Pacific Gas & Electric Company's SmartMeter™ Enabled Programs: Program Year 2016 Evaluation of Customer Web Presentment and Bill Forecast Alert

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Final Report

Applied Energy Group, Inc.
500 Ygnacio Valley Road, Suite 250
Walnut Creek, CA 94596
510.982.3525
www.appliedenergygroup.com

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Pacific Gas & Electric Company

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This report was developed by

Applied Energy Group, Inc.
500 Ygnacio Valley Blvd., Suite 250
Walnut Creek, CA 94596

Principal Investigators:
K. Marrin
T. Shah
T. Williams

in consultation with Pacific Gas & Electric Company.

Abstract

Customer Web Presentment (CWP) and Bill Forecast Alerts (formerly Energy Alerts) are two SmartMeter^{TM} enabled informational-energy-conservation-programs available to Pacific Gas & Electric (PG&E) customers. Customer Web Presentment of interval electric usage data is available to customers though PG&E's My Energy web portal. The My Energy website is a single, multi-functional, customer-facing portal that provides customers with tools to help manage their energy usage. The relevant aspect of the portal is the My Usage tab which allows customers, who are SmartMeter^{TM} read and billed, to view their electricity usage at a daily or hourly level. Bill Forecast Alert is a program in which participants elect to receive predictive energy-bill notifications.

The purpose of this report is to present the ex post energy and demand savings for 2016. The impact analysis in the evaluation report uses a restricted population to estimate savings to avoid double-counting impacts for customers who are also SmartRate^{TM} or SmartAC^{TM} participants. The impacts reported here are based on a population of 537,314 singly-enrolled CWP participants, 61,210 singly-enrolled Bill Forecast Alerts participants, and 39,219 participants dually-enrolled in CWP and Bill Forecast Alerts.

For the CWP and Bill Forecast Alerts programs, per customer segment-level ex post energy savings for 2016 were estimated using a statistical difference-in-difference approach, followed by a regression based approach to refine the estimates. Impacts for the subpopulations were then combined to develop overall impacts for three groups: 1) singly-enrolled CWP participants; 2) singly-enrolled Bill Forecast Alerts participants; and 3) participants dually-enrolled in CWP and Bill Forecast Alerts. The estimated aggregate energy savings impacts are 6,868 MWh for singly-enrolled Bill Forecast Alerts participants, and 2,349 MWh for dually-enrolled participants. The evaluation did not find any statistically significant savings for singly-enrolled CWP participants.

The estimated aggregate demand savings are 1.4 MW for singly-enrolled Bill Forecast Alerts participants, and 1.3 MW for dually enrolled participants. Again, the evaluation did not find any statistically significant savings for singly-enrolled CWP participants.

Executive Summary

This report includes the ex post evaluation of Pacific Gas and Electric Company's (PG&E's) SmartMeter^{TM} Enabled Programs for the Program Year 2016 (PY2016). Each of the programs covered in this evaluation are described below.

Customer Web Presentment. In this program, interval electric usage data is available to customers though the Customer Web Presentment (CWP) pages of PG&E's My Energy web portal. The My Energy website is a single, customer-facing portal with many different functions and tools beyond the scope of this evaluation. The relevant aspect of the portal is the My Usage tab which allows customers who are SmartMeter^{TM} read and billed to view their electricity usage at the daily or hourly level.

Energy Alerts (January to March of 2016). In this program, customers signed up for Energy Alerts (EAL) to receive notifications during the billing cycle about their energy usage. PG&E customers are billed according to an increasing block rate, where successively larger tiers of energy usage are billed at successively higher per-kWh rates. Starting on the 8th day of their billing cycle, Energy Alert customers were notified if their bill forecast projected that they would cross into Tiers 3, 4, or 5. Customers were subsequently notified after they crossed each of those three tiers for a maximum of four alerts in each billing cycle. Customers start receiving the alert on the 8th day of their billing cycle.

Bill Forecast Alert (April to December of 2016). In this program, customers can sign up for a Bill Forecast Alert (BFA) to set personalized budget thresholds and are notified via email, text, or phone when they are projected to exceed that amount during their monthly billing cycle.

This report presents the program year 2016 (PY2016) evaluation of ex post electricity savings associated with each of these programs.

Approach

The evaluation was conducted in five basic steps:

1. Characterize the participants in each program by examining both enrollment data and level of engagement. Identify customers with dual participation in both CWP and Energy Alerts/BFA.
2. Design the treatment samples for single enrollment in each program and for dual participation by segmenting the population according to the aspects of participation that have been shown to be correlated with savings in previous evaluations and then by stratifying based on energy use within relevant population segments. For CWP, the segmentation aspects include duration of participation and number of times a participant views the web tools; for Energy Alerts/BFA, the segments include continuing participants that transitioned from Energy Alerts to BFA in March of 2016 (subsequently referred to as Energy Alerts/ New BFA) and New BFA participants.
3. Match the treatment customers with non-participant control customers using a stratified matching strategy, employing both demographic and pretreatment energy usage data. Conduct matching in two stages: first with monthly billing data to obtain a three-to-one control-to-participant match and second with hourly on-peak and off-peak interval data to create a one-to-one control-to-participant match for a series of day types.
4. Estimate the energy savings for each program at the segment and population levels for each month and the entire program year first using a statistical difference-in-difference (DID) technique, then refining the estimates using a regression approach.
5. Estimate the demand savings for each program at the segment and population levels for each day type using a statistical difference-in-difference (DID) approach.

Key Findings

The following were identified as key findings during the AEG's evaluation of PG&E's CWP and Energy Alerts/BFA programs.

Findings

Total annual energy savings from both CWP and Energy Alerts/BFA are presented below in Table 5-1. These savings estimates are consistent with previous evaluation years. In total, the participants across programs saved just over 9.2 GWh of energy in 2016. This reflects an energy savings increase of 15% over 2015's total of 7.8 GWh. Singly-enrolled Energy Alerts/BFA participants saved an average of 112.2 kWh per customer in 2016, vs. 86 kWh per customer in 2015. While dually-enrolled participants saved an average of 59.9 kWh per customer in 2016 vs. 87 kWh per customer in 2015. We were unable to obtain statistically significant savings estimates for Singly-enrolled CWP participants at the population level.

Table 1-1 Total Annual Energy Savings: All Participants

Subpopulation	Number of Participants	Average Annual Savings (kWh per customer)	Total Savings (MWh)
Singly-enrolled CWP Participants	498,095	0	0
Singly-enrolled Energy Alerts/BFA Participants	61,210	112.2	6,868
Dually-enrolled Participants	39,219	59.9	2,349
Total	**598,524**	**15.4**	**9,217**

The total annual demand savings from both CWP and Energy Alerts/BFA are presented below in Table 5-2. Again, the demand savings are consistent with previous evaluation years. In total, the participants across all programs provided approximately 2.7 MW of demand reduction in 2016 which represents a 40% reduction in savings vs. 2015. Singly- and dually-enrolled Energy Alerts/BFA participants saved an average of 0.023 kW and 0.034 kW per customer respectively. We were unable to obtain statistically significant savings estimates for singly-enrolled CWP participants at the population level.

Table 1-2 Total Annual Demand Savings: All Participants

Subpopulation	Number of Participants	Annual Savings (kW per customer)	Total Savings (kW)
Singly-enrolled CWP Participants	498,095	0	0
Singly-enrolled Energy Alerts/BFA Participants	61,210	0.023	1,408
Dually-enrolled Participants	39,219	0.034	1,333
Total	**598,524**	**0.005**	**2,741**

Customer Web Presentment Findings

- Based on our analysis for 2016, at the program level singly-enrolled CWP participants are not saving energy as a result of interacting with their consumption data.
- One additional hypothesis that may explain why we were unable to detect savings for the CWP participants is the very large number of participants. This may, at first, sound counterintuitive since having many participants is often an advantage. However, in this case, it may be that many more customers are viewing the website out of curiosity, but fewer customers are engaging with and making modifications in behavior based on the information provided. We see some evidence of this, when we look at the distribution of participants across engagement levels, with the highly-engaged customers making up only about 4% of the total CWP population.

- At the segment level, we have seen consistently across evaluation years that the highly-engaged participants are more likely to save energy, while less engaged participants are less likely to save energy. While some individual months may be statistically significant (either positive or negative) among the less engaged participants, the overall pattern of the savings estimates does not suggest consistent positive or negative savings for those groups. In contrast, the savings estimates for the highly-engaged participants do show consistent positive and significant savings estimates across most months. This pattern indicates that those customers are actively engaging with the website and saving energy.

Energy Alerts/Bill Forecast Alert Findings

- Based on the analysis, all of the savings for the Energy Alerts/BFA program are attributable to the participants that transitioned from the Energy Alerts program to BFA in March of 2016. In this group, we saw consistent positive savings estimates across 11 of the 12 months, in addition we saw significant positive demand estimates across all day types in 2016.
- While we did not see statistically significant savings among the New BFA participants this year, we believe that the primary issue is the small sample size, rather than a true lack of savings. There is no reason to expect that we will not be able to detect savings next year when the sample size will be larger. Furthermore, the new BFA participants showed consistent positive point estimates in the monthly analysis, which while not significant, do indicate that those participants are likely to be saving energy.
- Relative to 2015, savings among both singly-enrolled customers increased slightly from 1.2% to about 1.8% at the program level. This increase was evident both in the monthly energy savings and in the demand savings for a typical summer day.
- Singly-enrolled Energy Alerts/BFA participants saved a total of 6,868 MWh during 2016, or 112.2 kWh per participant, for an average annual impact of 1.8%.
- Singly-enrolled Energy Alerts/BFA participants have an average on-peak demand savings of 0.023 kW per customer (2.6%) on a typical summer day. The singly-enrolled Energy Alerts/BFA participants achieved a demand savings of 1.4 MW in 2016.

Dually-enrolled Customer Findings

- Dually-enrolled participants saved a total of 2,349 MWH in 2016, or 59.9 kWh per participant, which translates to an average annual impact of 0.80%. This represents a slight reduction in impacts from 2015 during which the dual customers achieved a 1.0% reduction.
- Dually-enrolled participants have an average demand savings of 00.034 kW (or 3.3%) on a typical summer day. The dually-enrolled participants achieved a total demand savings of 1.3 MW in 2016. The demand savings are actually slightly higher than the savings achieved by dually-enrolled participants in 2015.
- Dually enrolled participants are saving energy; however, we believe the majority of the savings in the dually enrolled population to be attributable to Bill Forecast Alert vs. CWP.

Recommendations

The following were identified as recommendations for future program years:

- The high participation rate for CWP suggests that customers are receiving value from the program, even if savings cannot be attributed directly to those customers. Therefore, we recommend that PG&E continue to offer and enhance their customer interface, even if we cannot attribute savings directly to those customers.
- We also recommend that PG&E consider examining the non-energy benefits of CWP using a customer survey. Given the large number of users it is very likely that customers are getting significant value from the website, even though we cannot measure the savings at the programs level. A customer survey could help to uncover some of these potential benefits.

- Since BFA is a new offering, which replaced Energy Alerts in March of 2016, we recommend performing some additional analysis using the 2016 data to attempt to uncover potentially new or different savings patterns.
- Given that the program recently changed the way it interacts with participants, it would also be beneficial to explore customer opinions of, and satisfaction with, the program through a customer survey. The survey could also be used to uncover savings behavior that might help with the evaluation of the program in future years.

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Introduction

This report includes the ex post evaluation of Pacific Gas and Electric Company's (PG&E's) SmartMeter™ Enabled Programs for the Program Year 2016 (PY2016). Each of the programs covered in this evaluation are described below.

Customer Web Presentment. In this program, interval electric usage data is available to customers though the Customer Web Presentment (CWP) pages of PG&E's My Energy web portal. The My Energy website is a single, customer-facing portal with many different functions and tools beyond the scope of this evaluation. The relevant aspect of the portal is the My Usage tab which allows customers who are SmartMeter™ read and billed to view their electricity usage at the daily or hourly level.

Energy Alerts (January to March of 2016). In this program, customers signed up for Energy Alerts (EAL) to receive notifications during the billing cycle about their energy usage. PG&E customers are billed according to an increasing block rate, where successively larger tiers of energy usage are billed at successively higher per-kWh rates. Starting on the 8th day of their billing cycle, Energy Alert customers were notified if their bill forecast projected that they would cross into Tiers 3, 4, or 5. Customers were subsequently notified after they crossed each of those three tiers for a maximum of four alerts in each billing cycle. Customers start receiving the alert on the 8th day of their billing cycle.

Bill Forecast Alert (April to December of 2016). In this program, customers can sign up for Bill Forecast Alerts (BFA) to set personalized budget thresholds and are notified via email, text, or phone when they are projected to exceed that amount during their monthly billing cycle.

Additional information on each program is provided in Section 2.

Research Objectives

The four research objectives for this project are as follows:

- **Estimate ex post energy conservation for CWP**. It is hypothesized that customers who are aware of how much energy they are using on a daily basis will be more effective in managing their energy consumption. Therefore, the first research objective was to estimate the effect of viewing daily or hourly energy use during the billing cycle on customers' monthly energy usage both at the program level and within subpopulations that use the website more frequently
- **Estimate ex post energy conservation for Energy Alerts/BFA**. Because PG&E charges customers for energy use on an inverted block rate schedule, it is hypothesized that if customers know when they cross into a higher priced tier, they will conserve energy in response to the higher price. Similarly, if customers set their own dollar-based threshold, it is hypothesized that customers would conserve after receiving an alert. The second research objective was to estimate the effect of Energy Alerts/BFA on customers' monthly energy usage both at the program level and within subpopulations of new BFA vs. continuing Energy Alerts participants.
- **Estimate effects of dual participation**. The third research objective was to quantify the incremental impact of dual participation in both Energy Alerts/BFA and CWP on the energy savings relative to single participation in one program or the other. By studying dual participation, we can assess whether these more highly engaged participants conserve more energy.
- **Estimate Daily Load Shapes and Hourly Savings**. The fourth objective was to investigate how participation in the SME programs influences average on-peak and daily consumption.

Key Issues

There are some unique challenges associated with meeting the research objectives defined in this project for PY2016:

- **Lack of Formal Control Group –** In a pilot setting, it is often possible to use an experimental design with randomized treatment and control groups to control for self-selection bias. However, when a program is fully deployed, as are the SME programs, a randomized control group is no longer an option.
- **Very Small Impacts Relative to Total Usage –** Evaluations from the past five program years have indicated that changes in energy use resulting from the programs are small and difficult to detect, falling somewhere in the range of 1% to 3% at the population level.
- **A Wide Variety of Levels of Involvement with Critical Information** – In each program, the level of engagement varies widely across the participants. The different levels of involvement require careful consideration in the estimation of savings for both programs.
- **Dual Participants between Programs –** The presence of two related programs and the opportunity for dual participation has caused us to modify our approach over time. During the 2011 evaluation, we discovered that there is significant overlap between the two participant populations. We handled this by post-stratifying both samples to account for dual participants within each sample. During the 2012 evaluation, we could not address this issue due to a lack of data for CWP. In the 2013-2016 evaluations, we addressed the overlap between programs by looking at each population separately: singly-enrolled CWP participants, singly-enrolled EAL/BFA participants, and dual participants.

While it is important to acknowledge the challenges associated with these issues, continual refinement of evaluation methods each year has improved our ability to match treatment and control customers and to detect savings from the programs. However, because we are only able to match treatment to control customers based on observable characteristics, we will never be able to completely duplicate the results of a designed experiment and, consequently, the matching process will inevitably have some degree of bias. This, in turn, will always lead to uncertainty in the savings estimates. These uncertainties must be associated with the evaluation's context, not necessarily the effectiveness of the program.

In addition, we did not account for participation in PG&E's many Energy Efficiency (EE) programs. This may introduce bias in our estimates. The bias is present only to the extent that CWP and Energy Alerts/BFA participants are more likely than their matched controls to sign up for and participate in EE programs. In this case, we would overstate the savings attributable to CWP or EAL/BFA because some of those savings would already be counted in other EE evaluations.

