Model Dependence in Parametric Causal Inference." *Political Analysis* 15(3): 199-236.

[17] There are fewer matches than participants because matching was done with replacement.

For each program participant with monthly billing data available extending back at least 14 months before program enrollment, Navigant compared average daily energy consumption in each month in the period spanning 3-14 months before enrollment (a twelve-month period) to that of all of the customers in the available pool of potential matches over the same 12 months. For the sake of expositional clarity below, we denote by t_k=0 the month t in which customer k enrolled in the program, with t_k -1 denoting the month immediately before enrollment, t_k +1 the month immediately after enrollment, and so on. Customers with missing bills during the designated matching period [t_k -14, t_k -3], but whose billing data extended past 14 months before program enrollment, were matched based on their most recent 12 bills before t_k -2 (that is, starting three months before enrollment and working backwards in time).

For each comparison, Navigant calculated the difference in average daily energy use in the given month between a participant and a potential match, D_{PM} (**D**ifference between **P**articipant and potential **M**atch). The quality of a match is denoted by the Euclidean distance between the match and the participant over the 12 values of monthly D_{PM} used for matching; that is, denoting by SSD the sum of squared D_{PM} over the matching period, it is defined by $\sqrt{SSD}$.[18] The non-participant customer with the shortest Euclidean distance to a participant was chosen as the matched comparison for that participant. Matching was done with replacement. After excluding observations based on screening criteria explained in the next section, there were 582 participants and 574 unique comparison customers.

It is not possible to statistically test for selection bias, but Imbens and Wooldridge present a test that is suggestive (hereafter called the "IW test").[19] In the current context the logic of the test is that in the absence of selection bias there should be no difference between participants and matches in average energy use outside of the matching period prior to the start of the program period. A simple implementation of the test is to determine whether, given matching based on months t_k -3 to t_k -14, average D_{PM} in the two months before program enrollment, months t_k -1 and t_k -2, is practically or statistically different than zero.

The results of the matching exercise are presented in the first section of the gross impact results section.

2.4 Data Used in the Impact Analysis

In preparation for the impact analysis, Navigant combined and cleaned the data provided by ComEd. Billing data used in the analysis extended from January 2012 (17 months before the start of the program) to May 2014.

Both the VIA approach and the matching method involved the removal of the following customers:

- 23 customers who lacked billing data
- 1 customer with a signup date in 2017
- 1 customer with duplicate records
- 1 customer who signed up twice

[18] See Chiang, Alpha C., *Fundamental Methods of Mathematical Economics* Third Edition (McGraw-Hill 1984), pp. 73-74.
[19] Imbens, Guido W., and Jeffrey M. Wooldridge, 2009, "Recent Developments in the Econometrics of Program Evaluation." *Journal of Economic Literature*, 47(1): 5-86.

The VIA approach also involved the removal of the following billing data:

- 95 bills with less than 20 or more than 40 days in the billing cycle
- 305 outliers, defined as individual observations with average daily usage more than one order of magnitude from the median usage in the targeted sample for the analysis[20]

The matching method involved the removal of the following additional billing data:

- All billing data for 106 customers with fewer than 8 bills in the matching period
- 30 matched pair observations with an outlier, defined as individual observations with average daily usage more than one order of magnitude from the median usage in the targeted sample for the analysis[21]
- 147 matched pair observations with less than 20 or more than 40 days in the billing cycle

2.5 Statistical Approaches used in the Impact Evaluation

Navigant used two methods – the VIA and RPPM methods briefly described above – to estimate program savings. Final estimates of program savings are based on the RPPM approach because the VIA results indicated that the program data were inconsistent with the VIA model assumptions.

Details of the VIA approach are presented in the appendix in Section 6.1.1. The method uses only program participants to estimate savings, with late enrollees essentially serving as controls for early enrollees. It relies on the assumption that, controlling for both customer- and month-specific fixed effects, neither energy use in month t, nor energy savings s months into the program, is correlated with the timing of program entry.

Details of the RPPM approaches are presented in the appendix in Section 6.1.2. It treats matching as a "pre-processing" stage of the analysis and assumes that monthly energy use in the post-program period can be modeled as a linear regression function of month-specific fixed effects, a customer's usage from the same billing period of the prior year, and a participant indicator.

[20] The median usage was 18.03 kWh per day; observations with usage values greater than 180.3 kWh per day or less than 1.80 kWh per day were excluded from the analysis. Mean usage was 22.47 kWh per day, with a standard deviation of 18.57.

