BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of PACIFIC GAS AND ELECTRIC COMPANY for Authority to Increase Revenue Requirements to Recover the Costs to Upgrade Its SmartMeter™ Program	Application No. 07-12-009 (Filed December 12, 2007)

COMPLIANCE FILING OF PACIFIC GAS AND ELECTRIC COMPANY (U 39 E) PURSUANT TO DECISION 09-03-026

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Dated: April 30, 2013

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Pursuant to Ordering Paragraph 10 of Decision (D.) 09-03-026, Pacific Gas and Electric Company (PG&E) hereby files its 2011 Program Year SmartMeter™ Program Enabled Demand Response and Energy Conservation Annual Report. As directed by the Commission in D.09-03-026, PG&E—in direct consultation with Energy Division—files within this docket its report on the energy savings and associated financial benefits of all demand response, load control, and conservation programs enabled by PG&E's SmartMeter™. The Report is due in April of each year until 2019. PG&E's Report is attached hereto as Appendix A.

Respectfully Submitted,

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PG&E 2012 Program Year SmartMeter™ Program Enabled Demand Response and Energy Conservation Annual Report

April 30, 2013

Pacific Gas and Electric Company

Abstract

Pursuant to Ordering Paragraph 10 of Pacific Gas and Electric Company's (PG&E) SmartMeter Upgrade Decision (D.) 09-03-026, PG&E has prepared this report to provide a review of PG&E's program year 2012 ex post load impacts, energy conservation and financial benefits for the dynamic pricing, demand response and energy conservation programs enabled by PG&E's SmartMeter™ program. The report provides a description of each program as well as the methodology adopted to estimate the load impacts, energy savings and associated financial benefits.

In 2012, PG&E operated the following SmartMeter™ enabled programs: SmartRate™ and Peak Day Pricing (PDP), which are dynamic pricing programs designed to provide load response to pricing signals, Time-of-Use (TOU) which is a time varying program and Customer Web Presentment and Energy Alerts, which are both energy conservation programs. With methodologies evolving and more data becoming available in the future, more definitive findings can be expected in future Demand Response and Energy Conservation Reports under Ordering Paragraph 10 of D.09-03-026.

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1. Introduction

This report documents program year 2012 ex post load impacts, energy conservation, and financial benefits for the PG&E SmartMeter™ enabled Dynamic Pricing, Demand Response (DR) and energy conservation programs. It has been prepared pursuant to Ordering Paragraph 10 of PG&E's the SmartMeter Upgrade Decision (D.) 09-03-026 which requires PG&E to report to the California Public Utilities Commission (CPUC or Commission):

> "…the energy savings and associated financial benefits of all demand response, load control, energy efficiency, and conservation programs enabled by advanced metering infrastructure (AMI), including programmable communicating thermostat (PCT) programs, Peak Time Rebate (PTR) programs, and other dynamic rates for residential customers."[1]

The demand response impacts contained herein are estimated in compliance with the Commission's adopted load impact protocols contained in D.08-04-050.[2]

2. Program Overview

There were two types of SmartMeter enabled programs in operation during 2012. These are described below:

Demand Response and Dynamic Pricing (or Time Varying) programs: These currently include SmartRate™ (Residential Critical Peak Pricing), Peak Day Pricing (PDP) (non-residential Critical Peak Pricing), and residential and non-residential Time-Of-Use (TOU) rates.

Informational Energy Conservation Programs: These currently include Energy Alerts and Customer Web Presentment of interval data. In addition, Home and Business Area Network is a program which will enable the customers to view their energy usage almost on a real-time basis by incorporating a Home Area Network (HAN) gateway device into advanced electric meters. A HAN device within a customer's premise will be able to securely connect to the HAN gateway on the meter to obtain near real time usage and consumption information. This information will allow customers to monitor their home energy usage and automate their end-uses to balance between comfort and cost.

[1] D.09-03-026, Ordering Paragraph 10, SmartMeter Upgrade Decision, page 196.
[2] D. 08-04-050, Decision Adopting Protocols for Estimating Demand Response Load Impacts.

There are currently three additional PG&E SmartMeter enabled demand response programs being considered for future implementation. These are: (1) Programmable Communicating Thermostat (PCT) Program, (2) Peak-Time Rebate (PTR) Program, and, (3) Real Time Pricing (RTP) Rate.

2.1. SmartMeter™ Enabled Demand Response and Dynamic Pricing programs

2.1.1. *SmartRate*™--Residential Critical Peak Pricing

The SmartRate™ pricing structure is an overlay on top of PG&E's residential rate schedules. SmartRate™ pricing consists of an incremental charge that applies during the peak period on Smart Days and a per kilowatt-hour credit that applies for all other hours from June through September. For residential customers, the additional peak-period charge on Smart Days is 60¢/kWh, and applies between 2:00 pm and 7:00 pm. Up to fifteen Smart Days can be called during non-holiday weekdays from May 1 to October 31[3].

PG&E began offering SmartRate™ program in May 2008 to residential and small and medium commercial customers in the Bakersfield and greater Kern County area that had SmartMeters™ and interval data. Pursuant to D.10-02-032 (PDP Decision), SmartRate's small and medium commercial customers were transitioned to PG&E's non-residential PDP program beginning May 1, 2010.[4] The details of this transition are discussed in the Non-Residential section that follows. During the 2012 program year enrollment in SmartRate™ grew substantially. Approximately 37,000 customers were enrolled for the first event on July 9, 2012 and 77,999 were enrolled as of the last event on October 3, 2012. Of those enrolled last October, 50,941 were enrolled in SmartRate only, and 27,058 were dually enrolled in SmartRate and SmartAC. 10 events were called in 2012. For the average event, the load impact was 0.27 kW per customer, or a 15% reduction in per customer load; the aggregate load impacts for the program were 10.0 MW for SmartRate-only customers, and 11.1 MW for customers dually enrolled in both SmartRate and SmartAC[5].

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[3] PG&E proposed in the 2012 Rate Design Window Application (A.) 1202-020) to modify SmartRate to be dispatchable year-round. As of April 23, 2013, a decision from the CPUC is still pending. As such, PG&E does not estimate SmartRate's ex ante load impacts for the non-summer months.

[4] D.10-02-032, Decision on PDP for Pacific Gas and Electric Company, Page 10.

5 *2012 Ex Post Load Impact Evaluation of Pacific Gas and Electric Company's Residential Time-based Pricing Programs.* http://apps.pge.com/regulation/SearchResults.aspx?NewSearch=True&CaseID=729&DocType=&PartyID=4&fromDate=04%2F02%2F13&toDate=04%2F02%2F13&sortOrder=FileName&currentPage=1&recordsPerPage=100&searchDocuments=Search

To give a brief regulatory background, On January 14, 2011, PG&E filed a Petition for Modification of D.10-02-032 and proposed a new timetable for transitioning customers to time-varying rates, including both residential and non-residential PDP. PG&E proposed the elimination of the requirement to implement a new residential PDP rate by November 1, 2011 and requested that SmartRate™ be retained as an option for residential customers until residential dynamic pricing options are considered again by the Commission. PG&E also proposed that the timing of default enrollment of residential customers onto time-varying rates be addressed in the PTR Application (A.) 10-02-028 and Default Residential Rate Program application A.10-08-008.[6]

On November 10, 2011, the CPUC issued D. 11-11-008 granting PG&E's Petition for Modification, with some exceptions.[7] Importantly, the CPUC granted "PG&E's proposal to eliminate the requirement to implement a new residential PDP rate, and, instead, to retain SmartRate™ as an option for residential customers until the Commission completes its pending review of default residential dynamic pricing rates in A.10-08-005."[8]

2.1.2. Peak Day Pricing – Non-Residential Critical Peak Pricing

PDP[9] is critical peak pricing overlaying on top of non-residential TOU rates. PDP's price signals are designed to encourage customers to reduce peak load during event days, which are typically triggered by high market prices or extreme system conditions. Under the PDP tariff, PG&E will target a minimum of 9 and a maximum of 15 event days per year. On event days, PDP customers will face higher charges for energy used between 2 PM to 6 PM. Events can be called seven days a week, all year round. In return for the higher rates during event days, customers receive either per unit energy credits, capacity credits or both between May 1 and October 31, depending on their associated rate schedule. These have the effect of reducing on-peak and semi-peak charges. The adopted event-period price adder for customers on the A-10 rate is $0.90/kWh and $1.20/kWh for customers on E-19 or E-20 rates. The program had 180[10] SmartMeter™ customers in 2011 and 194 SmartMeter™ customers in 2012 which

[6] Petition of Pacific Gas and Electric Company for Modification of Decision 10-02-032, page 9.
[7] D.11-11-008. Decision Granting in Part and Denying in Part Petitions for Modification of Decision 10-02-032.
[8] Ibid, page 3-4.
[9] To be eligible for PDP, customers must have an interval meter with interval data, which does not have to be a SmartMeter. However, this report only includes the load reduction and energy savings of the customers with a SmartMeter.
[10] There are approximately 3000 telecommunication service agreements under one corporate customer providing little to no load impacts, and hence have not been considered in the analysis above.

contributed to majority of the load impacts[11]. In 2012, the customers with a SmartMeter™ provided an average aggregate impact of 0.95 MW and an average per customer impact of 4.9 kW of load reduction during the event season.

Pursuant to the CPUC's February 2010 PDP D.10-02-032, in May 2010 PG&E began defaulting onto PDP large commercial and industrial customers[12] (≥200 kW) that have met the eligibility criteria.[13][14] PG&E provides bill protection[15] during the first year on PDP to encourage customers to try it without risk. At the same time in May 2010, PG&E was also required to both transition all existing non-residential SmartRate™ customers to PDP and make the rate available on a voluntary basis to small and medium agricultural, commercial and industrial (C&I) customers with SmartMeter meters that are interval-billed enabled.

On November 10, 2011, the CPUC issued D. 11-11-008 granting PG&E's Petition For Modification, with some exceptions. In this decision, the CPUC ordered that beginning March 1, 2013; PG&E's small and medium agricultural customers that have access to at least 12 months of interval billing data will default to mandatory TOU.[16] Small and medium C&I customers that have had interval-billed electric SmartMeter meters for at least 12 months will default to mandatory TOU rates beginning November 1, 2012. These same customers, if they have at least 24 months experience on TOU rates, will default to PDP rates beginning November 1, 2014. All these customers are safeguarded by twelve months of bill protection for the first year they are on PDP.

In D.11-06-022 Adopting Local Procurement Obligations for 2012 and Further Refining the Resource Adequacy (RA), PG&E was ordered to change the operating hours for PDP from 2 PM – 6 PM to 1 PM – 6PM to align with RA requirements. PG&E proposed this in its 2012 Rate Design Window A.12-02-020, which is still awaiting Commission decision.