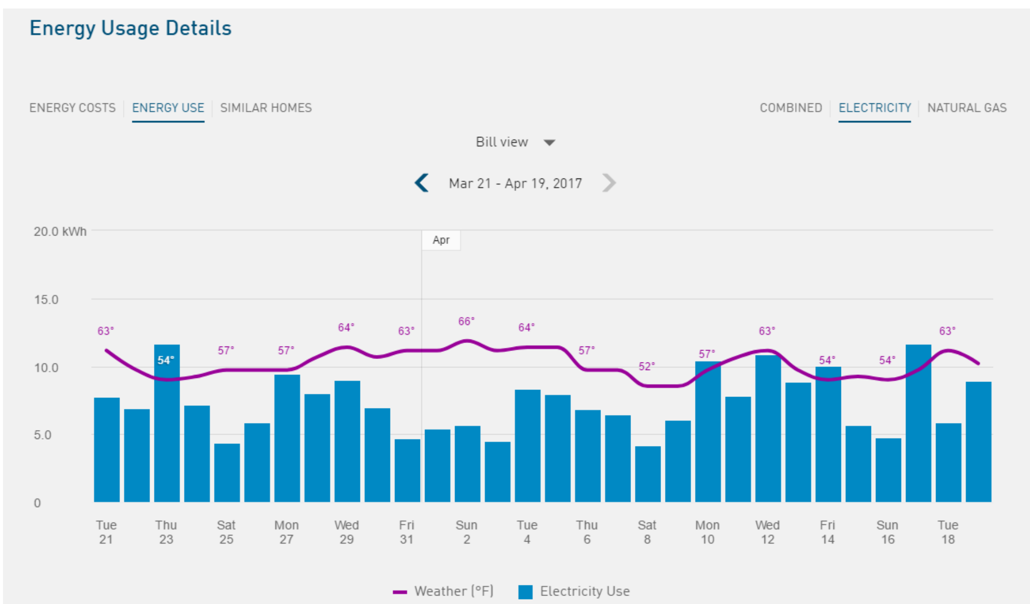
Program Details

In this chapter, we provide a more detailed program description and information regarding enrollment and engagement for each of the SME programs.

Customer Web Presentment

The CWP functionality provides online access to bills, energy usage, interval usage data, and energy management and diagnostics tools tailored to residential and small business customers with PG&E SmartMeters™ and interval data. It is available through PG&E's online portal, known as My Energy, which is a single customer-facing portal with many different functions and tools. Once an installed SmartMeter™ is read remotely, customers may log onto My Energy to check their energy usage on previous days and learn about ways to save energy.[1] The My Usage tab within My Energy provides customers with a variety of tools, which are enabled by the interval data collected by the SmartMeter™. These resources include an overview of the customer's interval (hourly or 15-minute), daily, monthly, and yearly energy usage patterns and energy costs, comparisons with the previous month's bill or the bill from twelve months prior, comparisons with similar homes and efficient homes, and comparisons of usage with the weather. Figure 2-1 shows an example of one of the customer facing views.

Figure 2-1 My Usage Tab View: "My Usage Details"



[1] Customers without a SmartMeter™ can still access My Energy to view their billed usage and create a customized energy savings plan.

Evaluation Considerations

Because our objective was to estimate the effect on customers' monthly energy usage of viewing daily or hourly energy use through the web tools, only the functions or tools that display customer interval usage data from the SmartMeter^{TM} system were evaluated within the scope of this project. In addition, to be consistent with PY2010 through PY2015 evaluations, the PY2016 analysis focused exclusively on residential customers.[2]

Participants

In this report, the CWP participants are defined as customers who viewed their usage details by logging in to "My Usage" tab at least once in 2016. In PY 2016 there were 595,280 CWP participants. This count includes participants, who are enrolled in other PG&E programs such as Energy Alerts/BFA, SmartRate^{TM} and SmartAC^{TM}. SmartRate^{TM} is PG&E's residential dynamic pricing rate, and SmartAC^{TM} is PG&E's Residential AC Load Control program. Of those 595,280 participants, 322,695 were new (first time) participants and 272,585 were continuing participants from previous years. While over 300,000 new participants[3] may seem like a large increase, it is similar to increases we have seen in previous years as PG&E continues to promote My Energy and its associated web pages to customers.

Analysis Population

The CWP population we used for the analysis is a subset of the CWP participant population that excludes SmartAC^{TM} and SmartRate^{TM} customers since their inclusion would add complexity to the analysis. To evaluate CWP savings from these participants, while isolating savings from SmartRate^{TM} or SmartAC^{TM}, we would have needed to ensure that each participant was matched to a control customer that was also participating in the appropriate additional PG&E program.

We also segment the analysis population into singly-enrolled CWP participants and participants dually-enrolled in CWP and Energy Alerts/BFA. As a result, the CWP analysis population consists of 498,095 singly-enrolled participants and 39,219 dually-enrolled participants, for a total of 537,314 CWP participants. From this point forward, unless otherwise stated, the term "participants" refers to only those included in the analysis population.

Level of Engagement

Figure 2-2 and Table 2-1 show the distribution of analysis population based on their engagement with the program. Over half of the participants (57%) viewed the My Usage data only once. Another sizeable block of participants (35%) viewed their data between two and six times. The remaining 9% of the participants viewed their data seven or more times in 2016. The engagement distribution is consistent with what we have seen in previous evaluations.

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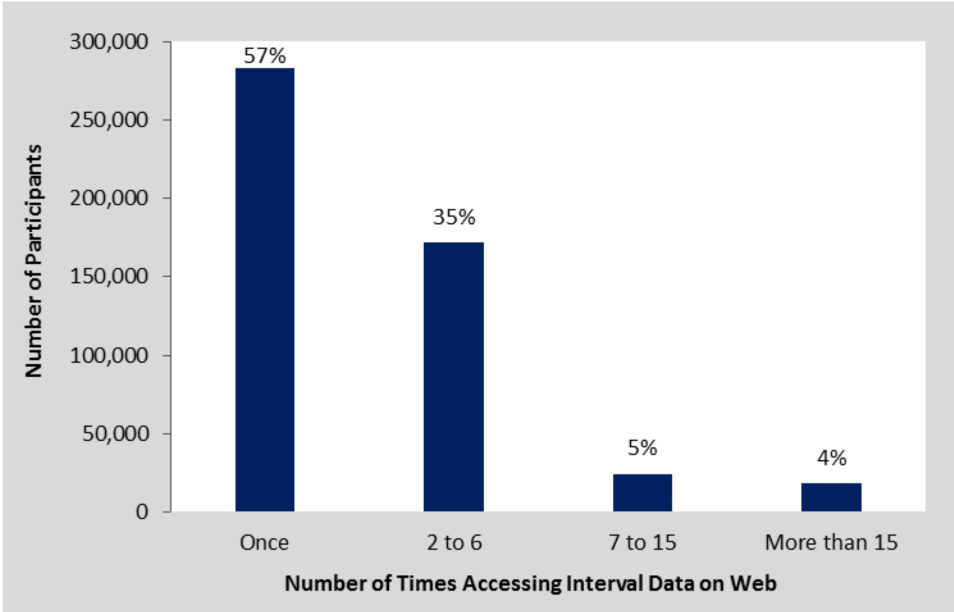
[2] Small and medium business customers and agricultural customers can also participate in CWP. When detailed participation data is available for all CWP participants, future evaluations of the program will include these customers at PG&E's request.
[3] CWP participants are counted using data from my-energy logins that tracks customer by their service agreement identification (SAID). These SAIDs are subject to change if a customer changes rates, or gets a new meter or similar reasons.

Figure 2-2 CWP Engagement - Number of Customer Logins to My Usage in PY2016



In Table 2-1 we also present the total customer count and percentage of customers in each group. By far the largest group is new customers viewing the web only one time, while the smallest groups are new and continuing customers viewing the web more than six times.

Table 2-1 Distribution of CWP Participants by Engagement Level

Number of Visits	Participant Count (New)	Participant Count (Continuing)
1 visit	187,374 (35%)	95,912 (19%)
2 to 6 visits	81,801 (16%)	90,216 (20%)
7 to 15 visits	7,428 (1%)	16,879 (4%)
More than 15 visits	7,203 (1%)	11,282 (3%)

Energy Alerts and Bill Forecast Alerts

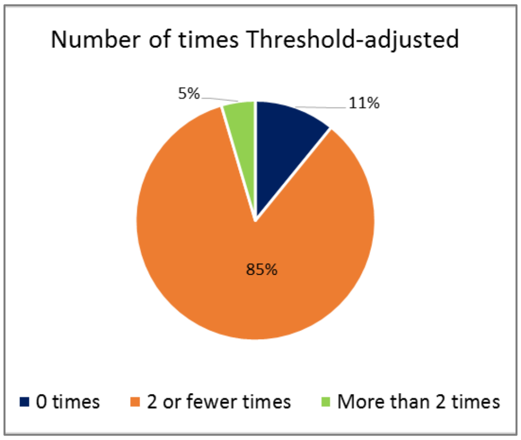
The Energy Alerts (EAL) Program became operational in June 2010 as an option for PG&E customers with a SmartMeter™[4] and this program was discontinued in March of 2016. The program allowed customers to receive advance warning via email, phone, or text message if their electricity usage was projected to move into Tiers 3, 4, 5 by the end of the current billing cycle. The customer's projected billing-cycle usage was calculated daily starting on the eighth day of the customer's billing cycle. Alerts were subsequently sent to those customers whose total usage for the billing cycle was likely to enter the higher (e.g. third or fourth) pricing tiers. Alerts were also sent out when the customer's actual usage entered any of the higher pricing tiers, with a maximum of four Energy Alerts per service agreement in a billing cycle. CARE[5] customers were only charged for usage on three tiers and were therefore notified only as they crossed into tier 3.

[4] PG&E implemented the program in 2010 prior to the CPUC's order to provide these services to customers under the Privacy Decision D.11.07.056.

[5] The California Alternate Rates for Energy (CARE) program provides discounted energy rates for low-income residential customers who qualify for the program based on the number of people living in the home and the household's total annual income.

In PY 2016 Energy Alerts changed its product offering and was renamed to Bill Forecast Alert (BFA). BFA replaced Tier Alerts with an alert that warns customers when their energy bill is projected to reach a dollar threshold. Customers can set a monthly bill alert amount of their choice. They are then notified via email, phone, or text message when they are on pace to exceed that amount by the end of their billing cycle. Figure 2-3 (left) shows the number of times that BFA participants adjusted their alert threshold in 2016.

Figure 2-3 Threshold Adjustments



BFA (and formerly EAL) are only available for residential customers who are SmartMeter™ read and billed BFA participants are required to be a single-premise customer with a SmartMeter™on an eligible residential rate plans.[6]

Customers could enroll in EAL, or currently BFA, online via the My Energy website. During the past few years, PG&E has marketed EAL/BFA in a similar manner as CWP and often in parallel with CWP and My Energy communications. In December 2013, the My Energy homepage was redesigned, which made it easier for customers to connect to other often-used functions, such as "analyze usage", "compare rate plans", and Energy Alerts or Bill Forecast Alerts. In the past three years, there were no direct marketing efforts for Energy Alerts, but enrollments continued to increase, most likely due to greater customer awareness of PG&E's digital services accessible through the My Energy website. There was no large direct marketing effort for BFA during 2016.

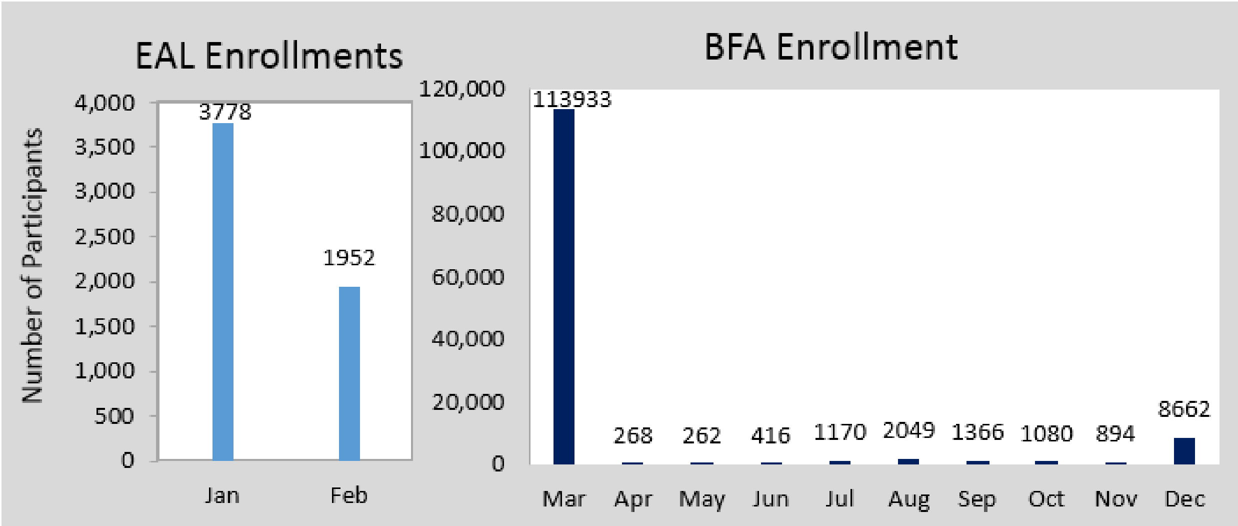
Participants

There were approximately 130,100 EAL and BFA participants[7] in 2016. This count also includes participants, who are enrolled in other PG&E programs such as CWP, SmartRate™ and SmartAC™. Of those, 16,167 were new (first time) BFA participants and 113,933 were transitioned from Energy Alerts from early 2016 or previous years. Figure 2-4 shows the number of new enrollments in each month of 2016. The enrollment numbers in January and February, in light blue, represent new EAL enrollments in those months. All of the dark blue bars represent enrollment in BFA. The large spike in enrollments in March represents the roll-over of EAL enrollees to the new BFA program.

[6] HG1, HE1, HE6, HE7, HE8, HE9, HEA9, HEB9, HEVA, HEVB, HETOUA, HETOUB, G1, E1, E6, E7, E8, E9, EA9, EB9, EVA, EVB are eligible residential rates to enroll in BFA.

[7] BFA enrollments are counted at account level but the analysis for this report is performed at SAID level.

Figure 2-4 Energy Alerts and BFA – New Enrollment by Month



Analysis Population

The Energy Alerts/BFA population we used for analysis is a subset of the Energy Alerts/BFA participant population. As with CWP, to avoid a more complex methodology, the analysis population excludes SmartAC™ and SmartRate™ customers. We also segment the analysis population into singly-enrolled Energy Alerts/BFA participants and participants dually-enrolled in CWP and Energy Alerts/BFA. As a result, the Energy Alerts/BFA analysis population consists of 61,210 singly-enrolled participants and 39,219 dually-enrolled participants, for a total of 100,429 analyzed Energy Alerts/BFA participants in 2016. From this point forward, unless otherwise stated, the term "participants" refers to only those included in the analysis population.

Level of Engagement

Figure 2-5 is divided in two sub-graphs. The graph on the left shows the average number of alerts per participant from the analysis population in January and February of 2016 for EAL. The graph on the right shows the percentage of participants that received a Bill Forecast Alert that month from the time period of April to December of 2016. As noted above, alerts for EAL and BFA are structured differently. EAL participants could receive up to four alerts per month as they crossed onto different tiers. On the other hand, BFA participants receive only one alert per month if their bill is projected to be above their dollar threshold amount. No alerts were sent in the month of March while participants transitioned from EAL to BFA. The BFA graph displays small peaks in the number of alerts in summer and a significant peak in the winter, which is expected due to seasonal impacts on energy usage. The slight summer peak is in the months of July and August where about 38% and 34% of the participants received an alert. 78% of participants received an alert for the month of December as they crossed their preset threshold amount.

Figure 2-5 Energy Alerts and Bill Forecast Alerts in PY2016

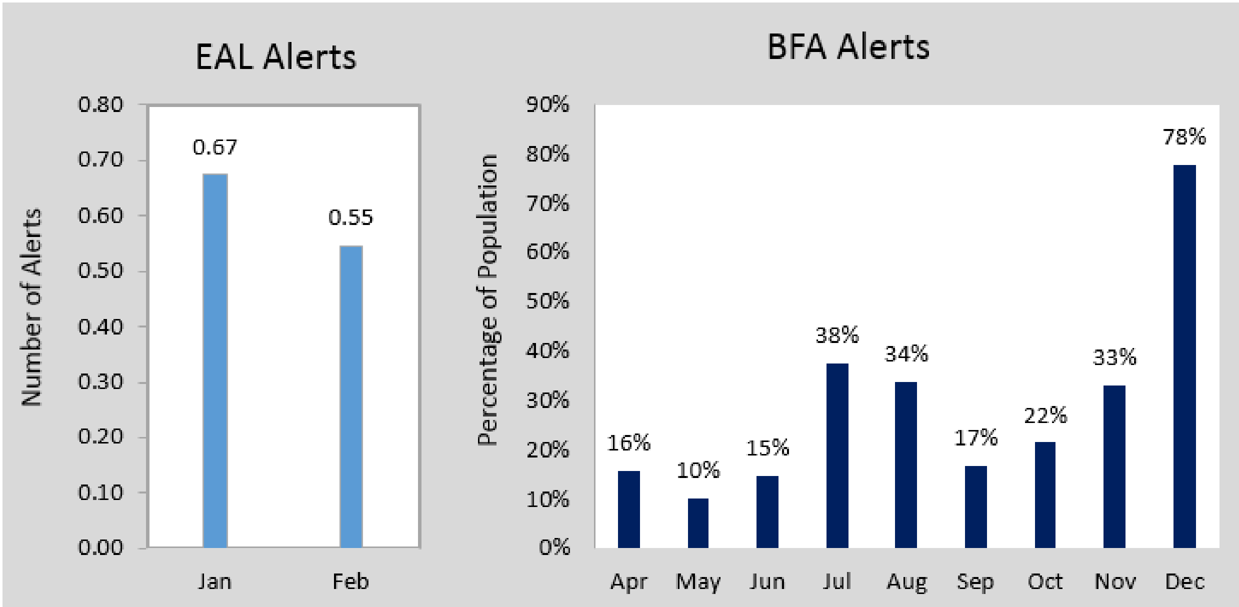


Table 2-2 summarizes the distribution of Energy Alerts participants in the analysis population by the number of alerts received from January through February and the notification type. Similar to 2015, more than half of the participants (58%) received an alert by email. The old product structure of EAL was discontinued after February of 2016.