[21] The median usage for participants was 18.35 kWh per day; observations with usage values greater than 183.5 kWh per day or less than 1.84 kWh per day were excluded from the analysis. The mean usage for participants was 23.44 kWh per day, with standard deviation of 23.18. The median usage for matched controls was 18.62 kWh per day; observations with usage values greater than 186.2 kWh per day or less than 1.86 kWh per day were excluded from the analysis. The mean usage for matches was 22.95 kWh per day, with standard deviation 18.33.

2.6 Accounting for Uplift in other Energy Efficiency Programs

If participation rates in other energy efficiency programs are the same on average for GES participants compared to similar non-participants, the savings estimates from the statistical analyses presented here are already "net" of savings from the other programs, as this indicates the GES program had no effect on participation in the other energy efficiency (EE) programs.[22] However, if the GES 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 GES and EE programs. For instance, if the GES program increases participation in another EE program, the increase in savings may be allocated to either the GES program or the other EE program, but cannot be allocated to both programs simultaneously.[23]

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 PY6 and a pre-program period for enrollees was subtracted from the same change for a similar group of nonparticipants. The group of nonparticipants used in the analysis is the customers matched to the participants for the RPPM method. The designated pre-program period is June 2012-May 2013, which is the 12 month period before *any* customer enrolled in the GES program.

As an example, if the rate of participation in an EE program during PY6 is 5% for the treatment group and 3% for the matched comparison group, and the rate of participation during the 12 months before enrollment in the GES program is 2% for the treatment group and 1% for the matched comparison group, then the rate of uplift due to the GES program is 1%, which is reflected in 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.

Navigant examined the uplift associated with four energy efficiency programs:

- The Residential Fridge and Freezer Recycle Rewards (FFRR) program, in which energy is saved by retirement and recycling of older, inefficient refrigerators, freezers, and room air conditioners.
- The Complete System Replacement (CSR) program, in which education and cash incentives are offered to ComEd's, Nicor Gas', North Shore Gas', and Peoples Gas' residential customers to encourage customer purchases of higher efficiency equipment.
- The Single Family Home Energy Savings (SFHES) program, in which customers in single family homes are offered a discounted home energy assessment and free or incentivized direct install and weatherization measure recommendations and installations.
- The Multi-Family Home Energy Savings (MFHES) program, which offers direct installation of low-cost efficiency measures, such as water efficiency measures and CFLs, at eligible multifamily residences.

[22] Here we assume that upon entry in the energy efficiency program the average program savings are the same for GES participants and non-participants.

[23] It is not possible to avoid double counting of savings generated by programs for which tracking data is not available, such as upstream CFL programs.

2.7 Process Evaluation

The evaluation of the GES program involved only a limited process evaluation that consisted of interviews with the program implementer and ComEd staff.