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11 2012 California Statewide Non-residential Critical Peak Pricing Evaluation – Ex Post Report http://apps.pge.com/regulation/SearchResults.aspx?NewSearch=True&CaseID=729&DocType=&PartyID=4&fromDate=04%2F02%2F13&toDate=04%2F02%2F13&sortOrder=FileName&currentPage=1&recordsPerPage=100&searchDocuments=Search

[12] Currently 80% of PG&E's commercial andindustrial customers are equipped with SmartMeter™ meters

[13] Default eligible customers may elect to opt-out prior to default or de-enroll from PDP after default.

[14] To be eligible for default as a large customer, bundled customers must have 12 months of valid interval electricity data, three consecutive months of peak demand of at least 200 kW, access to their interval data for at least 45 days and receive electricity service on an applicable tariff and may not be direct access, net-energy metered or participating in specific demand response programs. The default criteria for other customer classes (i.e. small and medium business as well as large agricultural customers with demand > 200kW) can change to reflect the appropriate minimum demand level and transition dates as ordered in D.10-02-032.

[15] Bill protection allows customers to try the PDP program risk free for one year. If at the conclusion of the first year on PDP, the customer's cumulative charges under PDP are higher than they would have been under their otherwise applicable tariff, they receive a bill credit for the difference.

[16] D.11-11-008, Decision Granting in Part and Denying in Part Petitions for Modification of Decision 10-02-032, page 3.

2.1.3. Time-Of-Use (TOU) Rate

PG&E has had TOU rates in place for many years for both residential and non-residential. Schedules E-6 and E-7 are residential TOU rates. E-7 is a two-period, five-tier schedule that has been closed to new customers since 2008. It was replaced by E-6, which is a three-period, four-tier TOU rate.[17] Prices during peak periods are substantially higher than during off-peak periods, particularly during summer months (May-October), encouraging customers to shift electricity use away from peak hours. The time-varying rates are in effect every weekday. While customers on TOU rates have had meters that collect the required TOU data, but with SmartMeters and the increased availability of interval data to more customers through the SmartMeter system, customers will be able to leverage the information from their interval data and understand how time matters for their energy usage and costs.

TOU rates became mandatory for small and medium (non-agricultural) customers starting November 2012, although customers could have voluntarily enrolled on those tariffs prior to the default date. Beginning November 2014, small and medium non-residential customers will be subject to opt-out PDP, at which time they will have experience with the TOU rates for at least two years. TOU rates became mandatory for all small and medium agricultural customers with smart meters installed for a sufficient period of time starting March 1, 2013. Consequently, PG&E has already begun transitioning roughly 400,000 small business customers, 40,000 medium business customers and 35,000 agricultural customers from flat pricing structures to TOU pricing. Some of the rates have both time varying energy and demand charges. Both types of charges provide customers an incentive to reduce demand during peak hours and shift their consumption.

Approximately 75,281 of the 97,290[18] residential E-6 and E-7 TOU participants have SmartMeters™ installed. However, a substantial number of E-6 and E-7 customers are net metered. Net metered customers typically have very different load patterns compared with standard metered customers, as they very often have solar power or some other form of distributed generation. The load impact evaluation excluded the impacts of net-metered customers because the majority of residential net-metered customers have rooftop solar and are already accounted for in the evaluation of solar programs. As of December 31, 2012,

[17] Rate schedule EL-6 Residential Care Program TOU for single-family dwellings where the Applicant qualifies for California Alternate Rates for Energy (CARE) program is a three-period, three-tier TOU rate.
[18] Approximately 70,500 residential customers on E-7 and 20,700 on E-6

approximately 18% of E-7 customers and 90% of E-6 customers were net metered.[19] As such, although the number of residential TOU customers with SmartMeters™ meters has increased, this primary results from SmartMeter installations on existing participants rather than on new participants. The same is also true with non-residential TOU rates. Therefore, since a) the majority of participants are either net metered or b) participants have been on the rates before the installation of a SmartMeter™, PG&E is not including load impacts from residential or non-residential TOU customers.

2.1.4. Real Time Pricing Rate (RTP)

This program has not yet been implemented by PG&E. Here, we provide a brief regulatory update on the program decision. On March 22, 2010, PG&E filed a new voluntary real time pricing (RTP) tariff option for all customer classes in its 2011 GRC II A.10-03-014. However, various parties moved to defer consideration of RTP until the Commission provided further guidance regarding dynamic pricing options. On March 3, 2011, the Presiding ALJ granted the parties' request and ruled that "Real Time Pricing issues are deferred pending further notice."[20] A.10-03-014 was subsequently closed in D.12-10-004, without any further action on PG&E's RTP showing. As of April 2013 no additional guidance from the Commission related to RTP has been issued.

2.1.5. Programmable Communicating Thermostat (PCT) Program

Under the SmartMeter™ Upgrade D.09-03-026, PG&E is required to incorporate a Home Area Network (HAN) gateway device into advanced electric meters to support in-home HAN applications. Deployment of this technology enables two-way communications with compatible home appliances and automated controls (e.g., programmable communicating thermostats, or PCTs) which can communicate such data as temperature set points, event status, and customer overrides.

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[19] Freeman, Sullivan & Co., *2012 Ex Post Load Impact Evaluation of Pacific Gas and Electric Company's Residential Time Based Pricing*, March 20, 2013. http://apps.pge.com/regulation/SearchResults.aspx?NewSearch=True&CaseID=729&DocType=&PartyID=4&fromDate=04%2F02%2F13&toDate=04%2F02%2F13&sortOrder=FileName&currentPage=1&recordsPerPage=100&searchDocuments=Search

[20] Administrative Law Judge's Ruling Granting Motion to Revise Schedule for Phase III. March 3, 2011, page 3.

In A.07-12-009, PG&E assumed the new Title 24 building code air conditioning standards, which included PCTs, would be effective in 2012. The Title 24-compliant PCTs, whether installed by third parties or customers, would have been available for enrollment in a PG&E direct load control program. However, shortly after PG&E submitted the application, the California Energy Commission withdrew its Title 24 building code air conditioning standards recommendation and the plans for a PCT direct load control program were put on hold. PG&E will continue to monitor the market and assess opportunities for PCTs in load control programs.

2.1.6. Peak Time Rebate (PTR) Program

Similar to RTP and PCT, PTR has not yet been implemented by PG&E. Described below is a brief regulatory background and update on this program. In A.10-02-028, PG&E filed a proposal for two-part PTR in compliance with D.09-03-026. An updated showing was filed October 28, 2011.[21] As directed by the Commission, PG&E has proposed a two-part rate structure for customers with and without enabling technology. Under its original proposal in the 2010 Rate Design Window, PG&E proposed that PTR would be available to eligible customers in a staged rollout beginning on May 1, 2011. In the updated testimony PG&E proposed a two year staged rollout of the PTR program with May 1, 2013 as the earliest possible start date. This schedule assumed the Commission would issue a final decision in September 2012. However, no decision has been issued as of the date of this report. As such, implementation in 2013 is no longer possible. It is unclear whether the Commission will order PG&E to implement PTR and, if it does, when the rollout would begin.[22]

2.2. Informational Energy Conservation Programs

2.2.1. Customer Web Presentment (CWP)

Customer Web Presentment (CWP) provides online access to interval usage data and analysis tools tailored to customers with PG&E SmartMeters™ and interval data. CWP is available

[21] The Administrative Law Judge in Application 10-02-028 revised schedule in an August 2011 Scoping Memo included an updated filing from PG&E in October 2011.

[22] Although PG&E has not implemented PTR, San Diego Gas & Electric (and Southern California Edison) have, and the results for SDG&E's first full summer have recently been released in the April 1, 2013 load impact reports.

through PG&E's online portal, known as My Energy. Once an installed SmartMeter™ is being read remotely, customers may log onto My Energy to check their energy usage on previous days and learn about ways to save energy. The "My Usage" tab within My Energy provides customers with a variety of tools which are made possible by the interval data collected by SmartMeter. These resources include an overview of the customer's daily, monthly and yearly usage characteristics, and a projection of how much their next monthly bill will be. Additionally, customers can compare their bill to the previous month's bill, or the bill from twelve months prior.

CWP was available for all of 2012 to eligible SmartMeter™ customers. However, information on the number of customers that accessed the My Usage portion of the website was not available to PG&E during the 2012 program year. In November of 2011 PG&E changed vendors for the My Energy website, moving from Aclara to Opower. Opower was not able to provide visibility into how specific service accounts use the My Energy website in 2012, such as who and how often customers view My Usage. This information is expected to be available for the 2013 evaluation. This year's evaluation estimated the number of participants in CWP based on trends from prior program years. In the past, the program was primarily marketed to customers via three channels: Pre-installation bill inserts to customers who were about to receive a SmartMeter™, the SmartMeter™ Transition Booklet, and two sets of emails reaching out to a total of approximately 2.4 million customers. For each campaign, CWP was marketed as a feature of My Energy.

2.2.2. Energy Alerts Program

The Energy Alerts Program became operational in June 2010 as an option for PG&E customers with an installed SmartMeter™ that is being read remotely. The program allows customers to receive advance warning via email, phone, or text message if their electricity usage is projected to move into higher pricing tiers by the end of the current billing cycle. Projected usage is calculated on the eighth day of the customer's billing cycle, and Energy Alerts are subsequently sent out to those customers whose total usage for the billing cycle is likely to enter the higher (e.g. third or fourth) pricing tiers. Energy Alerts are also sent out when the customer's usage has actually entered any of the higher pricing tiers, with a maximum of four Energy Alerts per service agreement in a billing cycle.

As of December 31, 2012, there were 92,458 customers enrolled in Energy Alerts. The program's enrollment grew at a rate of approximately 750 customers per month during 2012. Energy Alerts was marketed to customers as part of the information they receive during the SmartMeter™ installation process and participants can enroll through the My Energy website.

2.2.3. Home and Business Area Network (HAN)

Under the SmartMeter™ Upgrade D.09-03-026, PG&E is incorporating a HAN gateway device into advanced electric meters. A HAN device within a customer's premise will be able to securely connect to the HAN gateway on the meter to obtain near real time usage and consumption information. This information will give customers the ability to monitor or automate their home energy usage to balance between comfort and cost.