Table 2-2 Distribution of Energy Alerts Participants by Number of Alerts (Jan-Feb)

Number of alerts received	Participant Count (E-mail)	Participant Count (SMS/phone)
5 or less	26,840 (54%)	19,374 (39%)
More than 5	1,656 (4%)	1,352 (3%)

Table 2-3 summarizes the distribution of BFA participants in the analysis population by notification type. This represents alerts received from April through December. About one fourth of the participants never received an alert in the year of 2016 and therefore their preferred notification type is unknown.[8]

Table 2-3 Distribution of BFA Participants by Notification Type (Apr-Dec)

Participant Count (E-mail)	Participant Count (SMS/phone)	Participant Count (Unknown)
50,115 (43%)	37,771 (33%)	28,209 (24%)

Dual Enrollment

A large percentage of participants are enrolled in both CWP and Energy Alerts/BFA. For the CWP program, a customer is considered to "enroll" the first time they view their interval data on the web. For Energy Alerts/BFA, enrollment has the more traditional enrollment definition of the date the participant signed up for the program. Of the 595,280 customers who viewed the website at least once in 2016, 51,228 were dually-enrolled in Energy Alerts/BFA.

[8] It should be noted that notification channels are not mutually exclusive, and that a participants notification channel(s) can be determined without them receiving an alert.

Analysis Population

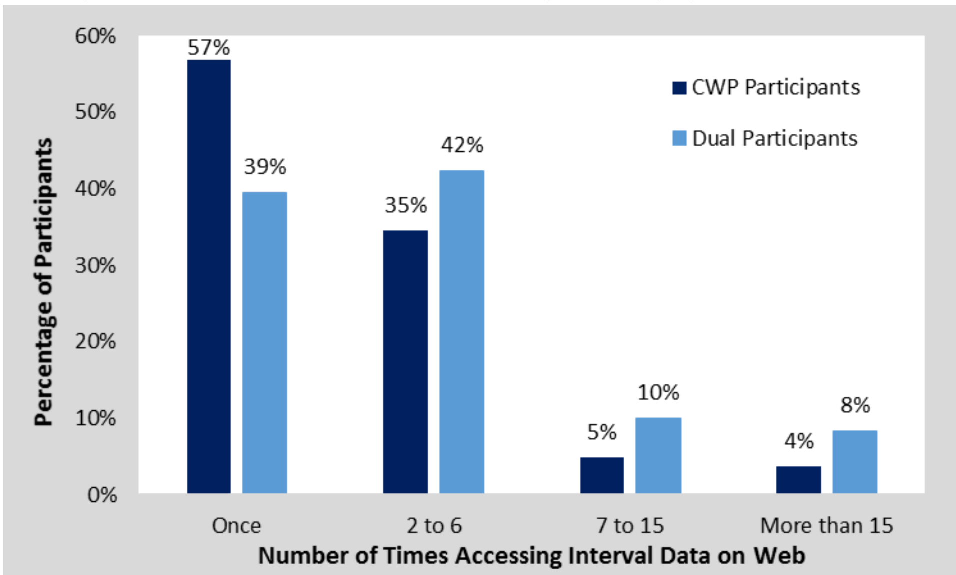
The analysis population for customers dually-enrolled in CWP and Energy Alerts/BFA, excluding SmartAC™ and SmartRate™ customers, is 39,219 customers.

Level of Engagement

Figure 2-6 shows the distribution of dual-participating customers that engaged with the CWP program at various levels during 2016 compared to all CWP participants. Clearly, dual participants are more highly engaged with the CWP portal, viewing their interval data more often that the singly-enrolled participants:

- About 42% of dual participants viewed their data between 2 and 6 times in 2016, compared to 35% viewed of CWP-only participants.
- About 18% of dual participants viewed their data seven or more times compared to only 9% of CWP-only participants.

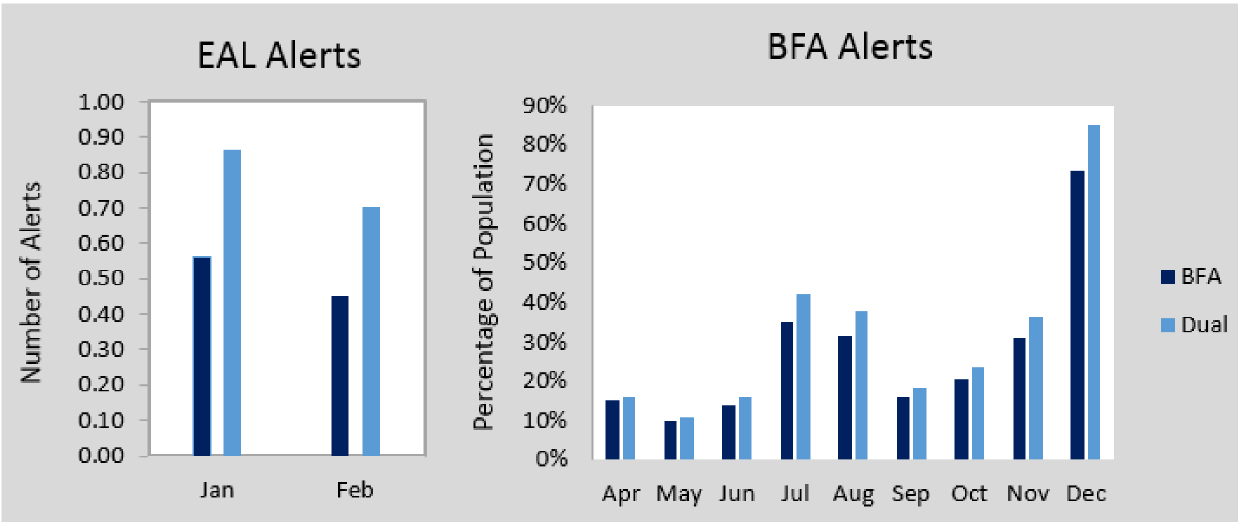
Figure 2-6 Comparison of CWP Program Engagement – PY2016



Again

Figure 2-7 is divided in two sub-graphs and looks at singly enrolled EAL/BFA and dual participants that are enrolled in EAL/BFA and CWP. The graph on the left shows the average number of alerts per participant from the analysis population in January and February of 2016 for singly and dually enrolled participants. The graph on the right shows the percentage of participants from the analysis population that received an alert from April to December of 2016 for singly and dually enrolled participants. Seasonality again plays a role in the results. These graphs show a similar trend across the two groups. Dual participants are likelier to receive alerts compared to singly-enrolled participants because dual participants tend to be higher energy users.

Figure 2-7 Comparison Energy/BFA Alerts per Participant in PY2016



Analysis Methodology

This section describes the analysis methodology for the evaluation of the CWP and Energy Alerts/BFA programs. First, we describe the sample design process and the matching strategy used to match sample treatment customers to control customers. Next, we describe the analysis techniques we used to estimate the impacts of the two programs.

Sample Design

In previous evaluations, we found that using very large samples enabled detection of small energy impacts with increased precision. Based on this experience, we selected large samples for the PY2016 analysis. In addition, we focused on optimizing the sample sizes for the individual subpopulations of interest to improve our ability to achieve statistically valid results within each subpopulation. As part of the optimization process, we stratified some population segments to reduce the variance of the estimates while keeping overall sample sizes manageable. For other subpopulations, we analyzed a census of participants, meaning that we included all participants who passed the data screening process.

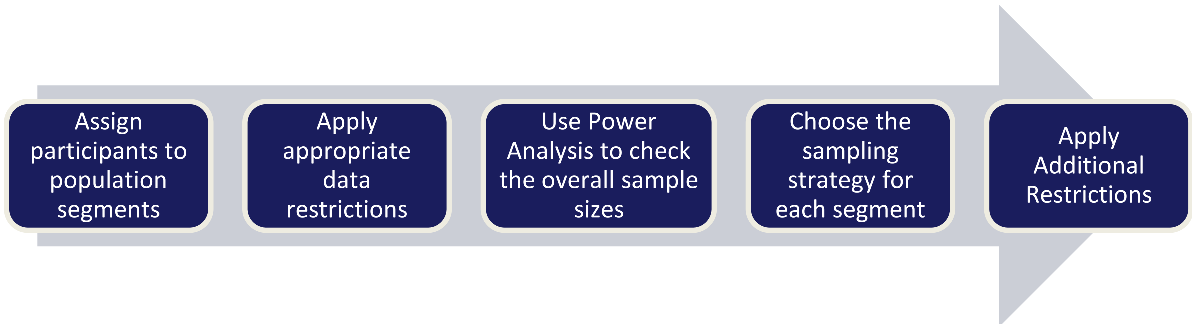
We designed three different samples – one for single enrollment in CWP, another for single enrollment in Energy Alerts/BFA, and the last for dual participation. We segmented each sample into several subpopulations of interest which correspond to subpopulations for which we have estimated impacts in past years:

- **Singly-enrolled in CWP** (8 segments)
  - Level of engagement measured by number of times the participant viewed their usage data online (1 view, 2-6 views, 7-15 views, 16+ views)
  - Continuing versus new user
- **Singly-enrolled in Energy Alerts/BFA** (2 segments)
  - Energy Alerts/New BFA versus New BFA user
- **Dual Participation in both Energy Alerts/BFA and CWP** (16 segments)
  - Level of engagement (1 view, 2-6 views, 7-15 views, 16+ views)
  - Continuing versus new CWP user
  - Energy Alerts/ New BFA versus New BFA user

Since there are 16 population segments for dual participants, we only present dual participation results at the CWP or Energy Alerts/BFA level in this report.

Figure 3-1 illustrates this sample design process. Following these steps allowed us to optimize the sample sizes and mitigate excessive interval data processing. More importantly, this optimization process helped to ensure that even small savings, if present, would be detected with statistical significance at both the population level and within the desired subpopulations.

Figure 3-1 Illustration of Sample Design Process



The steps are described in more detail below:

- **Assign each participant to the appropriate segment**. This step consists of classifying the participants into the population segments defined above for each of the three samples. It also includes categorizing participants by enrollment period.
- **Apply restrictions and exclude data where necessary.** We apply ten restrictions to ensure we have a sufficient duration of complete, validated, and matched demographic and interval data for the analysis and to exclude customers who also participated in other programs to avoid different methodology and control groups. The restrictions are as follows:
    - Participants that started participating in either CPW or Energy Alerts prior to January 1, 2013.[9]
    - Energy Alerts/BFA participants who un-enrolled before October 1, 2016
    - Participants that started (Energy Alerts/BFA enrollment date or CWP first visit) on or after October 1, 2016[10]
    - Participants who participated in SmartAC™ or SmartRate™ during the pretreatment period or 2016[11]
    - Participants without demographic data
    - Participants with billing data identified as problematic during our cleaning process
    - Participants without at least seven months of 2016 billing data
    - Participants without at least seven months (212 days) of 2016 interval data
    - Participants without nine months of pretreatment billing data
    - Participants without nine months (270 days) of pretreatment interval data
- **Power analysis.** To check the statistical power of each sample we used a power analysis tool that AEG developed for PG&E. This tool uses a statistical power calculation to determine the sample size needed to detect statistically significant monthly savings for a given effect size. This will provide us a confirmation that the total sample size for each sample should be able to detect an effect size of 1% with an alpha level of 5% and beta level of 80%.[12] Whenever possible, we

[9] For customers that started participating prior to 2013, we create their match based on pretreatment data that is 3 or more years old. Based on our analysis, presented in Appendix A, we believe that it is less risky to remove them from the population for analysis, than in match them based on old pre-treatment data.

[10] In addition to having limited analysis data for these customers in the treatment period, we believe we cannot accurately assign them to a proper segment. For example, if a customer started participating in November 2016 and received two alerts through the end of the year, we don't know how many more alerts they would have received had they started participating earlier.

[11] We exclude participants that participated in SmartAC™ and SmartRate™ to avoid double counting of savings. When savings are estimated for the other programs, the savings attributable to CWP or Energy Alerts/BFA would be embedded in those estimates, if we count them again here, we would count the CWP or Energy Alerts/BFA savings for those customers twice.

[12] The alpha level is our significance, we will have a 95% chance of detecting an effect of the given effect size given that it exists. The beta level is the probability of a type II error, or failing to detect an effect that is present.

selected a sample that would result in a statistically significant estimate; however, in some segments there were not enough customers in the population to achieve an adequate sample size, in those cases we used all the customers with viable data.

- **Choose the sampling strategy and select the sample**. For each segment in each of the three samples, we select either a usage-based stratified sample, a simple random sample, or a census based on our past evaluation results and the number of participants in the segment.
- **Apply additional restrictions**. Finally, we excluded any participants with interval data identified as problematic during our cleaning process.

The subsections below describe the sample design results for singly-enrolled participants of CWP, singly-enrolled participants of Energy Alerts/BFA, and dual participants of both CWP and Energy Alerts/BFA.

Singly-enrolled CWP Sample Design

We first divide the CWP analysis population into the eight segments listed previously and apply the data restrictions.[13] We began with a pool of 498,095 participants, and after applying all the data restrictions, the total analysis pool shrinks to 210,37, which is 43% of the total original pool. The majority of participants are removed due to lack of sufficient pre-treatment interval data and/or pretreatment billing data. Recall that the participation-start dates range from 2013 – 2016 with many customers having pretreatment periods that reach back several years in time. The farther back the pretreatment period is, the more likely a participant is to be excluded based on lack of interval or billing data. See Appendix A: Potential Sample Bias, for an exploration of the bias this may introduce.

Table 3-1 shows the breakdown of the number of participants in the sample for each CWP population segment. Of the eight CWP population segments, we concluded that five would be best suited for energy usage-based stratification (shaded in light blue). For the remaining three segments, we determined it was necessary to use the entire population of screened participants. The total sample size for the singly-enrolled CWP participants was 15,308.

Table 3-1 Singly-enrolled CWP Sample Breakdown

Number of Visits	Participant Count (New)	Participant Count (Continuing)	Total Participants
1 Visit	1,500	1,500	3,000
2 to 6 Visits	1,500	1,500	3,000
7 to 15 Visits	1,790	3,000	4,790
More than 15 Visits	1,507	3,011	4,518
Total	**6,297**	**9,011**	**15,308**

Singly-enrolled Energy Alerts/BFA Sample Design

Similarly, we divide the Energy Alerts/BFA analysis population into the two segments listed previously and apply the data restrictions.[14] We began with a pool of 61,210 participants, after applying all the data restrictions the total analysis pool shrinks to 17,565 which is 39% of the total original pool.[15]

Table 3-2 shows the breakdown of the number of participants in the sample for each Energy Alerts/BFA population segment. We concluded that it was necessary to sample one Energy

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[13] Our analysis pool consists of all singly-enrolled CWP participants (i.e., they are not also enrolled in Energy Alerts/BFA) who viewed data at least once in 2016, and are not enrolled in SmartRate™ or SmartAC™

[14] Our analysis pool consists of all singly-enrolled Energy Alerts/BFA participants (i.e., they are not also enrolled in CWP) who received at least one alert in 2016, and are not enrolled in SmartRate™ or SmartAC™

[15] The majority of participants are removed due to lack of sufficient pre-treatment interval data and/or pretreatment billing data. Recall that the participation start dates range from 2010 – 2016 with many customers having pretreatment periods that reach back several years in time. The farther back the pretreatment period is, the more likely a participant is to be excluded based on lack of interval or billing data. See Appendix A Potential Sample Bias for an exploration of the bias this may introduce.