3. Gross Impact Evaluation

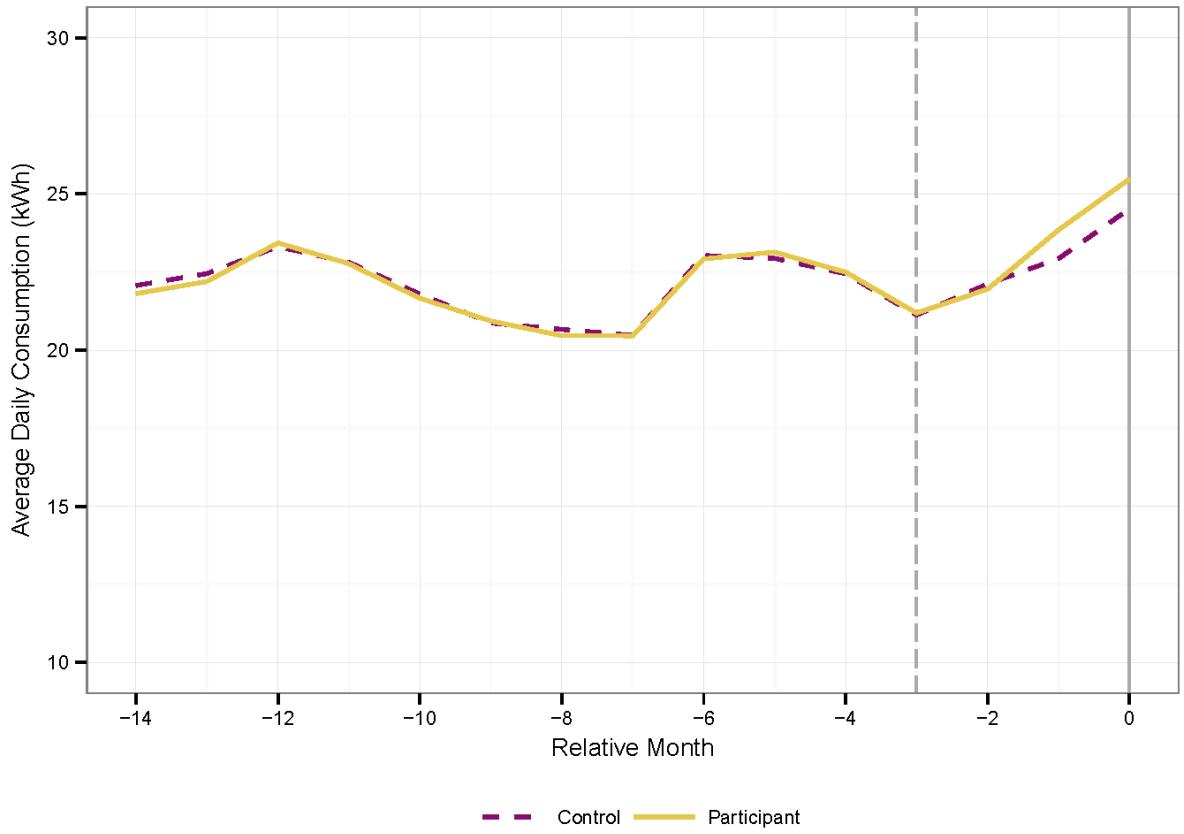
3.1 Matching Results

The matching method relies on a set of matched comparison households to estimate program savings. Figure 3-1 presents the mean of average daily energy use by participants and their matches over the period *t*-14 to *t*-1, and Figure 3-2 amplifies differences between the two groups by presenting the average *difference* in energy use between participants and their matches in percentage terms, with 90% confidence intervals superimposed. The figures illustrate two points:

- On average, the energy use by matches is very similar to that of program participants (Figure 3-1). Mean differences in energy use are neither statistically nor practically different than zero during the 12-month matching period.

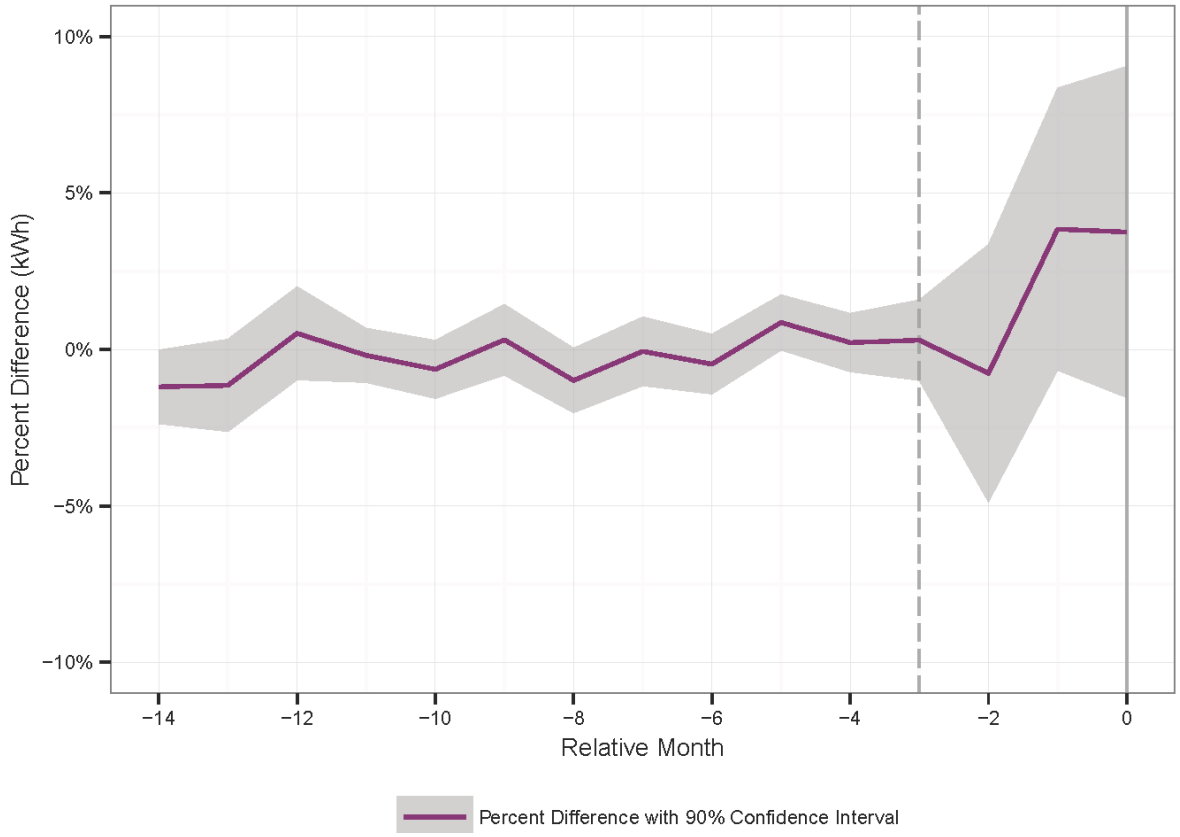
- The mean *difference* in energy use is not statistically different than zero in either test period *t*-2 or test period *t*-1 at the 90% confidence level (Figure 3-2). There is some divergence detected in period *t*-1, albeit not statistically significant. This leaves at least somewhat ambiguous the issue of selection bias in the sample. In other words, in period *t*-1 there is weak evidence that participants used more energy than their matches on average, which raises the possibility that the estimate of program savings could be biased downward.