On March 1, 2012, PG&E began implementing the initial rollout phase of its HAN pilot. In this phase, 430 In-Home Displays (IHD) were installed in order to determine how customers engaged with the device and obtain feedback on the processes and ways to optimize/improve the customer experience. In 2013, PG&E will begin Phase 2, or the Early Adopter phase, providing customers with a list of up to five PG&E validated devices (i.e.a device can successfully connect ("pair") with PG&E's SmartMeter™ in order to provide our customers with their near real-time energy use.) that they can purchase through retail channels. Customers will be able to purchase, install and self-register the HAN device of their choice. This phase will move HAN from a utility run pilot (i.e. the Initial Rolloutphase) to a platform which opens up third party products and services to customers. PG&E plans to automate the HAN device eligibility and registration process through My Energy before the end of 2013. This will allow for the platform to scale and support requests at volume. The Initial Rollout phase effort will be evaluated in 2013. PG&E will evaluate this program because it is sponsored and administered by PG&E. However, any IHDs installed by customers or third parties after this initial roll-out will not be included in the PG&E evaluation process. PG&E's SmartMeter™ HAN Implementation Plan was approved on April 8, 2013.

3. Methods and Assumptions

This section provides a high-level discussion of the methods and assumptions that are used to calculate the energy savings, demand response load impacts and associated financial benefits for the two categories of SmartMeter™ enabled programs.

3.1. SmartMeterTM Enabled Demand Response and Dynamic Pricing Programs

The CPP (SmartRate and PDP), TOU, PTR, RTP and PCT programs are enabled by the SmartMeter™ infrastructure and encourage (or will encourage) PG&E customers to temporarily reduce loads during periods in which demand might outstrip supply, or the system is constrained. Since PTR, RTP and PCT programs have not been implemented yet, this section does not discuss the methodology that would be adopted to estimate load impacts or energy savings from these programs.

The reported aggregate load impacts are equal to the number of enrolled service accounts multiplied by the per-customer demand response load impacts by program. Table I within this report provides the number of participating service accounts, estimated demand response (MW), energy savings (MWh), and financial benefits (in thousands) associated with the programs. The following sections describe the measurement methods and inputs that are used in developing the results.

3.1.1. Service Accounts

During the PG&E SmartMeter™ deployment period, the number of service accounts available for program participation will be dependent on a billing-ready PG&E SmartMeter™. A billing-ready PG&E SmartMeter™ is defined as a meter which has been installed, communicating, tested, cut-over to operations to allow for billing using interval data. Meter installations will occur throughout the deployment period. In 2012, PG&E had 77,999[23] active enrollments which included customers both with SmartMeter™ program billing and enrollment in SmartRate. In addition, in 2012 PG&E had 194[24] active C&I

[23] This number represents the total number of customers enrolled, both SmartRate only and dually enrolled in SmartRate and SmartAC as of the October 3, 2012 event.
[24] There were approximately 3000 active PDP customers with SmartMeters as of Dec 2012 but these were mostly telecom companies (signal boxes) that provided little or no load impacts and therefore, have not been discussed in this report.

enrollments in the PDP program that had SmartMeters™ and provided bulk of the load impacts for the program. For the 2012 program year, there were no PTR, RTP or HAN-enabled PCT programs. There were 75,281 residential TOU customers enrolled on either E-6 or E-7 and 271,418 non-residential customers enrolled in TOU for the 2012 program year.

3.1.2. Demand Response

The demand response load impacts will be estimated based on the number of participating service accounts and the per customer load impacts for each program. The load impacts reflects the performance of the demand response events in 2012—i.e., ex post load impacts, estimated in a manner consistent with the Load Impact Protocols approved in D.08-04-050. The analysis may incorporate a number of variables including the location of customers by CASIO-defined local capacity areas, weather zones, and customer types. PG&E performed a load impact analysis for all SmartMeter™ enabled demand response resources. The protocols require that an evaluation plan be developed for each program's load impact evaluation and submitted to the Demand Response Measurement and Evaluation Committee (DRMEC) prior to execution. Load Impact evaluation reports were prepared and filed on April 2, 2013 for the following programs: SmartRate, PDP and TOU. The links to these reports which contain the per customer load impacts have been provided in the respective program description section.

3.1.3. Financial Benefits

Financial benefits will be calculated by adding financial benefits associated with the demand reduction and the energy savings for each program. The demand reduction financial benefits will be calculated by multiplying the demand response times the most recently accepted avoided generation capacity cost. PG&E's most recent GRC Phase 2 settlement value for the avoided marginal generation capacity cost is $91.73/kW-year, pursuant to PG&E's January 7, 2011 updated testimony. Once the Commission adopts new values for the avoided marginal generation capacity costs in PG&E's 2014 GRC II proceeding, PG&E will use those adopted values to quantify the financial benefits in the annual report. To the extent that the Commission requires different (than those indicated above) marginal generation costs to be used for various programs, PG&E will use the latest approved value to calculate the financial benefits.

3.2. SmartMeter Enabled Information Energy Conservation Programs

The PG&E SmartMeter enabled CWP, HAN, and Energy Alerts Program provide information to the participant on their daily energy usage by leveraging interval data, thereby empowering the participant to take steps to reduce to conserve energy. The energy impacts of CWP and Energy Alerts were evaluated according to the guidelines presented in the California Energy Efficiency Evaluation Protocols.[25]

Table II, located at the end of this report, provides the service account numbers, energy conservation (MWh), and financial benefits (in thousands) associated with the PG&E SmartMeter project enabled energy conservation programs on an ex post basis. The following sections describe the measurement methods and assumptions used in developing the energy conservation results.

3.2.1. Service Accounts

During the PG&E SmartMeter deployment period, the number of service accounts will be dependent on a billing ready PG&E SmartMeter meter. In 2012, 150,880[26] customers logged in to Customer Web Presentment at least once and 92,458 customers were enrolled in Energy Alerts. HAN service accounts will be determined based on the number of devices (e.g., In-Home Displays) registered with PG&E.

3.2.2. Energy Savings

For the CWP and Energy Alerts programs, energy savings were estimated by using the same methodology as described above – multiplying the end-of-year participating service accounts with per customer energy savings. The per customer energy savings were calculated by taking into account each program's unique features and creating control and treatment groups using statistical matching strategies. A brief description of the method employed is described below for each of the programs. Detailed results of this evaluation are provided in Appendix A.

[25] California Energy Efficiency Evaluation Protocols, prepared for the California Public Utilities Commission, April 2006.
[26] For 2012, data on number of CWP participants was not available. Therefore, this number was estimated based on historical trends in CWP usage and number of SmartMeters implemented in 2012. Detailed methodology is described in Appendix A.

3.2.2.1. CWP: Generally, PG&E SmartMeter™ enabled service accounts will have next day access to their interval usage data, as well as 13-month historical energy usage through the portal. However, only a subset of these customers actually accesses their usage data. Note that the number of CWP customers is different from the number of customers who sign-up for a PG&E My Account. My Account is available to all customers, SmartMeter™ enabled or otherwise.

Because the data required to identify the participant and non-participant populations was not available for 2012, the energy savings associated with participation in CWP was estimated by refining the savings estimates from program year 2011 and applying those per customer savings to the number of customers estimated to be participants in program year 2012. The energy savings associated with participation in CWP in program year 2011 were estimated by comparing energy use of customers using CWP with a carefully selected control group of non-CWP customers. A stratified matching technique is used to construct a control group that is very similar to the treatment group in all observable ways, except being exposed to the program treatment. 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 and a randomized control group is no longer an option, a stratified matching technique or quasi-experimental design offers the next best strategy to minimize selection bias.

To match each treatment customer with a control customer and obtain an improved match, all populations were divided into four buckets using two filters: inland or coastal climate zone (based on CEC weather zone) and single or multi-family home. Within each of the buckets created by these filters, an algorithm matched each treatment customer with a unique control customer whose pre-treatment electric usage characteristics are most similar. The treatment effect is then estimated by the mean difference in energy usage between the customers in the treatment and control groups during the treatment period. The treatment group is further stratified by level of engagement to see if savings vary with either more frequent participation or a longer history of program participation. The improved approach also used a significantly larger sample in order to increase the precision of the estimates. The increased precision allowed for the detection of very small savings in the range of 1 to 3 percent.

The increased precision combined with the improved match allowed for the estimation of savings for 2011 CWP participants at the population level.

Using a direct comparison, the impact analysis of the CWP program estimated a per customer reduction in usage of 152 kWh annually, or 1.8%, among all CWP participants. The analysis estimated a per customer reduction of 825 kWh annually, or 8.0%, among CWP participants who accessed their SmartMeterinterval usage data more than 15 times during 2011. The refined estimates from 2011 were then applied to the estimated number of CWP participants in 2012 resulting in a total savings of 23,014 MWh for the 2012 CWP participants. The complete analysis of CWP is provided in Appendix A of this report.[27]

3.2.2.2. Energy Alerts Program: The number of Energy Alerts service accounts is calculated based on the number of customers who sign up for the program through PG&E's My Account web portal.

The energy savings for Energy Alerts participants was estimated by comparing the energy use of customers signed up for the program with a carefully selected control group. Similar to the CWP program above, a stratified matching technique is used to construct a control group that is very similar to the treated group in all observable ways, except being exposed to the program treatment.

To match each treatment customer with a control customer, all populations where classified into buckets using the following filters inland or coastal climate zone (based on their CEC weather zone, and single or multi-family. Within each of the buckets created by these filters, an algorithm matched each treatment customer with a unique control customer whose pre-treatment electric usage characteristics are most similar. The treatment effect is then estimated by the mean difference in energy usage between the customers in the treatment and control groups during the treatment period. The treatment group is further stratified by method of alert and frequency of alert to determine if savings vary based on how alerts are delivered or how often they are received.

[27] *PG&E SmartMeter Enabled Programs: PY2012 Evaluation*,EnerNOC Utility Solutions, Walnut Creek, CA. 2013.

In program year 2011 the evaluation was not able to detect any savings for the Energy Alerts participants. By improving the matching strategy and increasing the sample size significantly the 2012 evaluation was able to achieve the precision necessary to detect very small differences in usage between the treatment and control groups. The average monthly conservation effect of the Energy Alerts program across all participants that received at least one alert in 2012 is estimated to be 3.2% or 284 kWh per month. Therefore the annual energy conservation effect is 20,294 MWh in program year 2012. A more detailed evaluation of Energy Alerts with sections explaining the analysis methodology and results are presented in Appendix A of this report.[28]

Rigorous energy savings analysis will be performed for future SmartMeterenabled energy conservation program, such as HAN. Participation in PG&E's behavior-based programs began in the fall of 2011. Experimental design is being used to measure the amount of conservation enabled solely by SmartMeter program and the energy savings derived solely from the behavior-based program, per CPUC Decision 10-04-029.

3.2.3. Financial Benefits

Financial benefits will be calculated using the same methodology as the demand response financial benefits described previously. However, instead of using an avoided marginal generation *capacity* cost, the calculation for conservation programs will use an avoided *generation* energy costs of $49.19/MWh[29].

[28] *PG&E SmartMeter Enabled Programs: PY2012 Evaluation,* EnerNOC Utility Solutions, Walnut Creek, CA. 2013.