Alerts/BFA population segment (again shaded in light blue). These two cells were sampled primarily to keep overall sample sizes manageable. The total sample size for the singly-enrolled Energy Alerts/BFA participants was 10,609.

Table 3-2 Singly-enrolled Energy Alerts/BFA Sample Breakdown

	Total Participants
Energy Alerts / New BFA User	10,000
New BFA User	609
Total	**10,609**

Dual Participation Sample Design

Similarly, we divide the Dual participation analysis population into the 16 segments listed previously and apply the data restrictions.[16] We began with a pool of 39,219 participants, after applying all the data restrictions the total analysis pool shrinks to 8,486 which is 33% of the total original pool.[17]

For the dual participants, since the final population was of a manageable size we simply included the entire population of screened participants. Table 3-3 shows the breakdown of the number of participants in the sample for each Dual participant population segment.

Table 3-3 Dual Participation Sample Breakdown

	Number of Visits	New Participant Count (E-mail)	New Participant Count (SMS/phone)	Total Participants
Energy Alerts / New BFA User	1 Visit	2,095	1,426	3,521
	2 to 6 Visits	2,381	868	3,249
	7 to 15 Visits	489	68	557
	More than 15 Visits	396	82	478
New BFA User	1 Visit	70	183	253
	2 to 6 Visits	105	189	294
	7 to 15 Visits	28	39	67
	More than 15 Visits	28	39	67
Total		**5,592**	**2,894**	**8,486**

Creating the Matched Control Groups

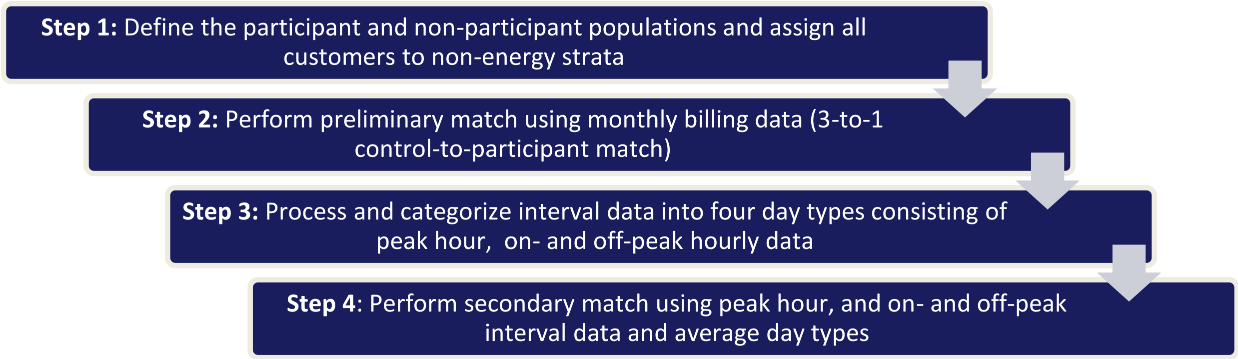
We estimated the energy savings for each program by comparing the energy use of participating customers with a carefully selected control group of non-participating customers who are also My Energy users. We used a stratified matching technique to construct a control group that is very similar to the participant group in all observable ways, except for being exposed to the program treatment.[18] Figure 3-2 and the subsequent text describe the four key steps in the matching process.

[16] Our analysis pool consists of all dually-enrolled CWP and Energy Alerts/BFA participants who viewed data at least once in 2016, received at least one alert in 2016, and are not enrolled in SmartRate™ or SmartAC™

[17] The majority of participants are removed due to lack of sufficient pre-treatment interval data and/or pretreatment billing data. Recall that the participation start dates range from 2010 – 2016 with many customers having pretreatment periods that reach back several years in time. The farther back the pretreatment period is, the more likely a participant is to be excluded based on lack of interval or billing data. See Appendix A Potential Sample Bias for an exploration of the bias this may introduce.

[18] In a pilot setting it is often possible to use an experimental design with randomized assignment to treatment and control groups to control for self-selection bias. Self-selection bias is the presence of systematic differences between customers who volunteer for a program or treatment and those who do not. Self-selection bias is problematic because the estimates of savings cannot be separated from the systematic differences between treatment and control customers. Matching

Figure 3-2 Illustration of Matching Process



Step 1 is to define non-participant population and the treatment and pre-treatment periods for each participant. We limited the non-participant pool to those customers that signed up for My Energy, but did not participate in CWP, Energy Alerts/BFA or any other excluded PG&E program. This ensures that potential control group customers have internet access and actively engage with PG&E through their website, making them more similar to CWP and Energy Alerts/BFA participants than those that would not have those characteristics.

Defining the treatment and pre-treatment periods for each participant is a slightly more complex. Both CWP and Energy Alerts/BFA are fully deployed programs in which participants can enroll or un-enroll freely. This means that pretreatment periods are customer specific. In order to avoid creating too many groups based on enrollment, we created several distinct enrollment windows and defined the pretreatment period as the 12 months immediately prior to the start of the enrollment window. To keep summer months together, we split the years into two six-month blocks, from December to May and from June to November, where all months but December belong to the same year.

Once the non-participant population is identified, both the treatment and candidate control group pools were assigned to strata or filters that are categorical in nature. We used PG&E defined weather zones, Community Choice Aggregation (CCA) status, housing type (single family vs. multi-family), and net energy metering (NEM) status as filters. This ensures that customers in similar regions and with similar home types will be matched to one another capturing some of the unobservable attributes that affect the way customers use energy. After developing strata based on their region, home type, CCA and NEM status, all of the customers, both participants and the non-participant pool, were assigned to a specific group based on their strata. At this stage, we ensured that there were enough control customers in each stratum. Usually, a ratio of 10 control customers to each treatment customer is sufficient.

Step 2 is to perform the preliminary match based on billing data. To determine how close each treatment customer is to a potential match, we used a Euclidean distance metric. The Euclidean distance is defined as the square root of the sum of the squared differences between the matching variables. Any number of relevant variables can be included in the Euclidean distance. For this preliminary match, we included twelve months of pre-treatment calendarized billing data with a rolling pre-treatment window based on the participant's start date. The Euclidean distance for this set of variables can be calculated by Equation 1 below.

$$ED = \sqrt{(jan_{Ti} - jan_{Ci})^2 + (feb_{Ti} - feb_{Ci})^2 + \ldots + (nov_{Ti} - nov_{Ci})^2 + (dec_{Ti} - dec_{Ci})^2} \qquad (1)$$

After calculating the distance metric within each group for each possible combination of treatment and control customer, the control customer with the smallest distance is matched to each treatment customer without replacement. We selected the three closest matches for each of our treatment

participants to the control group can help eliminate bias for any observable characteristic. Using only those customers who have accessed My Energy for the control group also helps reduce bias, since this captures some of the unobservable characteristics of online users. However, because we cannot fully duplicate the results of a designed experiment through matching, the matches will necessarily have some level of bias, and the estimates will also have some level of uncertainty.

customers creating a smaller control group pool with a 3-to-1 ratio of control to treatment customers.

Step 3 is to use pre-treatment interval data for both the treatment and control customers to create new variables that can be used to create a one-to-one match that will be suitable for hourly modeling. In this case, we want the control and treatment customers to have not only similar energy usage, but have similar daily and seasonal load shapes. For the secondary match, we included the following variables in the distance metric.

- Summer Weekday: average on-peak kWh, average off-peak kWh, maximum on-peak kW
- Summer Weekend: average on-peak kWh, average off-peak kWh, maximum on-peak kW
- Winter Weekday: average on-peak kWh, average off-peak kWh, maximum on-peak kW
- Winter Weekend: average on-peak kWh, average off-peak kWh, maximum on-peak kW

We also weight the variables to reflect the relative importance of the estimates, with maximum on-peak variables having the most weight and off-peak variables having the least weight.

Step 4 is to use the same process described above in Step 2 to generate a one-to-one match of treatment to control customers out of the pre-matched pool based on the seasonal and day-type variables described above.

Estimating Energy Savings

Once the matching process is complete, we estimated the monthly and daily, on and off-peak impacts first using a statistical DID approach, and second, using a fixed-effect regression approach. This two-step process allows us to obtain preliminary estimates of savings that are unconstrained by the assumptions of a regression model. Then, we refine those estimates using the regression approach. Both the statistical DID and regression based approaches are described below.

Statistical DID Approach – Estimating Preliminary Impacts

The difference-in-difference method compares the daily or monthly usage of the treatment customers to the matched control group customers, both during the participation period (treatment period) and for a time before participation started (pretreatment period). Comparison during the treatment period gives an unadjusted estimate of the impacts. This estimate is then corrected using the difference during the pretreatment period to adjust for any preexisting differences between the participant and control groups.

The DID method consists of the following steps for each of the three samples.

- **Input source data** – Start with either monthly or hourly interval data for the treatment and pretreatment periods for participating customers and a control group.
- **Create average load shapes for the daily analysis** – For each participant and matched control group customer, calculate the average load shape for each day type during the pretreatment and treatment periods. Then, average the load shapes across all customers for both the pretreatment and treatment periods.
- **Calculate first difference** – For the daily analysis, calculate the difference between the control group's average load and the participant group's average load for each day type, in the treatment period and in the pretreatment period. The result of the difference during the treatment period is the first difference, which represents the unadjusted impact. For the monthly analysis calculate the difference between the control and treatment group's monthly usage in the treatment and pretreatment period.
- **Calculate second difference** – The result of the difference during the pretreatment period is the pretreatment difference. Subtract pretreatment difference for each day type or month from the unadjusted impact to get the adjusted or corrected impact for each population segment. This second difference represents the estimated savings impacts for each day type or month corrected for the pre-participation differences between the treatment and control groups.

- **Estimate impacts for subpopulations** – Aggregate the results for each population segment to determine average monthly and annual impacts. Estimate demand and energy impacts for each day type using the day type estimates. Estimate the monthly and annual savings for the program using the monthly estimates.
- **Estimate program-level impacts for the population** – Apply the appropriate weights to the population segment results to expand them to the entire population.
- **Determine statistical significance** – Create 95% confidence intervals around the savings estimates. If we determine that the difference in consumption is statistically significant, this indicates that we can be 95% certain that the actual savings value for the subpopulation or population falls within the confidence interval and is not equal to zero.

Equation 2 shows a simplified form of the mathematical calculations used in the difference-in-differences analysis to estimate energy savings for each day type or month.

$$Savings = (Cntl_{after} - Tx_{after}) - (Cntl_{before} - Tx_{before}) \quad (2)$$

Where

$Cntl_{after}$ is the average control group customer energy use in the treatment (after) period

Tx_{after} is the average participant group (also referred to as the treatment group) customer energy use in the treatment (after) period

$Cntl_{before}$ is the average control group customer energy use in the pretreatment (before) period

Tx_{before} is the average participant group customer energy use in the pretreatment (before) period

Fixed Effect Regression Approach – Refining the Estimates

The models include the treatment and control customers in both the treatment and pre-treatment periods. This type of data is generally referred to as panel data and can be modeled in several different ways. However, it is important to recognize that panel data has some inherent issues:

- Panel data tends to be auto correlated, which simply means that the variables are correlated through time. For example, electricity use during a particular hour on one day is likely to be highly correlated with electricity use in that hour on the prior day.
- Panel data is also often heteroskedastic, which means that the variances associated with the variables are not constant. For example, customers that use more electricity are likely to have larger variances, and those that use less electricity are likely to have smaller variances.

The presence of these issues introduces additional considerations into the modeling approach. A fixed-effect model introduces indicator variables for each participant which are used to capture and control for unobservable customer-specific effects. The robust error correction adjusts the standard errors and t-statistics to account for autocorrelation and heteroskedasticity that would otherwise bias these values. Because the sample is stratified, we also used a weighted regression in order to properly handle the sample weights.

Monthly Ex Post Impacts

Equation 3 presents a simplified version of the model we used to estimate the monthly savings for each of the programs. The models were developed at the segment level and included the application of the stratum weights in the analysis.

$$kwh_{it} = \alpha_i + [\gamma_{1t} + \gamma_{2t}P(x)]Month_t + [\gamma_{3t} + \gamma_{4t}P(x)]CDD_t + \beta_t P(x)T(x)Month_t + \varepsilon_{it} \quad (3)$$

Where the variables and their coefficients are defined as:

kwh_{it}	Consumption of customer i in month t

α_i	A fixed effect for each customer i
$[\gamma_{1t} + \gamma_{2t}P(x)]Month_t$	A vector of monthly indicator variables where $P(x)$ is an indicator variable that takes on a value of one during the treatment period
$[\gamma_{3t} + \gamma_{4t}P(x)]CDD_t$	The cooling effect of month t where $P(x)$is an indicator variable that takes on a value of one during the treatment period
$\beta_t P(x)T(x)Month_t$	A vector of monthly indicator variables where $P(x)$ is an indicator variable that takes on a value of one during the treatment period and $T(x)$ is an indicator variable that takes on a value of one if a customer i is a program participant
ε_{it}	The error for customer i during month t

The model output allowed us to estimate the effect of the programs in each month of 2016. We then calculated the savings from the coefficients estimated in the model both at the segment and program level. Finally, we used a statistical software package to output the standard error of each of the impact estimate. The standard errors are used to calculate confidence intervals for the point estimates. Please see Appendix B Model Selection and Validation for a discussion of our model validation process.

On- and Off-Peak Ex Post Impacts

We developed eight day types for the average on- and off-peak impact analysis. These day types are consistent with the day types developed in previous evaluations and will allow us to produce comparable results across years. We used the distribution of temperatures in each weather station to establish cut-offs for the different day types at the 85^{th} and 15^{th} percentiles. Below we present the eight day types:

- Hot summer weekday – an average of approximately 8 to 12 days on which average temperature exceeds the 85^{th} percentile for that weather station
- Typical summer weekday – all summer weekdays not already defined as "hot" or "cold"
- Cool summer weekday – an average of approximately 8 to 12 days on which average temperature falls below the 15^{th} percentile for that weather station
- Summer weekend – an average of all summer weekends.
- Warm winter weekday – an average of approximately 8 to 12 days on which average temperature exceeds the 85^{th} percentile for that weather station
- Typical winter weekday – average of all winter weekdays not defined as "warm" or "cold"
- Cold winter weekday – an average of approximately 8 to 12 days on which average temperature falls below the 15^{th} percentile for that weather station
- Winter weekend – an average of all winter weekends.

While we developed on-peak and daily models at the segment level to estimate the savings, we did not observe statistically significant estimates at the program level. We also used the DID results to estimate the on-peak and daily impacts for each segment and program.

Accounting for Dual Participation

When we estimate the savings for each program, it is important to account for dual participation. We do this by estimating the savings in two pieces: first, for the singly-enrolled participants, and second, for the dually-enrolled participants. The savings estimates for the singly-enrolled participants represent the impacts from the treatment program only. It is tempting to conclude that the savings estimates from the dually-enrolled participants can tell us what the additional, or incremental, savings attributable to the second program are for the dually-enrolled treatment customers. However, it is important to note that the estimate of savings for the secondary program is indicative of savings only for dually-enrolled customers, since we cannot be sure if their participation in the first program influences their savings from the second program and vice-versa.

Impact Results

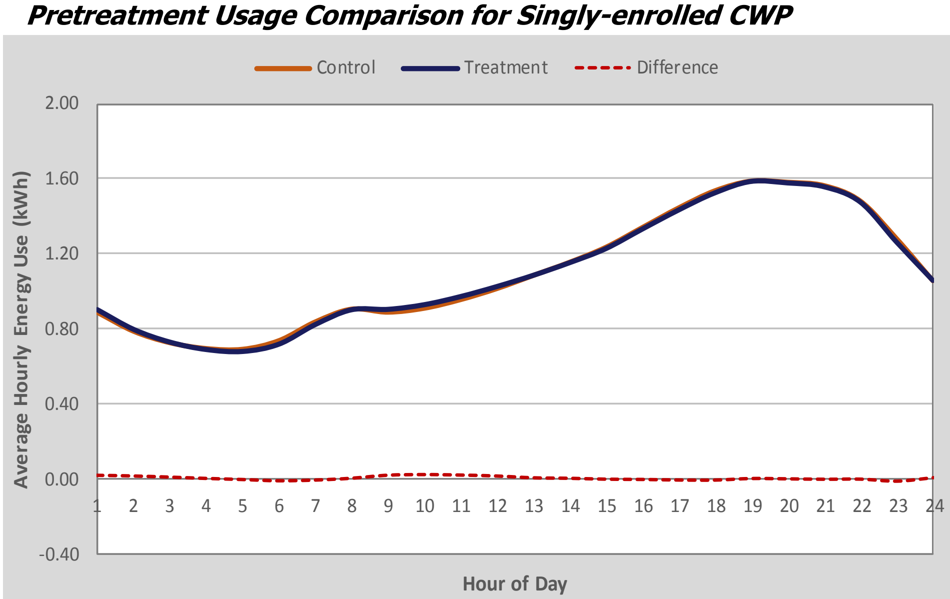
We estimated savings for singly-enrolled CWP participants, singly-enrolled Energy Alerts/BFA participants, and dual participants participating in both CWP and Energy Alerts/BFA. First, we provide the matching results, and then we present the energy impacts for single participation in each program and dual participation. The dual participation results tell us the incremental effect of participating in both programs on the impacts for CWP and Energy Alerts/BFA.