Figure 3-1. Average Monthly Energy Use Before Program Enrollment, GES Participants and Matched Controls



Source: Navigant analysis

Figure 3-2. Average Difference in Monthly Energy Use Before Program Enrollment, GES Participants Less Matched Controls, with 90% Confidence Intervals



Source: Navigant analysis

3.2 Model Parameter Estimates

Navigant used two evaluation approaches to estimate energy savings. Our final results were based on the pre-program matching (RPPM) approach, as presented in this section. Regression parameter estimates for the RPPM approach are found in Table 6-2 in the appendix.

The results from the variation-in-adoption (VIA) regression method are in Table 6-1 in the appendix in Section 6.1.1.

Table 3-1 presents the estimated savings for the RPPM method. For the approach the estimated savings are derived directly from the estimate of α_2 in Model 2 in the appendix, and the standard error is based on the standard error of α_2. We estimated robust standard errors with clustering of errors by customer.

Table 3-1. GES Program Gross (and Net) Program Savings, PY6

Type of Statistic	RPPM Method (*standard errors in parentheses*)
Number of Participants used in analysis	582
Average Percent Savings	-0.82%
	(2.92%)
Average kWh savings per customer per day	-0.19
	(0.67)
Average kWh savings per customer, PY6	-26
Gross Verified MWh Savings†	-18,592
	(66,119)

Source: ComEd billing data, GES implementation data, and Navigant analysis.
†Total savings are pro-rated for participants that close their accounts during PY6.

Since the gross verified savings estimate is much smaller than its standard error (which is more than 3.5 times its size), the estimate is not statistically different from zero.[24]

3.3 Gross Savings

The evaluation team calculated energy savings for the GES program using regression analysis of monthly billing data for participants. Table 3-2 summarizes the gross electricity savings from the GES program. While the program appears to have generated negative savings, they are not statistically significant and, thus, are not distinguishable from zero. Hence, our primary finding is that the program achieved no verified gross energy savings in PY6.

Table 3-2. PY6 Total Program IPA Electric Savings

Savings Category	Energy Savings (MWh)
As Calculated Verified Gross Savings Prior to Uplift Adjustment †	-18,592‡
Final Verified Gross Savings	0

Source: ComEd billing data, GES tracking data, and Navigant team analysis.
†The uplift adjustment reflects savings that are jointly produced by the program and other EE programs.
‡Not statistically significant

[24] The t statistic is -0.28, which indicates that the difference is not significantly different from zero at the 90 percent (or any other reasonable) level of confidence.

4. Net Impact Evaluation

Program savings calculated by the regression analysis are by nature net savings except for the uplift in participation in other energy efficiency programs caused by the GES program. To avoid double-counting of savings, program savings due to this uplift must be counted towards either the GES program or the other EE programs, but not both programs. The uplift of savings in other EE programs was very small: 1.65 MWh. Given that the program did not achieve any verified savings, the savings will automatically be counted towards the other EE programs.

Table 4-1 presents a summary of the PY6 double-counted savings due to uplift in other EE. Table 6-5 in the appendix presents the details of the calculation of the double-counted savings for each for the four ComEd energy efficiency programs considered in the analysis.

The estimate of double-counted savings is likely an *overestimate* because it presumes participation in the other EE programs occurs at the very start of PY6. Under the more reasonable assumption that participation occurs at a uniform rate throughout the year, the estimate of double-counted savings would be approximately .83 MWh, half the estimated value of 1.65 MWh. The main point is that double counting of savings with other ComEd energy efficiency programs is not a significant issue for the GES program.