[29] *Line No. 2 in Table 1-4 under the Secondary Distribution column from PG&E's 2011 General Rate Case Phase 2, January 7, 2011 Update to Prepared Testimony (A.10-03-014).*

4. Results

Tables I and II, located in the following pages, provide the 2012 program year demand response and energy conservation results. Because several of these programs are either in their very early startup stages or not yet initiated, the 2012 program enrollments, load impacts, energy conservation, and financial benefits are either zero or near-zero for these SmartMeter project enabled programs.

Table I
PG&E SmartMeter™ Program Enabled Demand Response Programs
Subscription Statistics – December 31, 2012

Program	Service Accounts	Demand Reduction (MW)		Energy Savings (MWh)		Total Financial Benefits (thousands)
		Aggregate Load Impact[30]	Financial Benefits[31] (thousands)	Energy Savings[32]	Financial Benefits[33] (thousands)	
Demand Response						
SmartRate	77,999[34]	21.1	$1,936	0	$0	$1,936
PDP	194[35][36]	0.95	$87	0	$0	$87
TOU	346,669[37]	0[38]		0	$0	
Total	424,862	22.05	$2,023	0	$0	$2,023

[30] Program MWs equal the sum of each enrolled participant's interruptible/curtailable load defined as follows:
- SmartRate and PDP: Number of SmartRate™/PDP service accounts x estimated average SmartRate™/PDP load impact per customer. Includes only residential.
- TOU: Number of TOU service accounts x estimated average TOU load impact per customer, from Annual Load Impact Analysis Report. Includes residential and small and medium C&I less than 200 kW.

[31] Financial benefits (in thousands of dollars) = total DR load reduction (kW) x accepted avoided marginal generation capacity costs per kW-year ($91.73/kW-year). This cost figure comes from the Transmission column of Line No. 1 in Table 15 of PG&E's *2011 General Rate Case Phase 2, January 7, 2011 Update to Prepared Testimony* (A.10-03-014).

[32] Energy savings will be calculated based on the results of the Annual Load Impact Analysis for each program.

[33] Financial benefits = energy savings (kWh) x avoided generation energy costs (in thousands of dollars).

[34] Number of residential service accounts enrolled in SmartRate™ who have a billing ready PG&E SmartMeter meter (installed, communicating, and cut-over to operations to allow for billing using interval data). For customers that are both on SmartRate™ with a SmartMeter program enabled PCT, their MWs and service accounts are included in SmartRate™ rate subscription statistics.

[35] Number of non-residential service accounts enrolled in PDP who have a billing ready PG&E SmartMeter meter (installed, communicating, and cut-over to operations to allow for billing using interval data).

[36] There are approximately 3000 telecommunication service agreements under one corporate customer providing little to no load impacts, and hence have not been considered in the analysis above.

[37] Number of residential and small and medium C&I (< 200kW) service accounts enrolled in TOU who have a billing ready PG&E SmartMeter meter (installed, communicating, and cut-over to operations to allow for billing using interval data). The total TOU service accounts may also include the PDP service accounts.

[38] PG&E is not including load impacts from residential and non-residential TOU customers due to the fact that the large majority of participants are net metered (holds true only for residential TOU customers) and because their participation in the program is long-standing and not directly enabled by the installation of a SmartMeter™.

Table II
PG&E SmartMeter™ Program Enabled Energy Conservation Programs
Subscription Statistics – December 31, 2012

Program	Service Accounts	Energy Savings (MWh)		Demand Reduction (MW)		Total Financial Benefits (thousands)
		Energy Savings	Financial Benefits[39] (thousands)	Load Impacts (MW)[40]	Financial Benefits[41] (thousands)	
Energy Conservation						
CWP	151,150[42]	23,014	$1,132	0	$ 0	$1,132
H AN	431[43]	0	$0	0	$0	$0
Energy Alerts	92,458[44]	20,294	$1,041	0	$0	$1,041
Total	244,039	43,308[45]	$2,173	0	$0	$2,173

[39] Financial benefits = energy savings (kWh) x avoided generation energy costs (in thousands of dollars). The avoided generation energy cost used in the calculation in Table II above is $49.19/MWh. This source of this value is Line No. 2 in Table 1-4 under the Secondary Distribution column from PG&E's *2011 General Rate Case Phase 2, January 7, 2011 Update to Prepared Testimony* (A.10-03-014). Line No. 2 of Table 1-4 shows values for the Summer Partial-Peak TOU price period.

[40] Demand reductions for the energy conservation programs will be calculated based upon an analysis consistent with that required by the Energy Efficiency Measurement and Evaluation Protocols.

[41] Financial benefits (in thousands of dollars) = total load reduction (kW) x accepted marginal avoided generation capacity cost per kW-year.

[42] Number of CWP service accounts will be calculated based on number of customer sign-ups for access to interval data on PG&E's web site.

[43] Number of HAN service accounts will be determined based on number of devices registered with PG&E's HAN program.

[44] Number of Tier Notifications Program service accounts will be determined by the number of program enrollments.

[45] Because we did not account for dual enrollment for CWP and EA, the two energy savings numbers corresponding to these programs when added together will be likely to double count the impacts from these programs.

Appendix A:
2012 Energy Conservation Evaluation of Pacific Gas and Electric Company's Energy Alerts and Customer Web Presentment Programs

PACIFIC GAS & ELECTRIC SMARTMETER™ ENABLED PROGRAMS: PROGRAM YEAR 2012 EVALUATION

Management Review Draft

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The report is a corporate document that should be cited in the literature in the following manner:

PG&E SmartMeter ™ Enabled Programs: PY2012 Evaluation, EnerNOC Utility Solutions, Walnut Creek, CA. 2013.

EXECUTIVE SUMMARY

Customer Web Presentment and Energy Alerts are two SmartMeter ™ enabled informational energy conservation programs available to Pacific Gas & Electric (PG&E) customers. Customer Web Presentment (CWP) 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 ™ read and billed to view their electricity usage at a daily or hourly level. Energy Alerts (EA) is a program in which participants elect to receive notifications during the billing cycle regarding their electricity usage. PG&E residential customers are billed according to an increasing block rate structure where successively higher tiers of electric usage are billed at successively higher per-kWh rates. Energy Alerts customers are notified for the first time if their bill forecast, calculated on the 8th day of their billing cycle, projects that they will cross into tiers 3, 4, or 5. Customers are subsequently notified after they cross each of those three tiers for a maximum of 4 alerts in each billing cycle.

This report presents the program year 2012 (PY2012) evaluation of ex-post electricity savings associated with each of the two SmartMeter ™ enabled energy conservation programs described above.

BACKGROUND

PG&E began active marketing of both CWP and Energy Alerts early in 2010, with 2012 being the third year that the programs have undergone a formal evaluation. For PY2010, the evaluators found no detectable savings at the program level for either program.

During the PY2011 evaluation of the Energy Alerts program, EnerNOC's evaluation team stratified the participants and used direct comparison and regression methods to analyze daily and monthly ex-post savings. Once again, statistically significant savings were not detected for the Energy Alerts program. We hypothesized that the quality of the match may have been an issue that prevented us from identifying savings for Energy Alerts. However, by employing a more granular approach that investigated key subpopulations of participants, the PY2011 CWP program evaluation yielded detectable ex-post savings of 2-3% for the subgroup of CWP customers who accessed the web portal more than 15 times during 2011. The savings were smaller and less consistent for the overall CWP population and for other subpopulations that accessed the web portal fewer than 15 times per year. The findings from PY2011 indicate that highly engaged customers are more likely to be early adopters of energy information, and are also more likely than the general population of participants to be looking for tools to help them manage and reduce their energy usage.

During the PY2012 evaluation of the CWP and Energy Alerts programs, EnerNOC's evaluation team modified the ex-post analysis approaches to address unique circumstances for PY2012 and to continually improve the evaluation process. Specifically, for the CWP program evaluation, we used an approach that leveraged historic data to augment 2012 data gaps. In addition, to better understand the reasons for undetectable savings from the Energy Alerts program, we conducted a participant survey during the PY2012 evaluation to supplement the ex-post impact analysis and to help inform our sample design strategy.

OVERALL APPROACH

The evaluation was conducted in four basic steps:

1. Characterize the participants in each program by examining both enrollment data and level of engagement. For CWP, conduct trend analysis based on historical data going back to 2008 to assist in pa rticipant characterization; for Energy Alerts, design and administer a participant survey to help characterize program participants.
2. Design the treatment samples for each program by stratifying on the aspects of participation that are hypothesized to affec t savings. For CWP, these aspects include duration of participation and number of times a participant views the web tools; for Energy Alerts, they include manner in which participants receive alerts and number of alerts received during the 2012 program yea r.
3. Match the treatment customers with non -participant "control" customers using a stratified matching strategy employing both demographic and pre -treatment energy usage data.
4. Estimate the savings for each program at the stratum and population levels for the entire program year using direct comparison of energy usage data between the treatment and control customers. Conduct the savings analysis using both monthly billing data and interval data and compare the results.

In addition it is important to note th at the lack of participation data for CWP prohibited us from accounting for dual participation between the two programs in this analysis. Because we are not able to estimate impacts for dual participants we are unable to determine what portion of the Energy Alerts savings is incremental due to CWP participation, and what portion of CWP savings is incremental due to Energy Alerts participation. While savings estimates do accurately reflect the savings of those customers that participated in each of the progr ams, we cannot add those two savings estimates together without double counting.

CWP SAVINGS ANALYSIS

Due to technical compatibility and contractual issues with the new PY2012 web presentment vendor, 2012 program participation data was not available. Th erefore, we relied heavily on the information used to evaluate CWP in program year 2011, as well as on historical trend data as far back as 2008, to fill data gaps and developed an estimate of the number of participants by year of first view and usage stra tum for 2012. Our PY2012 savings analysis method was similar to the PY2011 approach, but was refined and enhanced to obtain more accurate savings estimates. We first repeated the 2011 analysis with the original sample, but used an improved matching strateg y to obtain a closer match between the treatment and control group. We then compared the monthly usage of the control customers to the treatment customers using direct comparison. We examined the savings for the entire population of program participants, a s well as eight subpopulations:

- Continuing participants who accessed the web portal with the following frequencies during the year:
  - 16 or more times
  - 7 to 15 times
  - 2 to 6 times
  - Once
- New users who accessed the web portal with the following frequencies durin g the year:
  - 16 or more times
  - 7 to 15 times

- 2 to 6 times
- Once

In the first stage of our analysis, we calculated the monthly usage from interval data for a relatively small sample of customers for whom we had interval data. The analysis clearly showed a deviation between the treatment and control groups during the treatment period; however, due to the relatively small sample size, we were not able to obtain statistical significance for that estimate. Therefore, we conducted a secondary analysis using only cal endarized billing data and increased the overall sample size to nearly 20,000 participants. [1] This increased sample allowed us to estimate statistically significant ex post savings for 2012 at the population level and within the two highest usage strata: th ose participants accessing the website between 7 and 15 times annually, and those accessing the website 16 times or more annually.