Matching Results

Before estimating the savings, it is important to check the quality of the match between the treatment and control customers. We do this by plotting average hourly pretreatment energy use of the treatment and control customers on the same graph and comparing the load shapes for each day type in each enrollment window. We used four matching day types using season and day of the week—summer weekday, winter weekday, summer weekend, and winter weekend. Summer is defined as the months May through October. Comparing usage gives us a good idea of how well customers are matched.

Figure 4-1 through Figure 4-3 show examples of matching results for singly-enrolled CWP participants, singly-enrolled Energy Alerts/BFA participants, and dual participants, respectively. The graphs compare average hourly energy use for treatment and control customers during the pretreatment period on summer weekdays. The blue line represents the participant load shape and the orange line represents the control group load shape. The dotted red line that runs along the bottom of the graph represents the difference between the treatment and control groups. The results in the figures are for the enrollment window that corresponds to December 2015 through May 2016.

Figure 4-1 Pretreatment Usage Comparison for Singly-enrolled CWP



The figures illustrate that the matching process performed very well, with similar energy usage between treatment and control customers during the pretreatment periods for each of the three participant populations. In general, the closeness of these matching results for the December 2015 through May 2016 enrollment window is representative of what we observed for the other enrollment windows. An exception is the first enrollment window (December 2012 to May 2013), for which the Energy Alerts/BFA match was not as close.

Figure 4-2 Pretreatment Usage Comparison for Singly-enrolled Energy Alerts/BFA

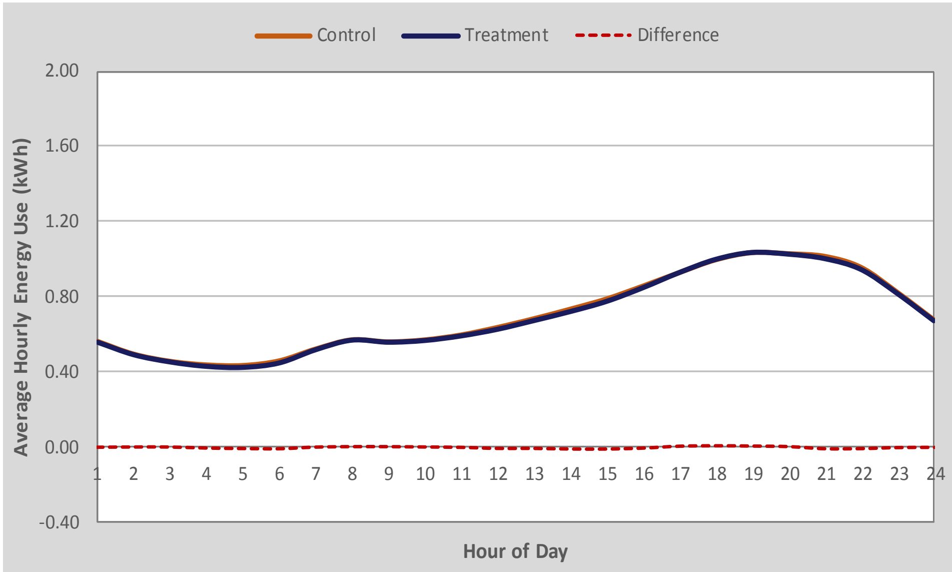
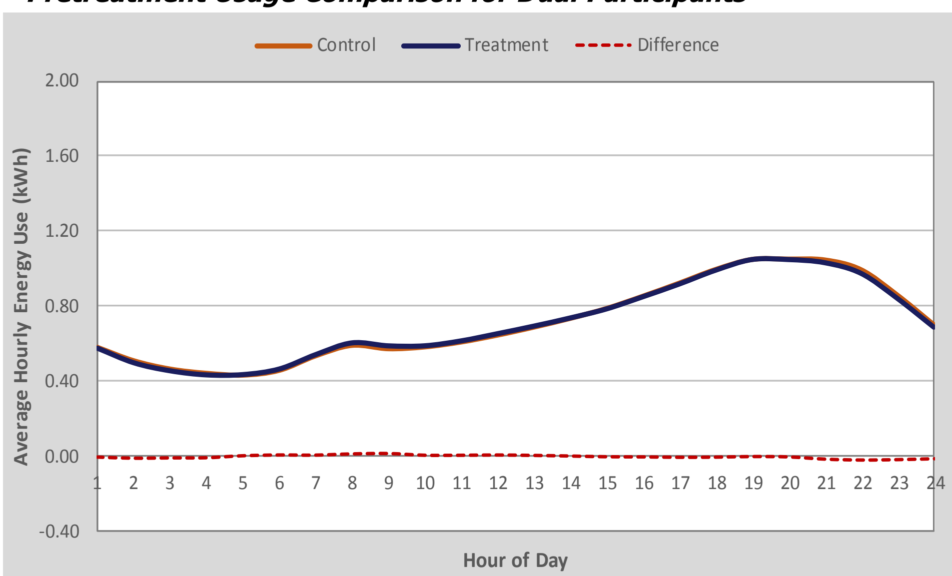


Figure 4-3 Pretreatment Usage Comparison for Dual Participants



To quantify the degree to which pretreatment energy usage between the treatment and control customers was different, we ran hourly two-sample t-tests for each of the four day types in each of the enrollment windows for singly-enrolled CWP participants, singly-enrolled Energy Alerts/BFA participants, and dually-enrolled participants. For each of the three samples in the June 2016 through November 2016 enrollment window, we conducted 24 hourly t-tests by day type. That corresponds to 192 comparisons, none of which was significant at the 90% level. For succinctness, we only show t-tests comparing *daily* energy during summer and winter weekdays for the three program groups in the June 2016 through November 2016 enrollment window in Table 4-1 below. None of the daily comparisons are statistically significant implying that the differences between control and treatment groups are not significant.

It should be noted that while in the section above we use a single enrollment window as an example to illustrate the matching results, we found that the results were very similar across all enrollment windows. We performed the hourly comparisons for each program, day type, and hour for each of the twelve enrollment windows. In total, 3,456 comparisons were made. Overall, across all programs only 0.01% of hours are statistically significantly different from their matches

Table 4-1 Comparison of Average Daily Energy: Enrollment Window December 2015 through June 2016

Subpopulation	Day Type	Control	Treatment	p-value
Singly-enrolled CWP	Summer Weekday	26.37	26.45	0.86
	Summer Weekend	27.22	27.29	0.86
	Winter Weekday	23.27	23.35	0.82
	Winter Weekend	24.15	24.24	0.79
Singly-enrolled Energy Alerts/BFA	Summer Weekday	16.85	16.78	0.86
	Summer Weekend	17.59	17.58	0.96
	Winter Weekday	14.47	14.43	0.88
	Winter Weekend	15.26	15.26	0.99
Dually-enrolled	Summer Weekday	17.17	17.14	0.95
	Summer Weekend	17.98	17.97	0.98
	Winter Weekday	16.38	16.43	0.89
	Winter Weekend	15.53	15.52	0.98

Customer Web Presentment Results

CWP Energy Savings

In order to assess annual energy savings, we estimated savings at the monthly level using both the difference in differences and regression approaches with comparable results. The monthly energy savings results presented throughout this chapter are based on the regression results, for a comparison of the two methods please see Appendix B, Model Selection and Validation. The daily demand results are based on the DID results only.

The analysis results are reported as the average per-participant savings estimates for each month in 2016. The annual total is simply the sum of each statistically significant point estimate, and the associated percentage impact is based on the total estimated usage for the year—that is, the adjusted control group load. Table 4-2 summarizes our findings for CWP, for both singly- and dually-enrolled participants.

For singly-enrolled CWP participants 11 out of 12 monthly estimates were insignificant and lower than 6 kW. We found one statistically significant savings estimate of 13.3 kW per customer in November. However, based on the overall pattern of the monthly savings and historical savings estimates, AEG and PG&E decided jointly to claim zero savings at the population level. We hypothesize that the single statistically significant estimate is likely either a Type I error, or a result of additional variation in November that we were unable to capture in the model.

Dually-enrolled CWP participants, on the other hand, showed positive savings across the year and statistically significant savings during the summer and shoulder months with 6 out of twelve significant estimates. We saw a slight decrease in the savings for dually-enrolled participants in 2016, from approximately 1.0% at the program level last year, to about 0.8% at the program level this year. It is important to note that the savings for the dually-enrolled customers appear to be driven primarily by Energy Alerts/BFA participation rather than CWP participation.

The program level savings for singly-enrolled CWP participants, was 0%. Dually-enrolled participants saved, on average, 0.8% across PY 2016.

Table 4-2 Average Per-Participant Energy Savings: All CWP Participants

Month	All Singly-enrolled Participants N = 498,095			All Dually-enrolled Participants N = 39,219		
	Savings (kWh)	95% CI	% Impact	Savings (kWh)	95% CI	% Impact
January	5.4	9.4	0.8%	7.3	9.4	1.2%
February	0.9	6.8	0.2%	8.6	7.3	1.7%
March	1.8	6.9	0.3%	11.2	7.7	2.1%
April	(2.2)	5.8	-0.4%	1.0	5.2	0.2%
May	(3.0)	5.9	-0.5%	3.3	5.6	0.5%
June	(3.1)	7.2	-0.4%	0.9	7.6	0.1%
July	(1.2)	7.7	-0.1%	9.0	8.2	1.1%
August	4.1	6.7	0.6%	13.6	7.0	1.8%
September	(1.6)	6.4	-0.3%	6.8	5.9	1.1%
October	5.3	6.9	1.0%	2.7	5.4	0.5%
November	13.3	7.1	2.3%	10.7	5.4	1.9%
December	(3.0)	13.6	-0.4%	4.5	12.1	0.6%
Annual Total	**0.0**		**0.0%**	**59.9**		**0.80%**

Blue indicates statistically significant savings.

In order to estimate the overall energy savings for the CWP program, we multiply the average annual per participant savings by the total number of singly- and dually-enrolled participants. We can then sum the energy savings for the two subpopulations. It is important to note that savings for dual participants will also be counted in the Energy Alerts/BFA section. We present the overall program level energy savings below in Table 4-3.

Table 4-3 Total Annual CWP Energy Savings: All CWP Participants[19]

Subpopulation	Number of Participants	Annual Savings (kWh per customer)	Total Savings (MWh)
Singly-enrolled Participants	498,095	0	0
Dually-enrolled Participants	39,219	59.9	2,349
Total	**537,314**	**4.4**	**2,349**

Segment Level Results

We also performed a monthly analysis at the segment level (identical to the program level analysis above) for each of the 16 CWP segments. However, full presentation of the monthly segment level results in the body of the report becomes excessive; therefore, we show only the annual savings summary.

In Table 4-4 below, we show the estimated annual segment level savings for singly- and dually-enrolled program participants. The program level savings estimates on the far right of the table were calculated by summing all the statistically significant segment level estimates for both the dually and singly-enrolled participants. The total annual savings based on the segment level estimates are different from the overall program savings shown above. This is because while we cannot always

[19] We do not include confidence intervals for the total annual savings estimates. We perform the analysis at the monthly level, and then we add the point estimates that are statistically significant across the months. This provides us with a valid estimate of the annual savings, and valid confidence intervals at the monthly level, however, we cannot similarly add the confidence bands across months to obtain an annual confidence interval. One must take into account the covariance between months. Given the complexity of the calculation, we did not estimate the annual confidence intervals here taking into account the covariance. However, one can be sure, given that each individual month is statistically significant, that the overall estimate will also be statistically significant.

estimate statistically significant savings at the program level due to the variation among customers, we are often able to estimate the savings at the segment level. We present these estimates to provide insight into which customers are saving more, or less, across segments only; we use estimates in Table 4-3 above when we claim savings for the CWP program as a whole.

Among the singly-enrolled participants, we see positive savings in each of the four continuing segments. We also see positive savings in two of the four new segments. The largest annual kWh savings occur in the "More than 15 Views" segment where continuing participants saved 113 kWh on average annually and new participants saved an average of 62 kWh annually.

Among the dually-enrolled participants, each of the statistically significant segment level estimates is positive. Again, the most engaged participants saved the most energy. Continuing customers saved 436 kWh (5.2%) and new customers saved 190 kWh (2.95%) annually.

Table 4-4 2016 CWP Segment Level Annual Energy Savings

Segment	Number of Participants	Per-customer Annual Savings (kWh)	Annual Percent Savings	Total Segment Level Savings (MWh)
		Singly-enrolled Participants		
Continuing: 1 View	95,912	48	0.66%	4,562
Continuing: 2 to 6 Views	90,216	NS	NS	NS
Continuing: 7 to 15 Views	16,879	19	0.26%	317
Continuing: More than 15 Views	11,282	113	1.50%	1,270
New: 1 View	187,374	25	0.38%	4,663
New: 2 to 6 Views	81,801	(47)	-0.64%	(3,871)
New: 7 to 15 Views	7,428	(3)	-0.04%	(25)
New: More than 15 Views	7,203	62	0.88%	449
Total / Average	**498,095**	**15**	**0.20%**	**7,368**
		Dually-enrolled Participants		
Continuing: 1 View	9,178	43	0.58%	390
Continuing: 2 to 6 Views	12,668	NS	0.00%	NS
Continuing: 7 to 15 Views	3,438	NS	0.00%	NS
Continuing: More than 15 Views	2,770	436	5.20%	1,206
New: 1 View	6,312	(2)	-0.03%	(10)
New: 2 to 6 Views	3,919	NS	0.00%	NS
New: 7 to 15 Views	457	49	0.63%	22
New: More than 15 Views	477	190	2.95%	90
Total / Average	**39,219**	**43**	**0.58%**	**1,700**

All the savings values shown are statistically significant. Insignificant values were replaced with "NS."

CWP Demand Savings

In addition to the monthly analysis, AEG evaluated the daily impacts of the CWP program. We created eight specific day types, shown in the following table, and provide information about the on- and off-peak savings estimates for each day type. The day types were based on the distribution of average daily temperatures in each participant and control group customer's representative weather station. The development of the day types is described in more detail above in Chapter 3. The on-peak period is defined as the hours between 12:00p and 6:00p[20]. When we calculate the per-

[20]PG&E's current on-peak period is 5:00 pm to 10:00 pm which reflects their high marginal cost generation hours.

participant demand savings in the tables in this section, we include all hours regardless of significance.[21]

At the program level, we were unable to detect statistically significant savings on any day type for the singly-enrolled participants. This is not an unexpected result given that the total annual energy savings for that group was also zero.

For the dually-enrolled participants, we were able to detect statistically significant savings across several day types during the on-peak period. Still, the statistically significant savings presented for the dually-enrolled participants below in Table 4-5 are small, ranging from 3.3% during the on-peak period of a typical summer day, to 1.3% during the on-peak period of a winter weekend. In this case, none of the off-peak estimates were statistically significant.

Table 4-5 Average Per-Participant Demand Savings: All Dually-enrolled Participants

	All Dually-enrolled Participants N = 39,219			
Day Type	Average On-peak kW Reduction	Average On-peak % Impact	Average Off-peak kW Reduction	Average Off-peak % Impact
Hot Summer	0.024	1.7%	0.000	-0.1%
Typical Summer	0.034	3.3%	0.001	-0.2%
Cool Summer	0.018	2.5%	(0.001)	-0.3%
Summer Weekend	0.034	2.9%	(0.000)	-0.3%
Cold Winter	0.009	1.0%	0.010	1.1%
Typical Winter	0.009	1.2%	(0.001)	-0.1%
Warm Winter	0.016	2.3%	(0.002)	-0.3%
Winter Weekend	0.012	1.3%	0.002	0.2%

Blue indicates statistically significant savings.

In order to estimate the overall on-peak demand savings for the CWP program on a typical summer day, we multiply the average per participant savings by the total number of singly- and dually-enrolled participants. We can then sum the demand savings for the two subpopulations. It is important to note that savings for dual participants will also be counted in the Energy Alerts/BFA section. We present the overall program level energy savings in Table 4-6.