Table 4-1. PY6 Uplift of Savings in Other EE programs

	FFRR	CSR	SFHES	MF
Participation uplift in other EE programs (# participants)	*2*	*-2*	*1*	*-1*
Savings Uplift in other EE programs (MWh)	*1.8*	*NA*	*NA*	*-.15*

Source: Navigant analysis

Table 4-2 summarizes the verified net electricity savings from the GES program. While the program appears to have generated negative savings, they are not statistically significant and are not distinguishable from zero. Hence, our primary finding is that the program achieved no verified net energy savings in PY6.

Table 4-2. PY6 Total Program IPA Electric Savings

Savings Category	Energy Savings (MWh)
As Calculated Verified Net Savings	-18,594‡
Final Verified Net Savings	0

Source: ComEd billing data, GES tracking data, and Navigant team analysis.
†The uplift adjustment reflects savings that are jointly produced by the program and other EE programs.
‡Not statistically significant

5. Findings and Recommendations

This section summarizes the key impact findings and recommendations.

Program Participation and Targeting

Finding 1a. The GES Program struggled with recruitment and did not meet its target enrollment of 3,000 to 4,000 participants, only managing to sign up just 716 customers by the end of PY6.

Finding 1b. The program experienced particular recruitment problems early on when its recruitment efforts were focused on local churches. Roughly 90 percent of participants signed-up in the latter half of the program year.

Finding 1c. The GES Program planned on recruiting participants "using a grass roots, faith-based campaign" aimed at local church congregations (African Methodist Episcopal and other denominations) in the greater Chicago area.[25] However, this proved less fruitful than anticipated, and most participants were recruited in other venues, mainly events targeting low-income or financially stressed households while they were seeking assistance paying their utility bills. When GES encountered difficulties in recruiting through local churches the program did not appear to have a "Plan B" and took time developing alternative approaches.

Recommendation 1. ComEd should identify and address the barriers that prevented Shelton from recruiting participants effectively in targeted area churches. Navigant identified the restrictions placed on Shelton's use of customer data to be one such barrier, as detailed in Finding 2 below. However, we note that this restriction is a basic requirement of customer privacy protection that ComEd applies to all of its implementers. It is also a common best practice of utilities and most large companies. To understand the extent to which other factors contributed to the program's difficulties with recruiting, ComEd should consider conducting process research, including a review of the program's marketing materials, interviews with program managers, implementer staff, and leaders at targeted churches, as well as surveys of participant and non-participant members at targeted churches.

Finding 2. The implementer failed to satisfy ComEd's information security requirements for third-party contractors wishing to host, process or store customer personal identifying information (PII). To comply with ComEd's PII security standards, Shelton would have had to implement significant computer hardware and software upgrades as well as purchase supplementary liability insurance[26], which Shelton did not do in PY6. Thus, Shelton could not store customer names, addresses, account numbers and monthly energy usage values

[25] The 2013 Great Energy Stewards Program SCOPE OF WORK DOCUMENT final vers.pdf (June 3, 2013), p. 3.

[26] We understand that Shelton did purchase the required insurance in August 2013, the third month of PY6. However, ComEd did not allow them to host customer PII because Shelton's servers were determined to represent an unreasonable risk to customer data privacy. Shelton chose not to invest in the necessary IT upgrades at that time, opting instead to wait for the results of the PY6 evaluation. They were concerned that the increased security might cost them more than the contract was worth, and hoped that the verified savings would correlate closely enough with their "raw savings" results to allow them to avoid having to expend the additional resources. Personal communications, ComEd program managers, November 20, 2014 and March 27, 2015.

electronically, which prevented them from implementing one of its key intended recruitment strategies: enrolling customers on a dedicated program website.

Recommendation 2a. It appears Shelton assumed that it would have access to customer data[27] and did not foresee the difficulties in accessing customer data at a large public utility. Shelton should consider making the necessary investments if they plan to continue serving as a third-party implementer of customer-facing energy efficiency programs in the future.

Recommendation 2b. ComEd should provide detail in their Request for Proposals (RFPs) for third-party EE programs describing all relevant customer data privacy/ security requirements (if this is not done today). ComEd should also consider making satisfaction of its customer data security standards a prerequisite for responding to its RFPs, when appropriate.

Program Response

Finding 3a. The GES Program failed to achieve significant energy savings among participants.

Finding 3b. No statistically significant difference in savings was detected between participants who were recruited through the mechanism envisioned in the program's plan, namely at local churches, and those who were recruited in other venues.