Per-Participant Savings for CWP

Table E-1 shows the weighted average per customer monthly differences between the control and treatment groups for all participants and the percent impact at the overall program level. A positive difference indicates savings in the treatment group, and a negative difference indicates higher usage in the treatment group. Statistically significant d ifferences are highlighted in blue. At the program level, 11 of the 12 months can be considered statistically different from zero; all of those differences are positive and are, on average, about 14 kWh or 1.8%.

We found the largest savings for the follo wing subpopulations:

- Continuing users versus new users
- High usage participants (7 or more views) versus low usage participants (< 7 views)

Table E-1 Difference between Treatment and Control: All CWP Participants

Month	All Participants n= 19,921	
	Savings	% Impact
January	13.2	1.7%
February	8.7	1.3%
March	11.4	1.6%
April	10.3	1.6%
May	8.7	1.3%
June	12.8	1.7%
July	24.4	2.9%
August	25.2	3.0%
September	15.8	2.0%
October	13.7	2.0%
November	8.4	1.2%
December	6.3	0.8%
Annual Total	**152.2**	**1.8%**

[1] We did not obtain interval data for this large sample due to the timeline of the project. It would not have been possible to obtain, validate and estimate savings with the interval data within the allotted time.

Program-Level Savings for CWP

Based on the analysis of both the entire sample and the subpopulations described above, we estimated the cumulative annual savings for the entire CWP program. This was done by calculating the annual savings per customer by summing all of the statistically significant monthly savings at the program level and multiplying the value by the number of participants in the population. Using this approach, we obtained an estimate of 152.5 kWh annual savings per customer. Table E-2 shows the savings estimate for the entire population in PY2012. Table E-3 presents the 2012 savings estimates for those participants that are assumed to have viewed the website 7 or more times annually.

Table E-2 2012 CWP Program Level Savings

	Number of Participants	Annual Savings (kWh per customer)	Total Savings (kWh)
Continuing Users	100,195	153	15,283,033
New Users	50,955	153	7,772,313
Total	**151,150**	**153**	23,055,346

Table E-3 2012 CWP Program Level Savings for participants with > 7 views per year

Stratum	Number of Participants	Annual Savings (kWh per customer)	Total Savings (kWh)
Continuing User: 7 to 15 Views	11,175	477	5,329,348
New User: 7 to 15 Views	3,349	310	1,036,811
Total: 7 to 15 Views	**14,524**	**438**	**6,366,159**
New User: 16+ Views	2,211	720	1,591,214
Continuing User: 16+ Views	9,283	850	7,888,239
Total: 16+ Views	**11,494**	**825**	**9,479,453**

Overall the CWP program is estimated to be responsible for 23,055 MWh of energy savings. Not surprisingly, the total savings for those more highly engaged participants, 15,846 MWh, represents about 68% of the total program savings but only 17% of the participant population.

ENERGY ALERTS SAVINGS ANALYSIS

To better understand the reasons for undetectable savings from the Energy Alerts program, we conducted a participant survey during the PY2012 evaluation to supplement the ex-post impact analysis and to help inform our sample design strategy. The survey covered aspects of awareness, satisfaction, preferences, and energy saving actions that resulted from Alerts. One of the most useful findings of the participant survey was that a participant's propensity to take action is not correlated with the number of alerts they receive or their annual or seasonal usage. This finding explained why, in this case, stratification of the sample was not helpful in the 2011 program evaluation and reinforced the need for a very large sample that would be able to detect savings at the population level.

The analysis was performed on two groups of participants, one being a subset of the other. The largest group consisted of approximately 35,000 participants. The participants in this group were limited only by the availability of complete billing data in the pre-treatment period. In the first group, calendarized [2] billing data was used both in the pre-treatment match and in the direct

[2] Billing data was calendarized using the number of days in each billing cycle and allocating the appropriate proportion of monthly billed consumption to each calendar month. This results in a reasonable estimate of actual calendar month consumption; however interval

comparison. We also selected a simple random sample of approximately 18,000 participants from the aforementioned group to make the use of interval data in the analysis more feasible. In the sample, calendarized billing data was use for pre-treatment matching, but monthly consumption calculated from interval data was used in the direct comparison, which more accurately reflects the true usage of participants in each month.

We examined the savings for the entire population of program participants, as well as four subpopulations:

- Participants receiving alerts via email
- Participants receiving alerts via SMS text
- Participants receiving more than five alerts annually
- Participants receiving fewer than five alerts annually

The PY2012 impact analysis for the Energy Alerts program showed savings at the population level, and at each sub-group level, including method of alert delivery, text vs. email, and the number of alerts, more than 5 annually vs. less than 5 annually.

Per-Participant Savings for Energy Alerts

Table E-4 presents the estimated difference (or savings) between the treatment and control groups for both the analysis using billing data and the analysis using interval data. All cells are shaded orange indicating that all the results are statistically different from zero.

Table E-4 Differences between Treatment and Control Group: All Energy Alerts Participants [kWh per Customer]

Month	All participants n=31,316 (billing data)	% Impact	All participants n=14,027 (interval data)	% Impact
January	26.1	3.4%	24.3	3.3%
February	24.2	3.6%	22.0	3.4%
March	24.1	3.5%	21.9	3.2%
April	22.1	3.4%	18.3	2.9%
May	23.8	3.4%	23.6	3.5%
June	25.2	3.2%	24.1	3.1%
July	27.8	3.1%	29.4	3.3%
August	22.1	2.4%	26.8	2.8%
September	24.5	3.2%	23.6	3.1%
October	21.5	3.1%	17.6	2.6%
November	21.3	3.1%	20.3	3.1%
December	21.4	2.7%	21.4	2.7%
Annual	284.2	3.2%	273.4	3.1%

Table E-4 above shows that regardless of the type of data used to calculate the difference, participants on average, save between 3.1% and 3.2% monthly relative to non-participants. Their savings also appear to be very similar across months of the year with slightly more savings in the winter and shoulder months and slightly less savings in the summer months. We found the largest savings for the following subpopulations:

data will still be the most accurate especially in shoulder months and during months with very extreme weather to the extent that a customer's weather sensitivity affects their daily average usage.

- Participants receiving fewer than five alerts annually (11.5 -12.0% average savings) versus those receiving more than five alerts annually (1.6% average savings), which is a significant difference between these two subgroups and suggests that less frequent alerts may actually be more effective because customers do not become desensitized to alerts over time
- Participants receiving alerts by email (3.3 -3.4% average savings) versus SMS text (2.7 - 2.9% average savings), which is only a slight difference between these two subgroups

Program-Level Savings for Energy Alerts

Based on the analysis of both the entire sample and the subpopulations described above, we estimated the cumulative annual savings for the entire Energy Alerts program. This was done by calculating the annual savings per customer by summing all of the statistically significant monthly savings at the program level and multiplying the value by the number of participants in the population that received at least one alert in 2012. Using this approach, we obtained an estimate of 284.2 kWh annual savings per customer. Table E-5 shows the savings estimate for the entire Energy Alerts population in PY2012. Table E-6 presents the 2012 savings estimates by subgroup.

Table E-5 2012 Energy Alerts Program Level Savings

	Number of Participants	Annual Savings (kWh per customer)	Total Savings (kWh)
2012 Energy Alerts Program	71,459	284	20,294,356

Table E-6 2012 Energy Alerts Program Level Savings by Alert Delivery Type and Number of Alerts

Stratum	Number of Participants	Annual Savings (kWh per customer)	Total Savings (kWh)
Email Recipients	46,670	284	13,254,280
Text Recipients	22,110	284	6,279,240
Total (excludes phone recipients)	**68,780**	**284**	**19,533,520**[3]
Fewer than 5 alerts	18,696	658	12,301,968
More than 5 alerts	52,763	140	7,386,820
Total	**71,459**	**284**	**19,688,788**[4]

Overall, we estimate the Energy Alerts program is responsible for about 20,294 MWh of annual energy savings. As observed for the CWP program, a relatively small number of participants in the Energy Alerts program are contributing the majority of the program savings. The total savings from those receiving fewer than 5 alerts in 2012 is 12,301 MWh, which accounts for about 60% of the program savings, while the participants represent only 26% of the total population.

While interpreting these savings, one thing to keep in mind is that because we are not able to estimate impacts for dual participants we are unable to determine what portion of the Energy Alerts savings is incremental due to CWP participation, and what portion of CWP savings is incremental due to Energy Alerts participation. While savings estimates do accurately reflect the savings of those customers that participated in each of the programs, we cannot add those two savings estimates together without double counting.

[3] Excluded phone recipients and therefore will not equal overall total in Table 5-16

[4] Annual savings per group excludes statistically insignificant months and therefore will not equal overall total in Table 5-16

RECOMMENDATIONS FOR FUTURE PROGRAM YEARS

Based on the evaluation activities conducted for both Energy Alerts and CWP, we present the following recommendations for future program years:

- In subsequent evaluations, evaluators should continue to select very large samples, near 20,000 participants, and use the improved matching approach in order to obtain the necessary precision to detect impacts.
- We recommend that PG&E encourage CWP partici pant engagement in order to increase per participant savings. More highly engaged customers save significantly more energy than less engaged customers. This could be done by highlighting the estimated savings of those highly engaged customers in CWP market ing and education.
- PG&E may wish to increase marketing efforts surrounding CWP. We estimated that participation dropped nearly 25% from approximately 200,000 customers in 2011 to 150,000 customers in 2012. Furthermore, without meter installs driving new pa rticipants, participation is likely to continue to decline in subsequent years.
- PG&E may wish to allow Energy Alerts participants to set their own alert threshold to reduce the number of alerts and make the program more useful. Participants that received fewer alerts were more likely to take action and saved more energy; this may be in part because those that receive more alerts become desensitized to them over time, and the later alerts are less useful or meaningful for them.
- While the improved matching strategy significantly improved the quality of the match between the treatment and control customers, it also necessitated excluding a large percentage of the population from the analysis based on availability of pre -treatment interval data. We found usin g these criteria caused a disproportionate number of lower usage and/or multifamily participants to be excluded from the analysis. While we can use weighting to correct the population impacts to accurately reflect the savings for those participants include d in the analysis, we are unable to measure savings for those excluded participants. We recommend exploring alternate matching strategies, provided that we can obtain a sufficient match, which might allow us to capture the impacts of those excluded custome rs.
- Improved matching strategies and very large samples were able to demonstrate savings in both CWP and Energy Alerts for the first time in this evaluation. In light of the substantial savings, we recommend that future evaluation years carefully consider dual participation both between CWP and Energy Alerts and between each program and Home Energy Reports (HERS).