Table 4-6 2016 CWP Program Level On-peak Demand Savings: Typical Summer Days

Subpopulation	Number of Participants	Average on-peak Impact (kW per customer)	Total on-peak Impact (kW)
Singly-enrolled Participants	498,095	0	0
Dually-enrolled Participants	39,219	0.034	1,333
Total CWP Demand Savings (Typical Summer Day)	**537,314**	**0.002**	**1,333**

Segment Level Results

Overall, looking at on- and off-peak demand savings across all CWP segments, we concluded the following:

[21] We included all hours in the estimate of the on peak impact, regardless of statistical significance, because each is still a valid estimate. The on-peak impact is the calculated as the mean of the point estimates. The drawback of this approach is that because the estimates are correlated, they are not independent, so calculating the variance (and therefore the confidence interval or the significance) of that mean requires the use of all the covariances between all the estimates. The complexity of this process made it impractical here. However, if all or most of the individual estimates are significant, then it is very likely that their mean will also be significant.

- We were unable to detect consistent and meaningful statistically significant savings by day type for the less engaged participants. More specifically, those customers that viewed the website less than seven times in 2016 (both the singly- and dually-enrolled groups) displayed near zero savings estimates for all day types.
- Consistent with the monthly results and analyses from previous years, we estimated statistically significant savings more often for the highly-engaged participants – those that viewed the website more than 15 times – particularly on "hot" and "typical" summer days.

Based on these high-level findings, we have included on- and off-peak impacts and average daily load shapes for participants that viewed the web 15 or more times during 2015, on "hot" and "typical" summer days in the subsections below.

CWP Engagement Segment: More than 15 views

This section focuses on the most highly engaged participants, those with more than 15 views in 2016. Table 4-7 below shows the on- and off-peak impacts on both the "hot" and "typical" summer weekdays by CWP segment. While the estimates for the dually-enrolled, new customers are not significant, both the magnitude and the consistent positive savings estimates suggest savings; unfortunately, our sample size is too small to achieve significance. For both the singly- and the dually-enrolled participants, the on-peak impacts on hot and typical days ranges from 5% to about 15%, with the continuing, singly-enrolled customers saving the least, and the continuing, dually-enrolled customers saving the most. It is important to note that the savings for the continuing, dually-enrolled customers represents a small sample (only 424 participants out of 2,270) and may be overstating the estimates for the true population because of the large confidence intervals associated with the small sample size. During the off-peak period, the savings are smaller and more often insignificant, with point estimates ranging from 2% to 8% for dually and singly-enrolled customers.

Table 4-7 Average Per-Participant Demand Savings CWP Participants: More than 15 Views[22]

			More than 15 Views			
Segment		Day Type	Average On-peak kW Reduction	Average On-peak % Impact	Average Off-peak kW Reduction	Average Off-peak % Impact
Singly	Continuing	Hot Summer	0.082	5.3%	0.029	2.0%
		Typical Summer	0.048	4.6%	0.011	1.3%
	New	Hot Summer	0.089	6.1%	0.019	1.5%
		Typical Summer	0.050	4.9%	(0.001)	-0.5%
Dually	Continuing	Hot Summer	0.279	14.8%	0.092	6.6%
		Typical Summer	0.185	14.6%	0.063	6.0%
	New	Hot Summer	0.209	13.9%	0.075	8.0%
		Typical Summer	0.118	11.8%	0.035	4.3%

Blue indicates statistically significant savings.

Below in Figure 4-4 and Figure 4-5 we present the average per customer savings and load shapes for singly- and dually-enrolled CWP participants that viewed the website more than 15 times during 2016 on an average hot summer day.[23] These shapes are representative of the impacts on hot summer days presented in Table 4-7 above. The graph on the left shows the savings shape (or the second difference) and associated confidence intervals. The graph on the right shows the adjusted control group load and the treatment load shape.

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[22] Note that we included all of the hours during the on- and off-peak periods in the estimate of kW savings regardless of significance, see footnote 12 above for a more detailed explanation.

[23] We include only the load shapes for the singly-enrolled participants in order to illustrate the load shapes and savings shapes. We do not include load shapes for the dually-enrolled participants in the body of the report, but all load shapes and savings shapes can be accessed in the spreadsheet attachment accompanying this report.

When we look at the two figures below we see a clear separation between the treatment and control group load, particularly during the on-peak period. We also see a corresponding savings shape that is above the zero line for much of the day with several statistically significant hours of savings during the on peak period.

Figure 4-4 Average Per-Participant Savings: Hot Summer Day, Singly-enrolled, Continuing Participants, More than 15 Views

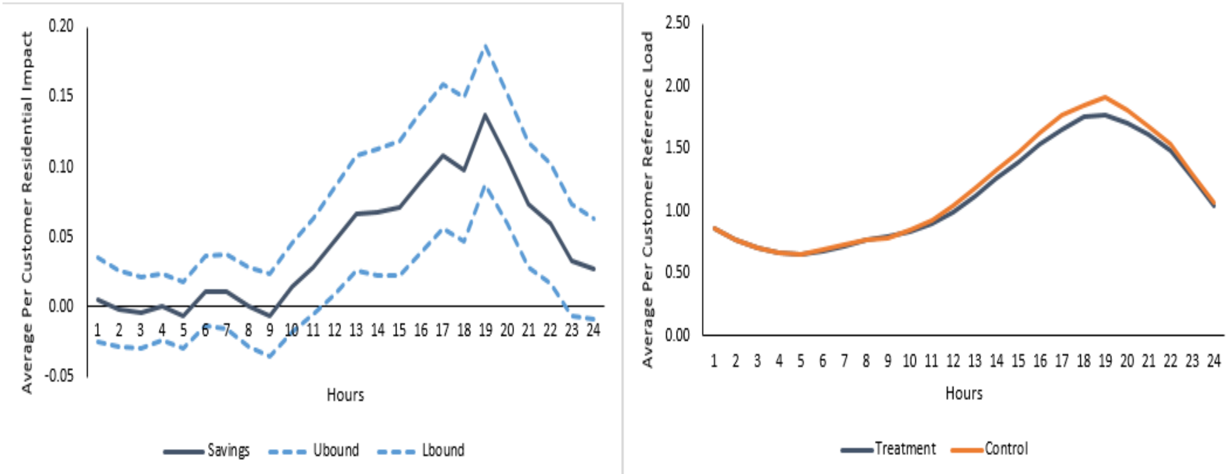
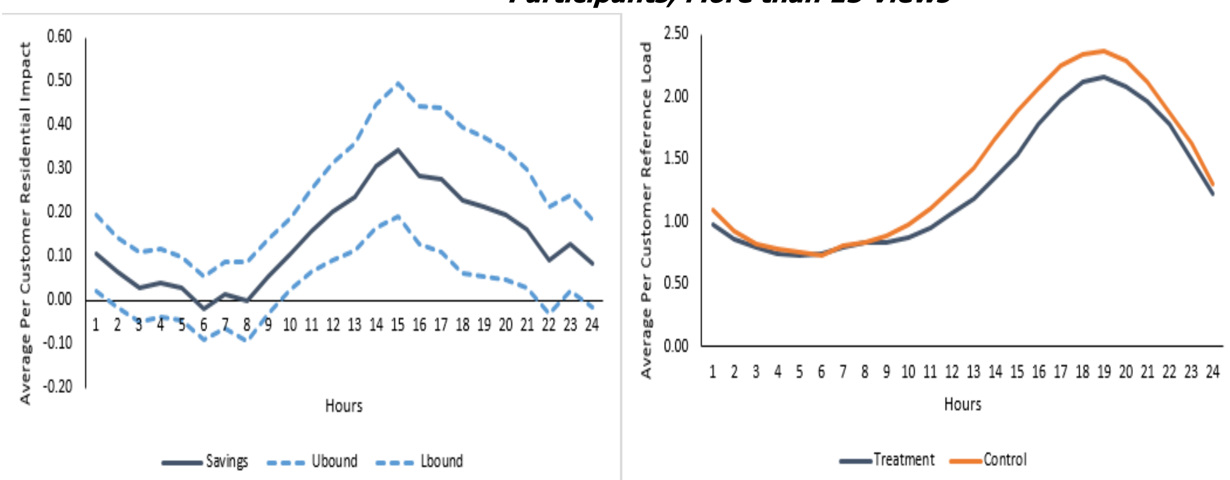


Figure 4-5 Average Per-Participant Savings: Hot Summer Day, Dually-enrolled, Continuing Participants, More than 15 Views



We do not include the load shapes for the newly-enrolled participants; however, they are similar to those for continuing participants presented above.

We were also interested in quantifying the total on-peak demand impacts on the most relevant day type—the hot summer days. In Table 4-8 below, we present the statistically significant estimated on-peak kW impacts for each CWP segment and the total impact for that segment. At the bottom of the table, we sum the significant on-peak impacts across segments for singly- and dually-enrolled participants to estimate the impacts for the entire program.[24]

As with the segment level energy savings, the demand savings estimates are different from the program level estimates. This is because while we cannot always estimate statistically significant

[24] We determined whether to consider an estimate significant based on the percentage of significant hours within each period. An estimate had to have at least three significant intervals and all intervals had to have the same sign, i.e. all positive or all negative in order to be included in the table above as significant. By doing this we are assuming that if we were to explicitly estimate confidence intervals for the on-peak period in questions, they would maintain overall significance, even though some individual hours may not be significant on their own.

savings at the program level because of the variation among customers, we are often able to estimate the savings at the segment level. We present these estimates to provide insight into which customers are saving more or less across segments only, we use estimates in Table 4-6 above when we claim savings for the CWP program as a whole.

Table 4-8 2016 CWP Segment Level On-peak Demand Savings: Hot Summer Days

Segment	Number of Participants	Average On-peak Impact (kW)	Total Estimated On-peak Impact (kW)
Singly-enrolled Participants			
Continuing: 1 View	95,912	NS	NS
Continuing: 2 to 6 Views	90,216	NS	NS
Continuing: 7 to 15 Views	16,879	NS	NS
Continuing: More than 15 Views	11,282	0.082	925
New: 1 View	187,374	NS	NS
New: 2 to 6 Views	81,801	NS	NS
New: 7 to 15 Views	7,428	NS	NS
New: More than 15 Views	7,203	0.089	641
Total/Average	**498,095**	**0.003**	**1,566**
Dually-enrolled Participants			
Continuing: 1 View	9,178	NS	NS
Continuing: 2 to 6 Views	12,668	NS	NS
Continuing: 7 to 15 Views	3,438	NS	NS
Continuing: More than 15 Views	2,770	0.279	773
New: 1 View	6,312	NS	NS
New: 2 to 6 Views	3,919	NS	NS
New: 7 to 15 Views	457	NS	NS
New: More than 15 Views	477	NS	NS
Total/Average	**39,219**	**0.020**	**773**

All the savings values shown are statistically significant. Insignificant values were replaced with "NS."

Energy Alerts/BFA Results

Energy Alerts/BFA Energy Savings

Program Level Results

Customers singly-enrolled in Energy Alerts/BFA showed statistically significant savings in 11 of 12 months during 2016. The monthly savings estimates range from 5.8 kWh (1.3%) in April to 13.5 kWh (2.2%) in August. On average the singly-enrolled participants saved 112 kWh in 2016 or 1.8%.

Dually-enrolled customers showed statistically significant savings in six of 12 months in 2016 with savings estimates ranging from 5.4 kWh to 8.2 kWh and an annual average impact of 59.9 kwh (0.80%).

The monthly savings in kWh and as a percentage are presented below in Table 4-9. The savings for both the singly-enrolled and dually-enrolled participants are lower in 2016 than they were in 2015. It is important to note that the savings estimates in January, February, and March were achieved under the old Energy Alerts program platform, while the savings for the remainder of the year were achieved under the new BFA program platform.

Table 4-9 Average Per-Participant Energy Savings: All Energy Alerts/BFA Participants

Month	All Singly-enrolled Participants N = 61,210			All Dually-enrolled Participants N = 39,219		
	Savings (kWh)	90% C I	% Impact	Savings (kWh)	90% CI	% Impact
January	11.3	6.9	2.0%	7.3	9.4	1.2%
February	9.8	5.2	2.2%	8.6	7.3	1.7%
March	10.5	5.6	2.2%	11.2	7.7	2.1%
April	5.8	3.8	1.3%	1.0	5.2	0.2%
May	2.3	4.3	0.5%	3.3	5.6	0.5%
June	8.2	4.9	1.4%	0.9	7.6	0.1%
July	12.0	5.4	1.8%	9.0	8.2	1.1%
August	13.5	4.6	2.2%	13.6	7.0	1.8%
September	6.9	4.3	1.3%	6.8	5.9	1.1%
October	11.6	4.8	2.5%	2.7	5.4	0.5%
November	9.2	3.9	1.9%	10.7	5.4	1.9%
December	13.4	13.0	2.3%	4.5	12.1	0.6%
Annual Total	**112.2**		**1.8%**	**59.9**		**0.80%**

Blue indicates statistically significant savings.

To estimate the overall energy savings for the Energy Alerts/BFA program, we multiply the average annual per participant savings by the total number of singly- and dually-enrolled participants. We can then sum the energy savings for the two subpopulations. Note that savings for dual participants were also presented in the CWP section. We present the overall program level energy savings below in Table 4-10.

Table 4-10 Total Annual Energy Savings: All Energy Alerts/BFA Participants[25]

Subpopulation	Number of Participants	Annual Savings (kWh per customer)	Total Savings (MWh)
Singly-enrolled Participants	61,210	112.2	6,868
Dually-enrolled Participants	39,219	59.9	2,349
Total Energy Alerts/BFA Energy Savings	**100,429**	**91.8**	**9,217**

Segment Level Results

We also performed a monthly analysis at the segment level (identical to the program level analysis above) for each of Energy Alerts/BFA segments. However, for consistency with the CWP results above, we present only the annual energy savings.

In Table 4-11 below, we show the estimated annual segment level savings for singly- and dually-enrolled program participants. The estimates were calculated by summing all the statistically significant segment level estimates for both the dually and singly-enrolled participants. The total annual savings based on the segment level estimates are different from the overall program savings shown above. We see two different estimates of savings because we use two different estimation approaches the outcome of which we do not expect to be exactly the same. We present these

[25] We do not include confidence intervals for the total annual savings estimates. We perform the analysis at the monthly level, and then we add the point estimates that are statistically significant across the months. This provides us with a valid estimate of the annual savings, and valid confidence intervals at the monthly level, however, we cannot similarly add the confidence bands across months to obtain an annual confidence interval. One must take into account the covariance between months. Given the complexity of the calculation, we did not estimate the annual confidence intervals here taking into account the covariance. However, one can be sure, given that each individual month is statistically significant, that the overall estimate will also be statistically significant.

estimates to provide insight into which customers are saving more, or less, across segments only; we use estimates in Table 4-10 above when we claim savings for the Energy Alerts/BFA program as a whole.

Table 4-11 2016 Energy Alerts/BFA Segment Level Annual Energy Savings

Segment	Number of Participants	Annual Savings (kWh)	Annual Percent Savings	Total Estimated Savings (MWh)
	Singly-enrolled Participants			
Energy Alerts/BFA User	53,299	94	1.5%	5,017
New BFA User	7,911	NS	NS	NS
Total/Average	**61,210**	**82**	**1.29%**	**5,017**
	Dually-enrolled Participants			
Energy Alerts/BFA User	35,492	65	0.9%	2,291
New BFA User	3,727	NS	NS	NS
Total/Average	**39,219**	**58**	**0.78%**	**2,291**

All the savings values shown are statistically significant. Insignificant values were replaced with "NS."

Energy Alerts/BFA Demand Savings

Program Level Results

In addition to the monthly analysis, AEG evaluated the on-peak and off-peak impacts at the program level by using the difference in differences methodology on hourly data. The development of the day types shown in the following tables is described in more detail above in Chapter 3. The on-peak period is defined as the hours between 12:00p and 6:00p[26]. When we calculate the per-participant demand savings in the tables in this section, we include all hours regardless of significance.[27] Blue highlighted cells are statistically significant.[28]

Among singly-enrolled Energy Alerts/BFA participants we see positive statistically significant demand impacts across all day types. All of the on-peak impacts are statistically significant, in addition all summer off-peak impacts are also significant This is not unexpected given the presence of consistent and statistically significant energy savings among this group. Summer on-peak impacts ranged from 2.0% to 2.6% and winter impacts ranged from 1.1% to 2.3%.

The dually-enrolled Energy Alerts/BFA participants had positive and significant on-peak estimates on 3 out of 4 summer day types, and on winter weekends. During the summer the on-peak impacts ranged from 1.7% (insignificant) to 3.3%. It should also be noted that each of the on-peak point estimates are positive.