Finding 3c. Shelton's failure to satisfy ComEd's data security requirements prevented them from monitoring participants' post-enrollment energy usage. While Shelton did have access to participants' "raw savings" information provided by ComEd, its lack of participants' monthly energy usage levels prevented Shelton from using this information to gain insights into participants' basic usage patterns. Shelton could have used this detail to tailor their energy-savings tips more closely to participants' particular situations.

[27] ComEd notified all RFP bidders that any data requests would have to comply with ComEd's data protection policies.

6. Appendix

6.1 Detailed Impact Methodology

Navigant used two methods to estimate impacts: the variation in adoption (VIA) approach and regression with pre-program matching (RPPM). Each is presented below.

6.1.1 VIA Approach

The method takes advantage of the differential timing of program enrollment by customers to identify program savings. It essentially takes the perspective that the best comparison group for customers enrolled at time *t* is those that enroll later in the program period.

The method uses a fairly simple, but flexible, linear fixed effects regression model of energy consumption by households. The base model casts monthly electricity consumption as a function of a household-specific fixed effect, month/year fixed effects, and the time-distance from enrollment (both pre- and post-enrollment). This is a two-way fixed effects model that accounts for all time-invariant customer characteristics, and all month/year-specific factors affecting all customers. Formally we have,

Model 1

$$ADU_{kt} = \alpha_k + \beta_t + \sum_{j=-\bar{m}}^{\bar{m}} \gamma_j D_{kt}^j + \varepsilon_{kt}$$

where,

ADU_{kt}	=	Average daily energy use by household *k* in month *t*;
α_k	=	Household-specific constant (fixed effect);
β_t	=	Month/year specific constant (fixed effect);
D_{kt}^j	=	A set of 0/1 indicators of month relative to month of program enrollment, taking a value of 1 if month *t* is the j^{th} month before/after household *k* enrolls in the program, where month $\bar{m} = 0$ is the month of enrollment.
γ_j	=	Coefficient on the indicator variable D_{kt}^j;
ε_{kt}	=	Model error term.

An underlying assumption of the VIA approach is that, after controlling for time-invariant customer characteristics (e.g., premise construction and square footage, number of sockets and appliances) and time-varying factors common to all customers (e.g., weather conditions), customer usage is completely determined up to a white-noise error term prior to program enrollment, and is also a function of program enrollment once they've signed up. An important feature of the model is that it embodies a test of its suitability for the particular data set to be analyzed. If the assumptions of the model are met, the program should have no apparent effect on participant usage prior to the time of enrollment, implying that the

values of the γ_j should all be zero for $j<0$. Thus, a test of the suitability of the VIA model is that $\gamma_j=0$ for all $j<0$.

6.1.2 Overview of the Matching Method

The basic logic of matching is to balance the participant and non-participant samples by matching on the exogenous covariates known to have a high correlation with the outcome variable. Doing so increases the efficiency of the estimate and reduces the potential for model specification bias. Formally, if the outcome variable Y (in this case, customer energy usage) is independently distributed conditional on X and D, where X is a set of exogenous variables and D indicates program participation, then the analyst can gain some power in the estimate of savings and reduce potential model specification bias by assuring that the distribution of X is the same for treatment and control observations.

In this evaluation, the outcome variable is the customer's average daily (post-program) energy use in a given bill period, and the available exogenous covariate with by far the greatest correlation with this outcome variable is the customer's average energy use in the same month of the pre-program period, $PREkWh_{kt}$, where k indexes the customer and t indexes the month; this is why the matching takes the form described in section 2.3. The RRPM approach can be interpreted as using regression analysis to further control for any remaining imbalance in the matching on this variable. If, for instance, after matching the participants use slightly more energy on average in the pre-program period than their matches –they are higher baseline energy users, in other words—then including $PREkWh_{kt}$ as an explanatory variable in a regression model predicting monthly energy use during the post-program period prevents this remaining slight difference in baseline energy use from being attributed to the program.

6.1.3 The RPPM Approach

In the RPPM approach the development of a matched comparison group is viewed as a useful "pre-processing" step in a regression analysis to assure that the distributions of the covariates (i.e., the explanatory variables on which the output variable depends) for the treatment group are the same as those for the comparison group that provides the baseline measure of the output variable. This minimizes the possibility of model specification bias. The regression model is applied only to the post-treatment period, and the matching focuses on those variables expected to have the greatest impact on the output variable.