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OVERVIEW

1.1 PROGRAM BACKGROUND

This report includes the ex-post (after the fact) Evaluation of Pacific Gas and Electric Company's (PG&E's) SmartMeter™ Enabled Programs for the Program Year 2012 (PY2012). The report provides an estimation of the energy savings for two SmartMeter™ enabled informational energy conservation programs:

- **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 –** In this program, customers can sign up for Energy Alerts (EA) to receive notifications during the billing cycle about 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. Energy Alert customers are notified for the first time if their bill forecast, calculated on the 8th day of their billing cycle, projects that they will cross into tiers 3, 4, or 5. Customers are subsequently notified after they cross each of those three tiers for a maximum of 4 alerts in each billing cycle.

PG&E began active marketing of both CWP and Energy Alerts early in 2010 and this is the third year that the programs have undergone a formal evaluation. It is important to note that the results of the PY2010 and PY2011 evaluations were considered in the objectives and design of this year's evaluation. At the program level, the PY2010 third party evaluator did not report detectable savings for either CWP or Energy Alerts. However, the evaluator noted in the Executive Summary that "there is significant uncertainty in these estimates, so it is possible that the programs could affect usage by 1-2% in either direction."[5] Similarly, EnerNOC's program evaluation team did not detect savings for the Energy Alerts program for PY2011, despite modifications to the approach to try to improve accuracy by use of SmartMeter™ interval data and sample design enhancements. However, we were able to detect small savings for the CWP program during the PY2011 evaluation by looking at key subpopulations, with the population of participants accessing the web portal more than 15 times during the year showing statistically significant savings of 2-3%.

During the PY2012 evaluation of the CWP and Energy Alerts programs, EnerNOC's evaluation team once again modified the ex-post analysis approaches to address unique circumstances for PY2012 and to continually improve the evaluation process. Specifically, for the CWP program evaluation, we used a dual approach that leveraged historic data to augment 2012 data gaps. In addition, to better understand the reasons for undetectable savings from the Energy Alerts program, we conducted a participant survey during the PY2012 evaluation to supplement the ex-post impact analysis and to help inform our sample design strategy. For both programs, we focused on achieving the increased precision needed to identify very small changes in energy consumption at the population level by significantly increasing the sample sizes from 6,000 and 3,000, to 20,000 and 35,000, for CWP and Energy Alerts respectively. We also adjusted our matching strategy to nearly eliminate the small bias we saw in last year's evaluation.

[5] Freeman, Sullivan & Co., 2010 Energy Conservation Evaluation of Pacific Gas & Electric Company's Energy Alerts and Customer Web Presentment Programs, April 29, 2012, p. 2.

1.2 RESEARCH OBJECTIVES

The two research objectives for this project are to evaluate the ex-post energy savings associated with SmartMeter™ enabled energy conservation programs:

- **Ex-Post Estimates of Energy Conservation for Customer Web Presentment** – 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 is to estimate the effect on customers' monthly energy usage of viewing daily or hourly energy use during the billing cycle both at the program level and within subpopulations that use the website more frequently and are more likely to conserve energy.
- **Ex-Post Estimates of Energy Conservation for Energy Alerts** – Because PG&E charges customers for energy use on an inverted block rate schedule, it is hypothesized that if a customer knows when she crosses into a higher priced tier, she will conserve energy in response to the higher price. The second research objective is to estimate the effect of Energy Alerts on customers' monthly or daily energy usage both at the program level and within subpopulations that are more likely to conserve energy.

1.3 KEY ISSUES

There are some unique challenges associated with meeting the research objectives defined in this project for PY2012:

- **Data availability for Customer Web Presentment** – During 2011, PG&E selected a new vendor to handle the web presentment of SmartMeter™ interval usage data. Aclara was the previous vendor and Opower is the new vendor. Due to contractual issues with Opower, no participant data was available for the 2012 program year. Therefore, we did not know who the 2012 participants were, nor did we have information on how frequently they accessed their interval data in 2012.
- **Dual participants between programs** – 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. We were not able to address dual participation in the PY2012 evaluation because we did not know who participated in the CWP program during 2012. Because we are not able to estimate impacts for dual participants we are unable to determine what portion of the Energy Alerts savings is incremental due to CWP participation, and what portion of CWP savings is incremental due to Energy Alerts participation. While savings estimates do accurately reflect the savings of those customers that participated in each of the programs, we cannot add those two savings estimates together without double counting.
- **Inability to identify impacts for Energy Alerts** – During the PY2010 and PY2011 evaluations, two separate evaluation firms were unable to identify any statistically significant impacts for the Energy Alerts program.

In addition, two general challenges were identified in last year's evaluation which continued to apply to the 2012 evaluation:

- **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 CWP and Energy Alerts, a randomized control group is no longer an option.
- **Very small impacts relative to total usage** – Evaluations from the past two 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.

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 characteristic s, 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 uncertain ties must be associated with the evaluation's context, not necessarily the effectiveness of the program.

PROGRAM DETAILS

2.1 PROGRAM MARKETING AND ENROLLMENT

Rollout and marketing of the CWP and Energy Alerts programs began in early 2010, targeting customers with the following mail and email messages.

- Introductory bill inserts were sent to customers who were about to have a SmartMeter™ meter installed. These i nserts described the SmartMeter™ meters in general, and highlighted ways in which both CWP and Energy Alerts could help customers manage their electricity use. Roughly 800,000 such inserts were sent out from January 2010 through April 2010.
- After SmartMete r™ installations, a Welcome Kit was sent with further information on the meters and supporting programming. These kits highlighted CWP, but did not mention Energy Alerts. Roughly 1.7 million SmartMeter™ Welcome Kits were sent out to residential customers from April 2010 through August 2010.
- After September 2010, a Transition Booklet replaced the SmartMeter™ Welcome Kits with similar information. The Transition Booklet advertised both CWP and Energy Alerts. About 900,000 Transition Booklets were sent to res idential customers from September 2010 to December 2010.
- In June 2010, an email was sent to about 14,000 customers who had previously indicated interest in the Energy Alerts program. The email announced that the Energy Alerts program was now available.
- The Anatomy of a Rate mailing was sent to customers who had had bills in tier 3 in August of 2010. This explained the tiered rate structure and again advertised both the CWP and Energy Alerts programs and how they can be used to manage electricity use. About 560,000 of these mailings were sent out.
- In July 2011, five -hundred thousand emails were sent to non -CARE customers that had a high propensity for crossing tier 3. Then, in October of 2011, an additional 430,000 emails were sent customers with the same ch aracteristics.
- In June of 2012, approximately 1.3 million emails were delivered promoting My Energy and several of its benefits including My Usage. The emails encouraged recipients to click on a link that took them to the My Energy login page. Approximate ly 25% of the emails were opened, and about 2.5% of recipients clicked through the My Energy login page. For the June emails no information is available regarding the number of participants that viewed the My Usage webpage.
- In August of 2012 a second grou p of 1.2 million emails were delivered promoting My Energy. In this second group there was a direct link to the My Usage through the My Energy website and PG&E was able to identify 1,934 recipients that viewed the My Usage webpage through the link. The 1,9 34 represents 5.5% of those that first clicked through to the My Energy Login.
- In addition the outreach campaign featured banners on PG&E's home page from 6/29/2012 – 7/26/2012. The banners resulted in 624 clicks through to the My Energy Login page.

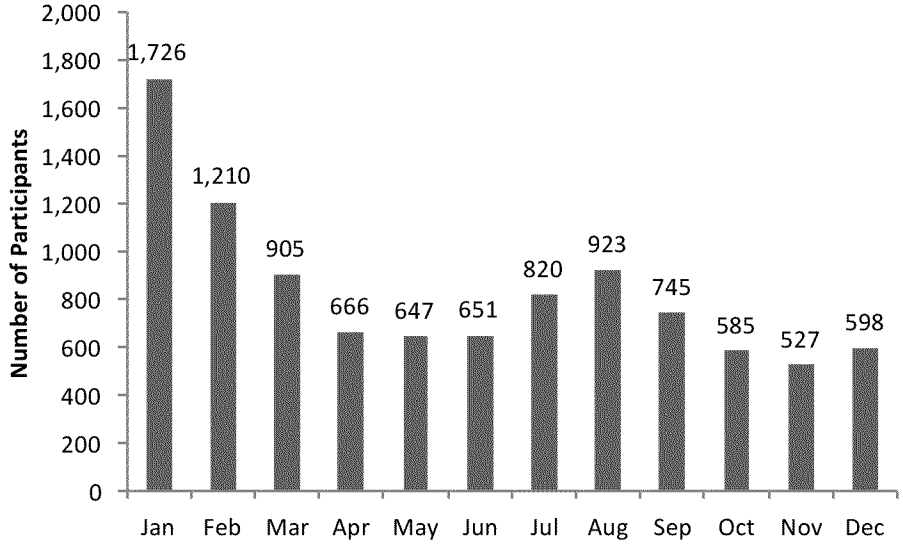
2.2 ENERGY ALERTS

Energy Alerts is a program that provides customers information about their cumulative energy use up to four times each billing month. Energy Alerts are only available for residential customers who are SmartMeter ™ read and billed. As of Decemb er 31, 2012, there were approximately 92,000 participants in Energy Alerts. Energy Alerts customers are notified for the first time if their bill forecast, calculated on the 8th day of their billing cycle, projects that they will cross into tiers 3, 4, or 5. Customers are subsequently notified after they cross each of those three tiers for a maximum of 4 alerts in each billing cycle. There is no price difference between tiers 4 and 5, however an alert is still issued if a customer crosses into tier 5 based on their usage above the baseline allocation applicable to their weather zone. CARE [6] customers are only charged for usage on three tiers and are therefore notified only as they cross into tier 3.