[26] As noted above PG&E's current on-peak period in 5:00 pm – 10:00 pm.
[27] We included all hours in the estimate of the on peak impact, regardless of statistical significance, because each is still a valid estimate. The on peak impact is the sum of the estimates, which are each random variable with a mean and a variance. The mean of the sum of the random variables is equal to the sum of the means of the random variables. The drawback of this approach is that because the estimates are correlated, they are not independent, so calculating the variance (and therefore the confidence interval or the significance) of that sum requires the use of all the covariances between all the estimates. The complexity of this process made it impractical here. However, if all or most of the individual estimates are significant, then it is very likely that their sum will also be significant.
[28] We considered an estimate to be significant if more than 50% of the individual estimates were statistically significant.

Table 4-12 Average Per-Participant Demand Savings: All Singly-enrolled Participants

	All Singly-enrolled Participants N = 44,978			
Day Type	**Average On-peak kW Reduction**	**Average On-peak % Impact**	**Average Off-peak kW Reduction**	**Average Off-peak % Impact**
Hot Summer	0.029	2.2%	0.017	2.0%
Typical Summer	0.023	2.6%	0.010	1.3%
Cool Summer	0.012	2.0%	0.010	1.6%
Summer Weekend	0.021	2.1%	0.010	1.3%
Cold Winter	0.018	2.3%	0.013	1.6%
Typical Winter	0.012	1.9%	0.009	1.3%
Warm Winter	0.013	2.0%	0.004	0.5%
Winter Weekend	0.009	1.1%	0.007	1.0%

Blue indicates statistically significant savings.

Table 4-13 Average Per-Participant Demand Savings: All Dually-enrolled Participants

	All Dually-enrolled Participants N = 25,956			
Day Type	**Average On-peak kW Reduction**	**Average On-peak % Impact**	**Average Off-peak kW Reduction**	**Average Off-peak % Impact**
Hot Summer	0.024	1.7%	0.000	-0.1%
Typical Summer	0.034	3.3%	0.001	-0.2%
Cool Summer	0.018	2.5%	(0.001)	-0.3%
Summer Weekend	0.034	2.9%	(0.000)	-0.3%
Cold Winter	0.009	1.0%	0.010	1.1%
Typical Winter	0.009	1.2%	(0.001)	-0.1%
Warm Winter	0.016	2.3%	(0.002)	-0.3%
Winter Weekend	0.012	1.3%	0.002	0.2%

Blue indicates statistically significant savings.

In order to estimate the overall on-peak demand savings for the Energy Alerts/BFA program, we multiply the average summer on-peak per participant savings by the total number of singly- and dually-enrolled participants. We can then sum the demand savings for the two subpopulations. Note that savings for dual participants were also presented in the CWP section. We present the overall program level energy savings below in Table 4-14.

Table 4-14 Total Annual On-Peak Energy Alerts/BFA Demand Savings: Typical Summer Days

Subpopulation	Number of Participants	Average On-Peak Impact (kW per customer)	Total On-Peak Impact (kW)
Singly-enrolled Participants	61,210	0.023	1,408
Dually-enrolled Participants	39,219	0.034	1,333
Total Energy Alerts Demand Savings	**100,429**	**0.027**	**2,741**

Segment Level Results

Overall, looking at on- and off-peak savings across all Energy Alerts/BFA segments we concluded the following:

- we were unable to detect consistent and meaningful statistically significant savings by day type for customers that enrolled in the BFA program in 2016.

- However, as we will see below, all the point estimates for new BFA users are positive, and while smaller than those of the continuing participants they are in the same range.
- We believe that, similar to the energy savings above, our inability to detect significant savings, is simply a result of having a small sample size (681 participants) this year.

Below we included on- and off-peak impacts and average daily load shapes for both the continuing and new BFA participants. We include only the results for "hot" and "typical" summer days to allow for comparison with the CWP results presented earlier in this chapter.

Overall the on-peak impacts range from 1.5% to 3.3% on a hot or typical summer day, with the singly-enrolled customers saving just slightly less than the dually-enrolled customers. In addition, it is apparent that while the new BFA participants do not have statistically significant results, the point estimates are similar to the continuing participants.

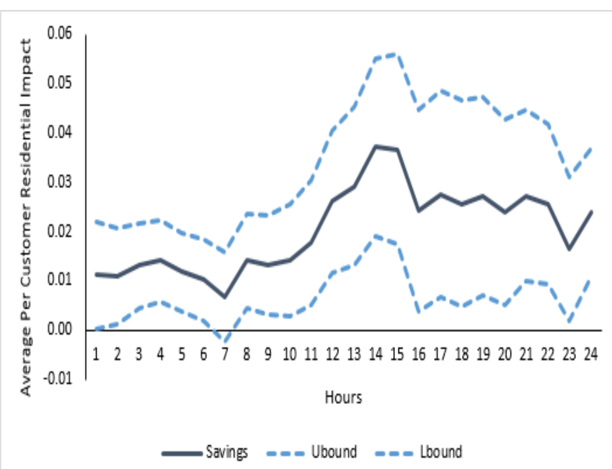
Table 4-15 Average Per-Participant Energy Alerts/BFA Demand Savings: Segment Level

Segment		Day Type	Average On-peak kW Reduction	Average On-peak % Impact	Average Off-peak kW Reduction	Average Off-peak % Impact
Singly	Energy Alerts/BFA User	Hot Summer	0.030	2.4%	0.017	2.0%
		Typical Summer	0.022	2.5%	0.010	1.4%
	New BFA User	Hot Summer	0.019	0.5%	0.018	1.6%
		Typical Summer	0.027	2.7%	0.002	0.1%
Dually	Energy Alerts/BFA User	Hot Summer	0.033	2.3%	0.006	0.5%
		Typical Summer	0.033	3.3%	0.004	0.3%
	New BFA User	Hot Summer	0.008	0.8%	(0.015)	-1.1%
		Typical Summer	0.017	1.5%	(0.016)	-2.0%

Blue indicates statistically significant savings.

Below in Figure 4-6 and Figure 4-7 we present the average per customer savings and load shapes for singly-enrolled Energy Alerts/BFA participants, and the singly-enrolled New BFA participants.

Figure 4-6 Average Per-Participant Savings: Hot Summer Day, Singly-enrolled, Energy Alerts/BFA User



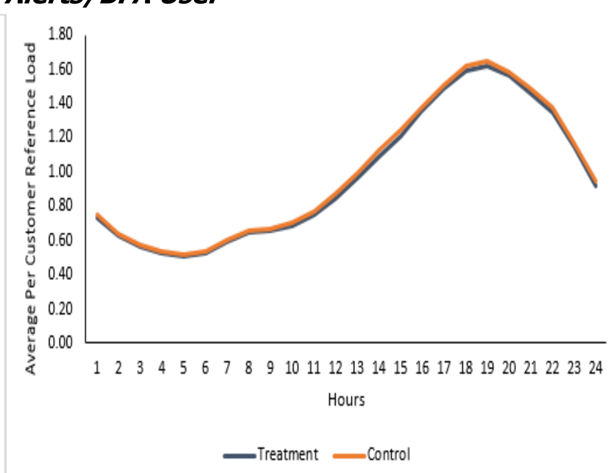
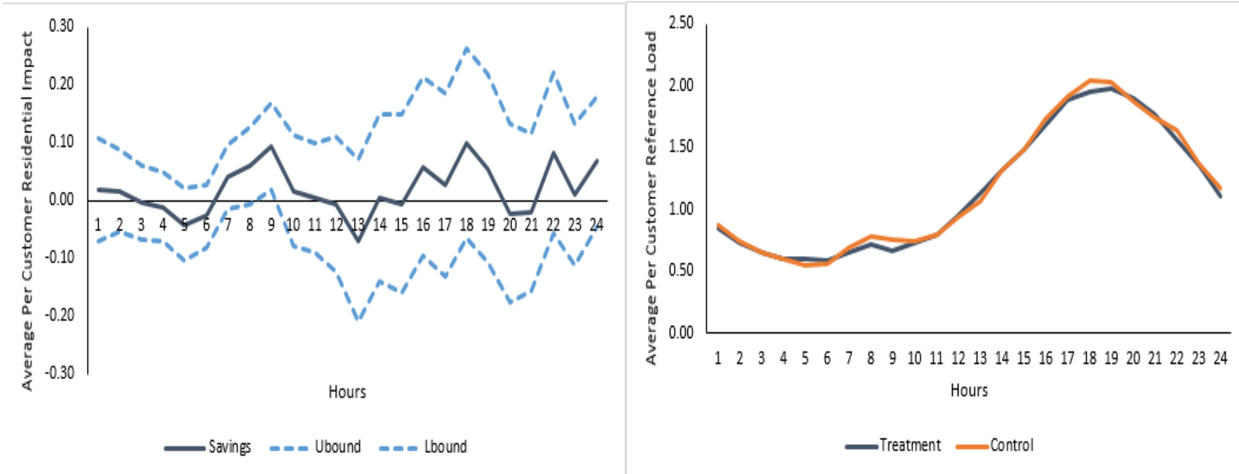


Figure 4-7 Average Per-Participant Savings: Hot Summer Day, Singly-enrolled, New BFA User



We do not include the load shapes for the dually-enrolled participants; however, they are similar to those for singly-enrolled participants presented above.

We were also interested in quantifying the segment-level on-peak demand impacts on the most relevant day type—the hot summer days.

As with the segment level energy savings, the demand savings estimates are different from the program level estimates. We see two different estimates of savings because we use two different estimation approaches, the outcome of which we do not expect to be exactly the same. We estimated these impacts by summing all of the statistically significant segment level estimates for both the dually and singly enrolled participants. We present these estimates to provide insight into which customers are saving more or less across segments only, we use estimates in Table 4-14 above when we claim savings for the Energy Alerts/BFA program as a whole.

In Table 4-16 below, we present the estimated on-peak kW impacts for each Energy Alerts/BFA segment; we also indicate whether the estimate was significant, and the total recognized impact for that segment. At the bottom of the table, we sum the recognized, or significant, on-peak impacts across segments for singly- and dually-enrolled participants to estimate the impacts for the entire program.[29]

[29] We determined whether to consider an estimate significant based on the percentage of significant hours within each period. An estimate had to have at least three significant intervals and all intervals had to have the same sign, i.e. all positive or all negative in order to be included in the table above as significant. By doing this we are assuming that if we were to explicitly estimate confidence intervals for the on-peak period in questions, they would maintain overall significance, even though some individual hours may not be significant on their own.

Table 4-16 2016 Energy Alerts/BFA Program Level On-peak Demand Savings: Hot Summer Days

Segment	Number of Participants	Average On-peak Impact (kW)	Total Estimated Impact (kW)
	Singly-enrolled Participants		
Energy Alerts/BFA User	53,299	0.03	1,599
New BFA User	7,911	NS	NS
Total/Average	**61,210**	**0.026**	**1,599**
	Dually-enrolled Participants		
Energy Alerts/BFA User	35,492	0.033	1,171
New BFA User	3,727	NS	NS
Total/Average	**39,219**	**0.030**	**1,171**

All the savings values shown are statistically significant. Insignificant values were replaced with “NS.”

Key Findings and Recommendations

This section presents our key findings and recommendations for future program years.

Key Findings

The following were identified as key findings during the AEG's evaluation of PG&E's CWP and Bill Forecast Alert programs.

Findings

Total annual energy savings from both CWP and Energy Alerts/BFA are presented below in Table 5-1. These savings estimates are consistent with previous evaluation years. In total, the participants across programs saved just over 9.2 GWh of energy in 2016. This reflects an increase of 15% over 2015's total of 7.8 GWh. Singly-enrolled Energy Alerts/BFA participants saved 30% more per capita an average of 112.2 kWh per customer in 2016, vs. 86 kWh per customer in 2015. While dually-enrolled participants saved an average of 59.9 kWh per customer in 2016 vs. 87 kWh per customer in 2015. We were unable to obtain statistically significant savings estimates for singly-enrolled CWP participants at the population level.

Table 5-1 Total Annual Energy Savings: All Participants

Subpopulation	Number of Participants	Annual Savings (kWh per customer)	Total Savings (MWh)
Singly-enrolled CWP Participants	498,095	0	0
Singly-enrolled Energy Alerts/BFA Participants	61,210	112.2	6,868
Dually-enrolled Participants	39,219	59.9	2,349
Total Energy Savings	**598,524**	**15.4**	**9,217**

The total annual demand savings from both CWP and Energy Alerts/BFA are presented below in Table 5-2. Again, the demand savings are consistent with previous evaluation years. In total, the participants across all programs provided approximately 2.7 MW of demand reduction in 2016, which represents a 40% reduction in savings vs. 2015. Singly- and dually-enrolled Energy Alerts/BFA participants saved an average of 0.023 kW and 0.034 kW per customer respectively. We were unable to obtain statistically significant savings estimates for singly-enrolled CWP participants at the population level.

Table 5-2 Total Annual Demand Savings: All Participants

Subpopulation	Number of Participants	Annual Savings (kW per customer)	Total Savings (kW)
Singly-enrolled CWP Participants	498,095	0	0
Singly-enrolled Energy Alerts/BFA Participants	61,210	0.023	1,408
Dually-enrolled Participants	39,219	0.034	1,333
Total Energy Savings	**598,524**	**0.005**	**2,741**

Customer Web Presentment Findings

- Based on our analysis for 2016, at the program level singly-enrolled CWP participants are not saving energy as a result of interacting with their consumption data.
- One additional hypothesis that may explain why we were unable to detect savings for the CWP participants is the very large number of participants. This may, at first, sound counterintuitive since having many participants is often an advantage. However, in this case, it may be that many more customers are viewing the website out of curiosity, but fewer customers are engaging with and making modifications in behavior based on the information provided. We see some evidence of this when we look at the distribution of participants across engagement levels, with the highly-engaged customers making up only about 4% of the total CWP population.
- At the segment level, we have seen consistently across evaluation years that the highly-engaged participants are more likely to save energy, while less engaged participants are less likely to save energy. While some individual months may be statistically significant (either positive or negative) among the less engaged participants, the overall pattern of the savings estimates does not suggest consistent positive or negative savings for those groups. In contrast the savings estimates for the highly-engaged participants do show consistent positive and significant savings estimates across most months. This pattern indicates that those customers are actively engaging with the website and saving energy.

Energy Alerts/Bill Forecast Alert Findings

- Based on the analysis, all of the savings for the Energy Alerts/BFA program are attributable to the participants that transitioned from the Energy Alerts program to BFA in March of 2016. In this group, we saw consistent positive savings estimates across 11 of the 12 months, in addition we saw significant positive demand estimates across all day types in 2016.
- While we did not see statistically significant savings among the New BFA participants this year, we believe that the primary issue is the small sample size, rather than a true lack of savings. There is no reason to expect that we will not be able to detect savings next year when the sample size will be larger. Furthermore, the new BFA participants showed consistent positive point estimates in the monthly analysis, which while not significant, do indicate that those participants are likely to be saving energy.
- Relative to 2015, savings among both singly-enrolled customers increased slightly from 1.2% to about 1.8% at the program level. This increase was evident both in the monthly energy savings and in the demand savings for a typical summer day.
- Singly-enrolled Energy Alerts/BFA participants saved a total of 6,868 MWh during 2016, or 112.2 kWh per participant, for an average annual impact of 1.8%.
- Singly-enrolled Energy Alerts/BFA participants have an average on-peak demand savings of 0.023 kW per customer (2.6%) on a typical summer day. The singly-enrolled Energy Alerts/BFA participants achieved a demand savings of 1.4 MW in 2016.

Dually-enrolled Customer Findings

- Dually-enrolled participants saved a total of 2,349 MWH in 2016, or 59.9 kWh per participant, which translates to an average annual impact of 0.80%. This represents a slight reduction in impacts from 2015 during which the dual customers achieved a 1.0% reduction.
- Dually-enrolled participants have an average demand savings of 00.034 kW (or 3.3%) on a typical summer day. The dually-enrolled participants achieved a total demand savings of 1.3 MW in 2016. The demand savings are actually slightly higher than the savings achieved by dually-enrolled participants in 2015.
- Dually enrolled participants are saving energy; however, we believe the majority of the savings in the dually enrolled population to be attributable to Energy Alerts/BFA vs. CWP.