As described in section 2.3, we matched participant and comparison customers on energy use during the pre-treatment period, and then estimated the following model for all post-program observations:

Model 2

$$ADU_{kt} = \alpha_{0t} + \alpha_1 PREkWh_{kt} + \alpha_2 Treatment_k + \varepsilon_{kt}$$

where:

ADU_{kt}	=	Average daily energy use by household *k* in month *t*;
α_{0t}	=	Month/year specific constant (fixed effect);
$Treatment_k$	=	A 0/1 indicator variable, taking a value of 1 if customer *k* is a GES participant, and 0 otherwise.
$PREkWh_{kt}$	=	The average daily electricity use by household *k* during the same month in the prior year.
ε_{kt}	=	Model error term.

In this model α_2 indicates average daily savings generated by the program. We include a monthly fixed effect to account for unobserved time-related factors, such as weather, that affect all customers.

We also estimated a form of the model that included a test of whether energy usage by customers who were recruited at a church-sponsored event differed from that of other customers:

Model 2a

$$ADU_{kt} = \alpha_{0t} + \alpha_1 PREkWh_{kt} + \alpha_2 Treatment_k + \alpha_3 Treatment_k \cdot Church_k + \varepsilon_{kt}$$

where:

$Church_k$	=	A 0/1 indicator variable, taking a value of 1 if customer *k* was recruited into the GES program at a church-sponsored event, and 0 otherwise.

In this model, α_2 indicates average daily savings for non-church recruits, while $(\alpha_2 + \alpha_3)$ is average daily savings for church recruits.

6.2 Detailed Impact Results: Parameter Estimates

6.2.1 Parameter Estimates for VIA Approach

The variables of interest for the VIA approach are the indicators of the months before and after program enrollment. Coefficient estimates for these variables are presented in Table 6-1. Variable names *D+k* correspond to indicator variable D^k in Model 1; so, for instance, *D-1* corresponds to variable D^{-1} in Model 1, indicating the month just before program enrollment. The results in Table 6-1 indicate that in eight of the 12 months before enrollment in the program, the program effect is statistically different than zero at a

90% confidence level or better.[28] It is logically inconsistent that the program should have an effect prior to enrollment, therefore this model was deemed unsuited for this application and was not used to estimate program savings.

Table 6-1. Parameter Estimates for VIA Model (Model 1)

Variable	Coefficient	Standard Error	t-statistic
D-12	-2.9712	1.6272	-1.8260
D-11	-1.4668	1.3438	-1.0916
D-10	-1.9262	1.1803	-1.6319
D-9	-2.3687	1.0774	-2.1985
D-8	-2.4440	1.0019	-2.4394
D-7	-2.5004	0.9494	-2.6336
D-6	-2.4853	0.8989	-2.7649
D-5	-1.1532	0.8436	-1.3670
D-4	-1.0463	0.8445	-1.2389
D-3	-1.3733	0.7479	-1.8363
D-2	-1.8518	0.6797	-2.7244
D-1	-1.0770	0.4853	-2.2190
D=0			
D+1	0.5521	0.4747	1.1631
D+2	1.4127	0.8728	1.6185
D+3	-0.3636	0.9463	-0.3842
D+4	-0.9544	1.0479	-0.9108
D+5	-1.1072	1.2411	-0.8921
D+6	-0.9093	1.6294	-0.5581
D+7	-1.1802	2.7439	-0.4301
D+8	-0.7956	2.0280	-0.3923
D+9	-1.5677	1.7183	-0.9124
D+10	-7.7512	3.9638	-1.9555
D+11	-5.6994	4.0787	-1.3974

Source: Navigant analysis

6.2.2 Parameter Estimates for RPPM Approach

Parameter estimates for the two variables of interest in Model 2, $PREkWh_{kt}$ and $Treatment_k$, are presented in Table 6-2 along with their estimated standard errors and t statistics.

[28] A t-statistic greater in absolute value than 1.65 indicates statistical significance at the 90% confidence level. A t-statistic greater in absolute value than 1.96 indicates statistical significance at the 95% confidence level.

Table 6-2. Parameter Estimates for RPPM Model (Model 2)

Parameter	Coefficient	Standard Error	t statistic
PREkWh	0.5972	0.0863	6.92
Treatment	0.1875	0.6667	0.28

Source: Navigant analysis

Since the treatment effect is not statistically significant, we conclude that there is no measurable savings evident for the program.