2.2.1 Enrollment

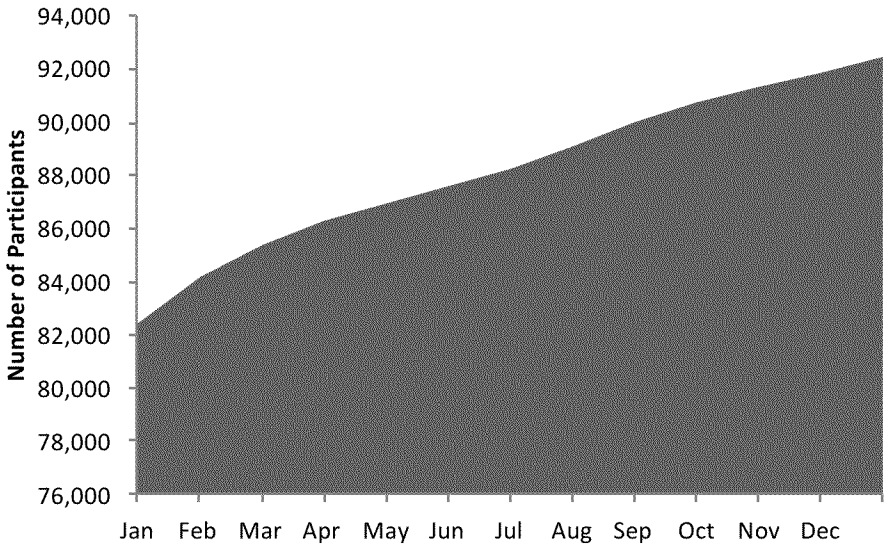
As of December 31, 2012, there were 92,458 customers enrolled in Energy Alerts. The program's enrollment grew at an average rate of approximately 800 new customers per month during 2012. New enrollment rates were highest in the beginning of the year, betwe en January and March, as well as during the summer months between July and August. The larger numbers of new enrollments during these winter and summer periods could be due to higher seasonal energy bills causing customers to take notice of their energy us age. In addition, the larger new enrollment values during the summer months could have been influenced by marketing efforts between June and August 2012 (see Section 2.1). See Figure 2-1 and Figure 2-2, respectively, for graphs of the new enrollments and cumulative enrollments throughout 2012.

Figure 2-1 Energy Alerts - Graph of New Enrollments over Time for PY2012



[6] 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 th e home and the household's total annual income.

Figure 2-2 Energy Alerts - Graph of Cumulative Enrollments over Time in PY 2012



2.2.2 Level of Engagement

Figure 2-3 shows the total number of Energy Alerts dispatched to participant s throughout 2012 and Figure 2-4 shows the number of alerts normalized on a per participant basis. Both graphs display peaks in the number of alerts i n summer and winter months, which is expected due to seasonal impacts on energy usage. The peak winter month for alerts was December, with 88,545 total alerts, equating to 0.96 alerts per participant. (The January value of 82,045 total alerts was also rela tively high; it actually corresponded to a larger number of alerts per participant (0.97) since there were fewer participants enrolled at the beginning of the year.) The peak summer month for alerts was August, with 116,228 total alerts and 1.29 alerts per participant.

Figure 2-3 Energy Alerts - Total Number of Alerts in 2012

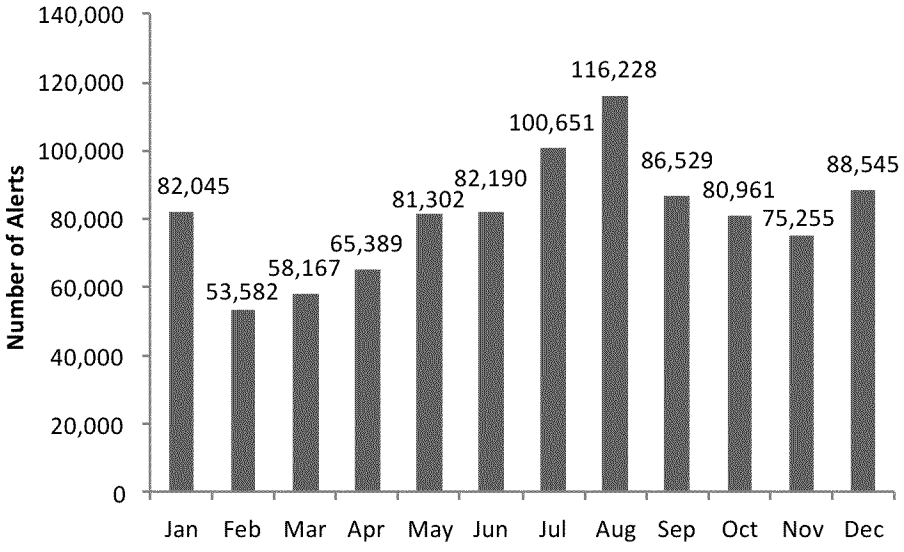


Figure 2-4 Energy Alerts – Average Number per Participant in 2012

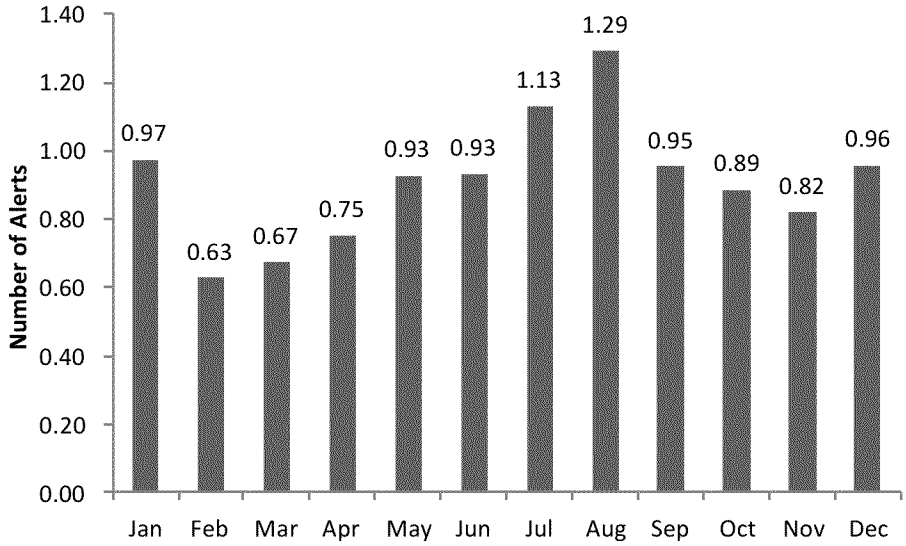
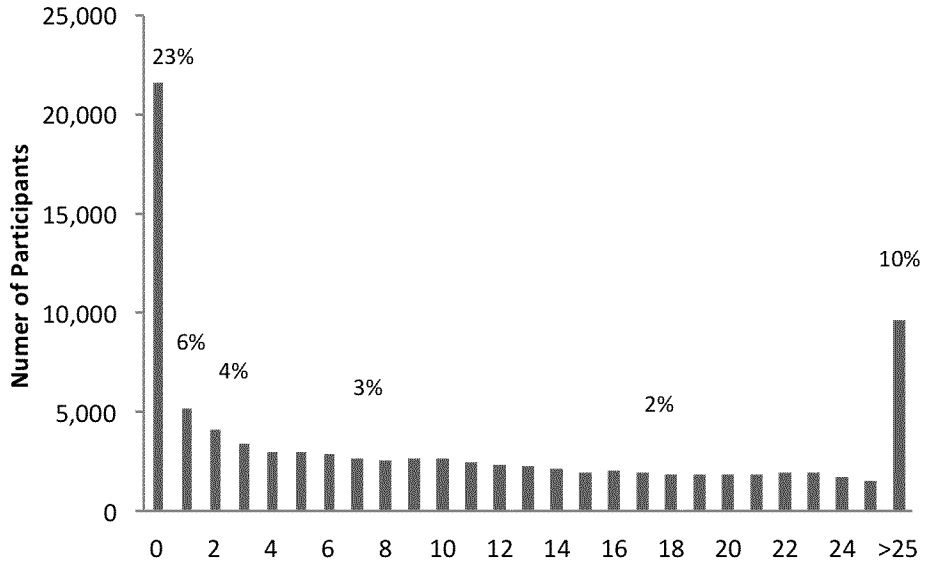


Figure 2-5 below shows the distribution of participating customers by number of alerts received. The largest group (21,633 participants, or about 23%) did not receive any alerts in 2012. This statistic is slightly higher than the 20% of participants who received no alerts in 2011 and slightly lower than the 25% who received no alerts in 2010. The next largest group (9,657 participants, or about 10%) was at the other end of the spectrum, receiving more than 25 alerts in 2012; this value is significantly higher than the 3% of participants in this category in 2011. Though this category differs from the other data points in that it encompasses all participants receiving more than 25 alerts as opposed to participants receiving only a single, discrete number of alerts, it is notable. The large share of participants in this greater-than-25-alerts category may be indicative of more high usage customers joining the program. Customers who use more energy will cross into the higher tiers more often and receive more alerts.

Figure 2-5 Energy Alerts Engagement: Number of Alerts Received in 2012



2.3 CUSTOMER WEB PRESENTMENT

Customer Web Presentment of usage data is a feature that lives inside the My Energy website, which is a single customer-facing portal with many different functions and tools. Residential and small business customers that are SmartMeter™ read or billed can view their interval data through tools in the My Usage tab on the website. 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™ system were evaluated within the scope of this project. In addition, to be consistent with PY2010 and PY2011 evaluations, the PY2012 analysis focused exclusively on residential customers. [7]

In 2011, PG&E transitioned to a new platform for the web presentment of SmartMeter™ interval usage data. After the upgrade was complete, technical compatibility and contractual issues associated with the new platform limited PG&E's ability to track detailed customer activity within the web presentment pages. As such, we have limited visibility into the participants and their activities during 2012, furthermore we have no visibility into how individual, unique, customers accessed and used the website in 2012. Therefore we have used historical participation information, 2012 marketing campaign data, and 2012 SmartMeter™ installation data to estimate the total number of participants in 2012 and make assumptions about how often the participants on average view the CWP web site.

2.3.1 Assessment of Participation Trends

In order to inform our estimate of 2012 participants we performed an assessment of CWP participation trends over the past four years. This assessment helped to identify not only the total number of continuing participants (2012 participants that would have also been participants in previous years) but also how often those participants viewed their interval data based on the strata defined in the 2011 evaluation.

The first step included a review of all the CWP log-in data from the Aclara System for 2008 through 2011. The data included the following:

- Unique ID
- My Energy Account ID
- Participation start date
- Date and time of each CWP log-in
- CWP pages viewed

We then analyzed how customers, on average, use the CWP system over time, paying close attention to whether those in different usage strata seem to continue to use the system at the same rate over time, or, if their usage tends to decrease or increase over time. The purpose of this analysis was to help us estimate the number of participants for CWP in 2012 in each stratum of usage. The findings from our assessment of historical participation trends are presented in three categories:

- Total number of participants by usage stratum and program year
- Growth in continuing participants over time
- Continuing participants by usage stratum and program year

Number of Participants by Usage Strata

Table 2-1 lists the number of participants who visited the web to view their usage data by stratum and program year between 2008 and 2011. The strata represent four levels of usage: 1 view per year; 2-6 views per year; 7-15 views per year; and 16 or more views per year. The data

[7] Small and medium business customers and agricultural customers can also participant 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.