Recommendations

The following were identified as recommendations for future program years:

- The high participation rate for CWP suggests that customers are receiving value from the program, even if savings cannot be attributed directly to those customers. Therefore, we recommend that PG&E continue to offer and enhance their customer interface, even if we cannot attribute savings directly to those customers.
- We also recommend that PG&E consider examining the non-energy benefits of CWP using at a customer survey. Given the large number of users it is very likely that customers are getting significant value from the website, even though we cannot measure the savings at the programs level. A customer survey could help to uncover some of these potential benefits.
- Since BFA is a new offering, which replaced Energy Alerts in March of 2016, we recommend performing some additional analysis using the 2016 data to attempt to uncover potentially new or different savings patterns.
- Given that the program recently changed the way it interacts with participants, it would also be beneficial to explore customer opinions of, and satisfaction with, the program through a customer survey. The survey could also be used to uncover savings behavior that might help with the evaluation of the program in future years.

Potential Sample Bias

Imposing any type of limitation on a sample can introduce bias. In this case, we limited the sample to participants with adequate historical data. By limiting the treatment group to customers who maintain the same residence, we are more likely to select single family homes or long term renters. These types of customers may be likely to make changes in energy use that require investment in their property and therefore may be more likely to act on information provided to them about their usage. They may also be more likely to use more energy.

It is not possible to estimate the level of bias introduced into the sample due to these restrictions directly, but it is possible to get a sense of how much bias might be present by comparing the characteristics of the participants selected for analysis and those that were excluded.[30]

Singly-enrolled Customer Web Presentment Potential Bias

Table A-1 presents a comparison of the percentage of CWP participants with various demographic characteristics between the overall participant population and the restricted participant population.

Table A-1 Comparison of Population to Restricted Population – Singly-enrolled CWP

Characteristic	CWP Population N=498,095	Restricted Population N=210,377
CARE	17.7%	20.5%
Non-CARE	82.3%	79.5%
Coastal	53.5%	54.2%
Inland	46.5%	45.8%
Single Family	77.4%	82.9%
Multifamily	22.6%	17.0%

Coastal customers have very similar distributions in both the population and restricted population. Interestingly, we see an increase of CARE customers in the restricted population compared to the CWP population. However, by restricting the participants to those with complete billing data, thereby capturing those that remain in the same residence longer, we see about 5 percent fewer multifamily customers in the restricted population. This means that this group is underrepresented in our sample. However, because the sample is weighted based on the distribution of participants in the population, we will accurately reflect the savings for those multifamily, CARE, and coastal customers we are able to analyze.

It can also be useful to examine the relationship between key population segments and demographic characteristics. In Table A-2 below, we show the percentage of customers with different characteristics by number of My Usage views for the restricted population. When we compare the number of participants by segment with each characteristic, we can see that the number of times a participant views the website is not highly correlated with their CARE status, weather zone, or dwelling type. For example, 55.4% of all single-family participants and 61.9% of multifamily participants only viewed the My Usage webpage one time during 2016. This supports the conclusion that CWP energy savings are not highly correlated with the characteristics we could compare here; therefore, excluding multifamily participants is unlikely to introduce a significant bias.

[30] Participants were excluded because of limited or missing data. Unfortunately, it is exactly this data that we would need to accurately estimate the bias. Therefore, it is extremely difficult to know how the energy consumption or savings of excluded customers might differ from those included in the analysis.

Table A-2 Correlation Between Views and Demographic Characteristics – Singly-enrolled CWP

Characteristic	One View	2-6 Views	7-15 Views	16+ views
CARE	63.4%	30.6%	3.5%	2.5%
Non-CARE	55.5%	35.4%	5.2%	3.3%
Coastal	59.4%	33.2%	4.3%	3.1%
Inland	54.0%	36.1%	5.5%	4.4%
Single Family	55.4%	35.8%	5.1%	3.7%
Multifamily	61.9%	30.7%	4.1%	3.3%

We were also interested in comparing rates between treatment and control group customers in our analysis sample. Table A-3 shows the percentage of singly-enrolled CWP participants and controls in each rate. We defined TOU as customers on either HE6, HE7, or HEVA and standard as everything else. In our sample, there were no customers on the traditional TOU rate, E-6. The overwhelming majority (97.5%) of singly-enrolled CWP customers are on the standard rate. There were 339 participants and eight control customers on a TOU rate. Even with only eight control group customers participating in TOU, the total number of treatment customers that are on a TOU rate is so small, only 2.7%, that this difference is unlikely to affect the analysis in any appreciable way.

Table A-3 Comparison of Standard and TOU rates – Singly-enrolled CWP N=13,466

Rate	Control Group	Treatment Group
Standard	100%	97.5%
TOU	0%	2.5% (339 participants)

Singly-enrolled Energy Alerts/BFA Potential Bias

Table A-4 presents a comparison of the percentage of Energy Alerts/BFA participants with various demographic characteristics between the overall participant population and the restricted participant population.

Table A-4 Comparison of Population to Restricted Population – Singly-enrolled Energy Alerts/BFA

Characteristic	Energy Alerts Population N=60,544	Restricted Population N=17,565
CARE	22.2%	22.3%
Non-CARE	77.8%	77.7%
Coastal	52.3%	58.3%
Inland	47.7%	41.7%
Single Family	71.1%	75.7%
Multifamily	28.9%	24.3%

Our restrictions had a more significant effect on the CWP group this year than last year. The distribution that changed the most was for the multifamily and single family categories. The multifamily group is underrepresented by a little more than 4 percent, with the overall number of participants dropping from 28.9% to 24.3%. We used weighting to ensure that we will accurately reflect the savings for the customers we analyzed.

In Table A-5 below, we have a breakdown of the demographic characteristics by continuing EAL and new BFA participants. When we compare the percentage of participants by two programs (continuing EAL and new BFA), we can see that there are 14% more multifamily homes enrolled in new BFA compared to EAL. New BFA has 11% higher representation of CARE customers than EAL. BFA is a new program and has only 7,526 participants compared to 53,018 in continued EAL segment.

Table A-5 Correlation Between Views and Demographic Characteristics – Singly-enrolled Energy Alerts/BFA

Characteristic	Continued EAL N=53,018	New BFA N=7,526
CARE	20.9%	31.0%
Non-CARE	79.1%	69.0%
Coastal	53.2%	45.6%
Inland	46.8%	54.4%
Single Family	73.4%	55.1%
Multifamily	26.6%	44.9%

Table A-6 shows the percentage of singly-enrolled Energy Alert participants and controls in each rate. We defined TOU as customers on either HE6, HE7, or HEVA and standard as everything else. In our sample, there were no customers on the traditional TOU rate, E-6. The overwhelming majority (99%) of singly-enrolled Energy Alerts/BFA customers are on the standard rate. There were 51 participants and zero control customers on a TOU rate. Only two control group customers participated in TOU, but the total number of treatment customers that are on a TOU rate is so small (0.6%), that this difference is unlikely to affect the analysis in any appreciable way.

Table A-6 Comparison of Standard and TOU rates – Singly-enrolled Energy Alerts/BFA N=8,819

Rate	Control Group	Treatment Group
Standard	100%	99.4%
TOU	0%	0.6% (51 participants)

Dual Participation Potential Bias

Table A-7 presents a comparison of the percentage of dual participants with various demographic characteristics between the overall participant population and the restricted participant population.

For dual participants, we see slightly lower percentages of inland and multifamily customers in the restricted population. Once again, we used weighting to ensure that we will accurately reflect the savings for those coastal and multifamily customers we are able to analyze.

Table A-7 Comparison of Population to Restricted Population – Dually-enrolled

Characteristic	Dual Population N=39,219	Restricted Population N=8,486
CARE	19.4%	20.8%
Non-CARE	80.6%	79.2%
Coastal	46.9%	52.9%
Inland	53.1%	47.1%
Single Family	78.7%	80.9%
Multifamily	21.3%	19.1%

In Table A-8 and Table A-9, we show the percentage of customers with different characteristics by CWP viewing stratum and by Energy Alerts/BFA stratum. Similar to the singly-enrolled CWP participants, when we compare the number of participants by segment with each characteristic, we can see that the number of times a participant views the website is not highly correlated with their CARE status, weather zone, or dwelling type. This suggests that under-representing the inland and multifamily participants is unlikely to introduce a significant bias.

Table A-8 Dual Participation Correlation Between Views and Demographic Characteristics – Continuing EAL

Characteristic	One View	2-6 Views	7-15 Views	16+ views
CARE	41.7%	40.8%	9.5%	8.0%
Non-CARE	38.8%	43.0%	9.0%	6.7%
Coastal	42.7%	42.2%	8.9%	6.2%
Inland	36.3%	43.0%	10.8%	9.9%
Single Family	38.5%	42.9%	10.1%	8.4%
Multifamily	42.7%	41.3%	8.8%	7.2%

Table A-9 Dual Participation Correlation Between Views and Demographic Characteristics – New BFA

Characteristic	One View	2-6 Views	7-15 Views	16+ views
CARE	41.1%	39.5%	9.6%	9.8%
Non-CARE	28.8%	28.4%	7.5%	6.5%
Coastal	47.3%	38.6%	8.6%	5.4%
Inland	35.4%	40.6%	11.6%	12.4%
Single Family	37.3%	41.1%	11.0%	10.5%
Multifamily	49.5%	36.0%	8.4%	6.1%

Table A-10 shows the percentage of singly-enrolled Energy Alert participants and controls in each rate. We defined TOU as customers on either HE6, HE7, or HEVA and standard as everything else. In our sample, there were no customers on the traditional TOU rate, E-6. The overwhelming majority (98.2%) of dual participants are on the standard rate. There were 119 participants and a single control customer on a TOU rate. Even with only two control group customers participating in TOU, the total number of treatment customers that are on a TOU rate is so small, only 1.8%, that this difference is unlikely to affect the analysis in any appreciable way.

Table A-10 Comparison of Standard and TOU rates – Dually-enrolled

Rate	Control Group	Treatment Group
Standard	100.0%	97.5%
TOU	0.0%	2.5% (339 participants)

Model Selection and Validation

Model selection and validation

Above, we discuss the development of a set of regression models capable of estimating program effects. However, for each model that we develop, we also tested many different specifications during the modeling process. During that process we generally use several different methods to validate the results and select the most precise model. For this evaluation, we will use a combination of visual inspection, and MAPE comparisons. We also include a cross check of the model results using statistical DID.

Visual inspection can be a simple, but highly effective tool during the model selection and validation process. During the inspection, we will look for specific aspects of the predicted actual daily and monthly load estimates to tell us how well the models perform, for example:

- We closely examine the differences between the actual and predicted load for odd increases or decreases that could indicate an effect that is not properly being captured in the model.
- We also look for bias both visually and mathematically. Bias is the consistent over or under prediction of the actual load. We may see bias that is temperature related, under predicting during hotter months and under predicting during cooler months. We have also seen bias that is time based, over predicting in the beginning of the year, and under predicting at the end of the year. Identification of bias and its source often allows us to adjust the models to capture and isolate the bias-inducing effects within the model specification.

Regression Model MAPEs

It is particularly important to have a concrete method of comparing model accuracy during the model selection process. We compared both model MAPE (mean absolute percent error) and MPE (mean percent error) to determine the most accurate and unbiased model. The model's MAPE can tell us the overall error of the model. Comparing the MAPE of several different models shows which is the most accurate. Looking at the MPE shows us if there is any bias in the model, since consistent negative or positive values indicate a consistent under or over prediction of the load

Table B-1 to Table B-2 present the MAPEs of the regression models at both the program and segment level, averaged across the months in 2016. These represent the average modeling error between the actual and predicted values. Lower MAPEs indicate that the model is a good predictor of an average customer's monthly usage. All of the MAPEs are below than 10%, with most below 5.0%. they range from 1% on the low end to 8.1% on the high end.

Table B-1 Mean Absolute Percent Error– Program Level Models

Program	MAPE
CWP Only	1.0%
Energy Alerts/BFA Only	2.2%
Dual Participants	1.2%

Table B-2 Mean Absolute Percent Error– Segment Level Models

Segment	MAPE (Singly-enrolled)	MAPE (Dually-enrolled)
Continuing: 1 View	1.0%	3.0%
Continuing: 2 to 6 Views	1.0%	2.8%
Continuing: 7 to 15 Views	0.8%	2.9%
Continuing: More than 15 Views	0.9%	3.6%
New: 1 View	2.2%	6.3%
New: 2 to 6 Views	2.7%	4.6%
New: 7 to 15 Views	1.6%	1.2%
New: More than 15 Views	1.5%	8.1%
Energy Alerts/New BFA	4.1%	4.0%
New BFA	2.4%	1.1%

Comparison of DID and Regression Results

We also present a comparison of the DID and Regression savings estimates. We expect the DID estimates and the regression estimates to be similar, although we do view the regression estimates as a refinement of the initial DID estimates.

Figure B-1 Average Per-Participant Program Savings Comparison: CWP

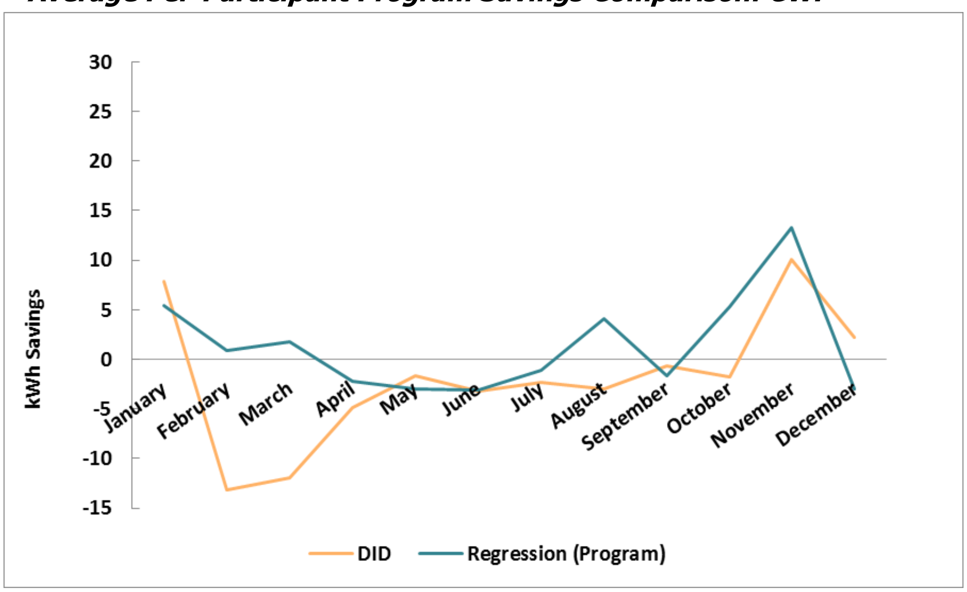
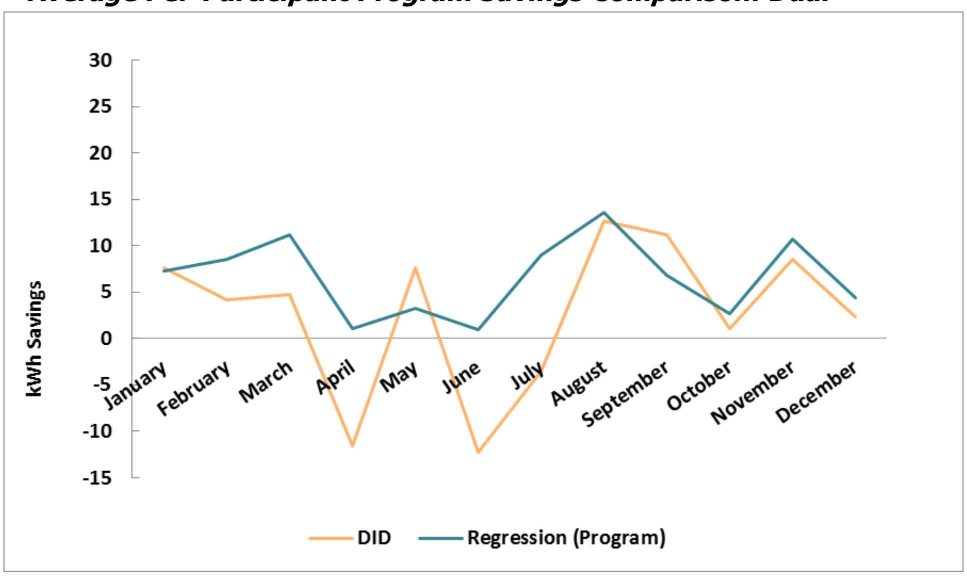


Figure B-2 Average Per-Participant Program Savings Comparison: Energy Alerts/BFA

Figure B-3 Average Per-Participant Program Savings Comparison: Dual



Applied Energy Group, Inc.
500 Ygnacio Valley Road, Suite 250
Walnut Creek, CA 94596

P: 510.982.3525
www.AppliedEnergyGroup.com