Two questions arose in the context of evaluating the matching-model results. The first was whether any difference was evident in the savings behavior of participants who had been recruited at church-sponsored events as opposed to other venues. Table 6-3 shows the parameter estimates of interest for the version of model 2 testing for a differential result between customers who enrolled at a church-sponsored event versus some other venue:

Table 6-3. Parameter Estimates for RPPM Model with Recruitment Venue (Model 2a)

Parameter	Coefficient	Standard Error	t statistic
PREkWh	0.5974	0.0858	6.96
Treatment	0.1298	0.7360	0.18
Treatment x Church	0.2251	0.9023	0.25

Source: Navigant analysis

Since the coefficient on the Treatment x Church interaction is not statistically significant, we conclude that there is no differential effect of being recruited into the program in a church as opposed to some other venue. And while the point estimates of the treatment coefficient changes, it also remains both positive, indicating negative savings, and statistically indistinguishable from zero.

The second question has to do with whether the fact that a large proportion of GES participants were enrolled in LIHEAP through CEDA events biased our results. Specifically, to the extent that LIHEAP assistance spurred increased energy usage by recipients, did this effect offset the effect of the program, which is designed to reduce energy consumption? First, it is important to note that while a higher fraction of GES participants than potential matches received LIHEAP assistance at some point during the analysis period – which is hardly surprising in view of the fact that the implementer effectively targeted them – LIHEAP recipients were also represented in the pool of potential matches, and indeed some matched non-participants did receive LIHEAP assistance.

Second, it should be noted that the potential difficulty that LIHEAP assistance poses to our model results is not related to whether or not a given customer received it or not. After all, what LIHEAP assistance does, in effect, is relax a recipient's budget constraint for the period during which they receive it. There is no reason to assume that the full value of the assistance was spent on extra energy consumption: each dollar of LIHEAP assistance received frees up a dollar of the recipient's income that would otherwise have been spent on their utility bill. Whether the recipient chooses to spend some or all of this added

purchasing power on additional energy consumption, or on some combination of other goods and services (or, indeed, saves it instead) depends on their individual tastes and preferences. Thus, we can have no a priori expectation as to the size, or even the direction, of the effect LIHEAP assistance might have on a recipient's energy consumption.

The key issue, for our purposes, is whether a customer changes LIHEAP status between the pre-enrollment period and the post-enrollment period. If a customer in our sample – either a GES participant or a potential match – received LIHEAP assistance during the pre-enrollment period, on the basis of which they were matched to a comparison customer, and also received LIHEAP assistance during the post-enrollment period, there would be no net effect on our analysis: their net income should not have changed as a result of LIHEAP. The same is true for customers who did not receive LIHEAP assistance in either period. The concern arises for cases where a customer – either a participant or a potential match – changed state between the two periods, either from recipient of LIHEAP assistance to non-recipient or vice versa. In that case, the matching might have been inappropriate to the extent that the changed purchasing power from receiving LIHEAP assistance was not accounted for.

To test for evidence of this effect, we constructed two dummy variables, LIHEAP_PreNotPost and LIHEAP_PostNotPre. The first took on the value of one if a customer received LIHEAP assistance in the pre-enrollment (i.e., matching) period but not the post-enrollment period, and zero otherwise. The second equaled one if the customer received it in the post-enrollment period but not the pre-enrollment period. We then included these variables in the RPPM model and reran it. The results are shown in Table 6-4.

Table 6-4. Parameter Estimates for RPPM Model with LIHEAP Status Change (Model 2b)

Parameter	Coefficient	Standard Error	t statistic
PREkWh	0.9937	0.7041	1.41
Treatment	1.2335	1.0997	1.24
LIHEAP_PreNotPost	0.3381	1.3117	0.26
LIHEAP_PostNotPre	0.3239	0.7575	0.43

Source: Navigant analysis

What is notable in these results is, first of all, that the coefficients on the LIHEAP status-change variables are not statistically different from zero, on the basis of which we conclude that there is no strong evidence of bias from this effect in our model. And secondly, the treatment effect also remains both positive, indicating negative savings, and statistically indistinguishable from zero.

6.3 Savings Due to Participation Uplift in Other EE Programs

Table 6-5 presents program savings due to participation uplift in other EE programs.

Table 6-5. Estimates of Double Counted Savings in PY6

	Program			
	FFRR	CSR	SFHES	MF
Average program savings (annual kWh per participant)	1,041	769	451	234
# GES Treatment Customers	559	559	559	559
Program participation, PY6	11	0	0	3
Change in participation from pre-program Year	2	-1	0	-1
# Comparison Customers	559	559	559	559
Program participation, PY6	5	2	0	0
Change in participation from pre-program	0	1	-1	0
DID statistic	0.35%	-0.35%	0.18%	-0.18%
Participation uplift	2	-2	1	-1
Statistically Significant at the 90% Confidence Level?	No	No	No	No
Savings attributable to other programs (kWh)	1,800	NA	NA	-155

Source: Navigant analysis