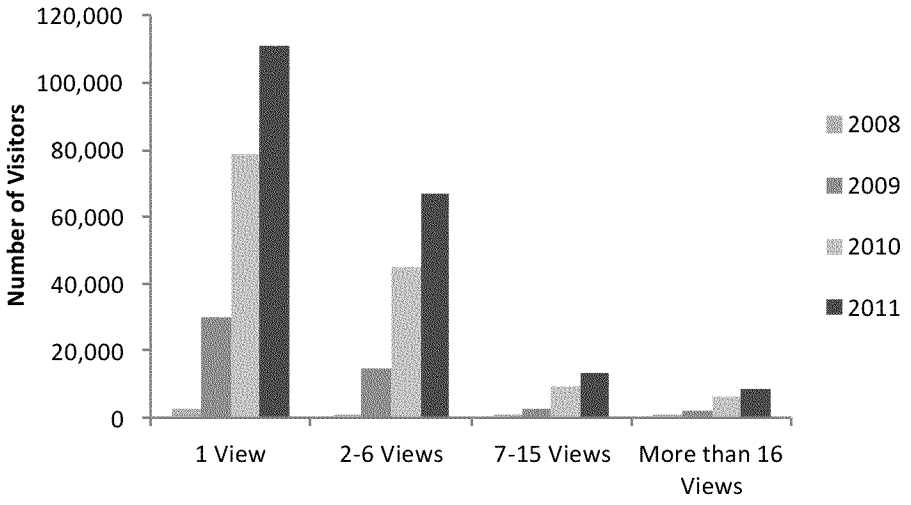
are also plotted in Figure 2-6 to illustrate the growth in overall program participation over time and to show the relative number of participants in the four strata.

The table and figure show that the majority of participants view the data once in a given year. The share of participants in this 1 -View stratum ranges from 56 -68% across the fo ur years, with the percentage of customers in this stratum decreasing each year. The 2 -6 Views stratum has the next largest share of customers, with the percentage increasing from 24% to 34% between 2008 and 2011. The 7 -15 Views stratum has the third large st share of participants, with the percentage increasing from 4% to 7% between 2008 and 2010 and remaining at 7% in 2011. Lastly, the 16 -plus views stratum has the smallest share of participants, representing 4% of the participant populations each year.

Table 2-1 CWP Participant Visits by Usage Strata and Program Year

Total Visits Stratum	2008		2009		2010		2011	
	No. of Visitors	%	No. of Visitors	%	No. of Visitors	%	No. of Visitors	%
1 View	2,382	68%	29,991	61%	78,546	57%	110,664	56%
2-6 Views	845	24%	14,790	30%	44,945	32%	66,757	34%
7-15 Views	155	4%	2,800	6%	9,027	7%	13,091	7%
16+ Views	136	4%	1,879	4%	6,147	4%	8,643	4%
Totals	**3,518**	**100%**	**49,460**	**100%**	**138,665**	**100%**	**199,155**	**100%**

Figure 2-6 Illustration of Trends in CWP Participation by Usage Stratum and Program Year

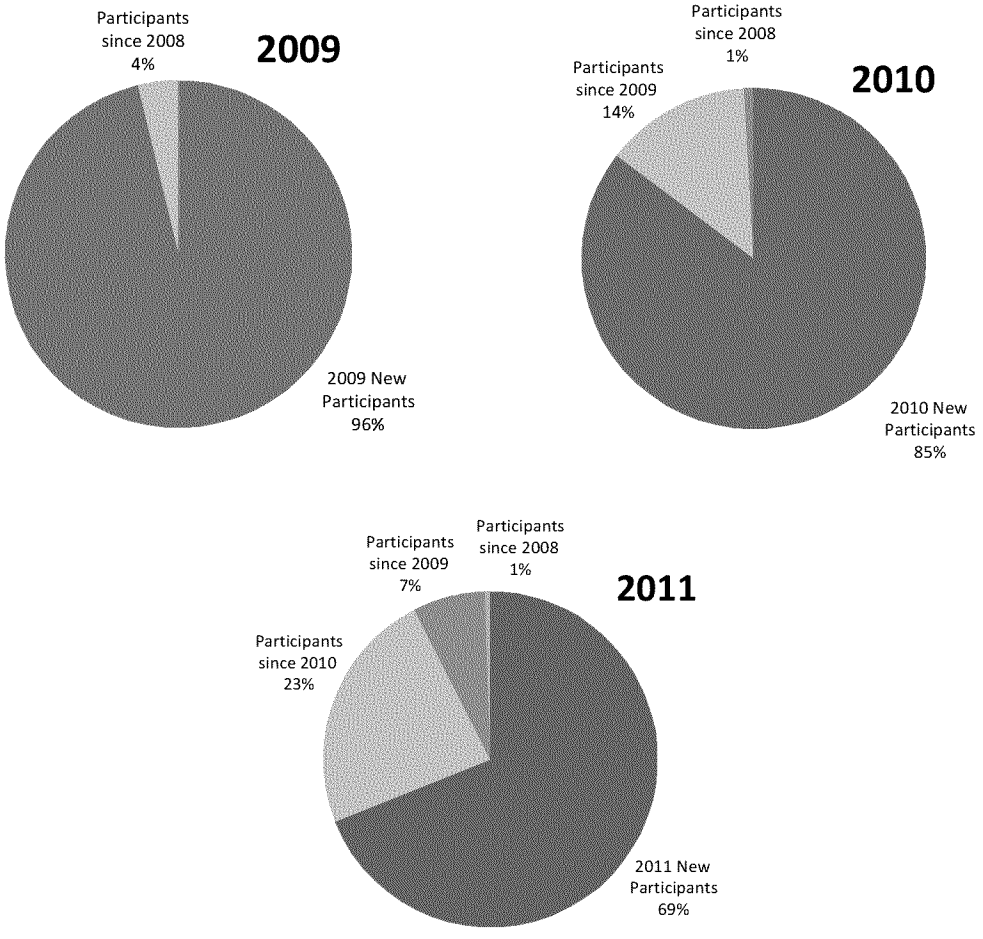


Continuing Participants over Time

It is also important to analyze the percentage of participants that are continuing participants from prior year s in order to estimate the number of participants who are likely continue to participate in CWP in 2012. Figure 2-7 summarizes results from our investigation of the overlap in participation from one year to another. For a given program year, the values in pie charts represent the number of program particip ants who were new or continuing participants. For continuing participants, the data indicate the first year the customers participated in the program. Participants are defined as those who viewed web data one or more times during the program years.

The results show that the combined share of continuing participants increased from 4% in 2009 to 15% in 2010 and to 31% in 2011. Looking at trends by first year of participation, we see that the shares of continuing participants are smaller for longer ter m participants and are higher for shorter-term participants. This is consistent with the significant growth in participation between 2008 and 2011. Indeed, total participants increased from 3,518 in 2008 to 199,155 in 2011, as shown in Table 2-1. In 2012, we would expect a similar breakdown of continuing participants as seen for 2011, with one additional category of continuing participants to account for returning parti cipants who joined the program in 2011.

Figure 2-7 Growth in Continuing Users over Time[8]



Over the past three years the vast majority of the participants in CWP are new participants rather than conti nuing participants. This is a result of the connection between SmartMeter ™ installs and CWP participation. PG&E customers are able to participate in, and are made aware of CWP only after their SmartMeters ™ are installed; therefore, meter installs are a p rimary driver of new participants. As meter rollout slows down significantly due to its completion in 2012, we expect to see the percentages of continuing vs. new participants change substantially.

Because we know how many participants continued to parti cipate in subsequent program years between 2008 and 2011, we can also make assumptions about how many participants from each program year will continue to participate in CWP in 2012.

[8] In the 2010 and 2011 Figures the 1% is rounded up from 0.96% and 0.6% respectively. All percentages in the pie charts are rou nded to the nearest percentage.

Table 2-2 shows the percentage of new participants in a particular year that continued to participate in the program in each subsequent year in the 2009 through 2011 columns. The percentages in the 2012 column were assumed based on the past participation of each group. Using those assumed percentages from 2012, we were able to apply them to the total number of new participants in each year to estimate the number of continuing participants in 2012. For example, 53% of the 3,518 (see Table 2-1) 2008 participants continued to participate in 2009, and 38% of those original participants continued into 2010 and so on. [9] Based on this method, we estimated a total of 100,195 participants will continue to use the CWP interface.

Table 2-2 Estimated Number of Continuing Participants in 2012 by First Usage Year

	2009	2010	2011	2012	Continuing Participants 2012
2008 Participants	53%	38%	32%	27%	950
2009 Participants		40%	29%	21%	9,992
2010 Participants			40%	29%	34,304
2011 Participants				40%	54,949
Total					**100,195**

Continuing Participants by Usage Stratum and Program Year

After estimating the total number of continuing participants, we can also look at usage trends to estimate the percentage of participants in each usage stratum. Table 2-3 through Table 2-5 summarizes continuing participation results by usage stratum and program year. The data in Table 2-3 represent the subpopulation of customers who were participants between 2008 and 2011. All of these participants viewed data in 2008 and 2011 and many, but not all of them, viewed data in 2009 and/or 2010. Similarly, Table 2-4 shows the subpopulation of customers who have been participants since 2009. Lastly, Table 2-5 includes the subpopulation of participants who viewed data in 2010 and 2011.

The data show that the ordering of the strata sizes changes for customers that have participated for at least one prior year. That is, after the first year, the largest share of participants viewing data falls into the 2-6 View stratum, followed by the 1-View stratum, the 7-15 View Stratum, and then the 16-plus stratum.

Table 2-3 CWP Participant Visits by Usage Strata and Program Year: Subpopulation of 2008 2011 Participants

Total Visits Stratum	2008		2009		2010		2011	
	No. of Visitors	%	No. of Visitors	%	No. of Visitors	%	No. of Visitors	%
0 Views			236	21%	309	28%		
1 View	593	53%	185	17%	137	12%	399	36%
2-6 Views	325	29%	320	29%	293	26%	413	37%
7-15 Views	100	9%	174	16%	166	15%	159	14%
16+ Views	100	9%	203	18%	213	19%	147	13%
Totals	**1,118**	**100%**	**1,118**	**100%**	**1,118**	**100%**	**1,118**	**100%**

[9] The numbers in Table 2-2 are different than those in Figure 2-7, the percentages in the Figure represent the percent of the total current population that is made of continuing participants, while the percentages in the Table represents the percentage of new participants in a specific year that continued to use the web in subsequent years.

Table 2-4 CWP Participant Visits by Usage Strata and Program Year: Subpopulation of 2009 2011 Participants

Total Visits Stratum	2008		2009		2010		2011	
	No. of Visitors	%	No. of Visitors	%	No. of Visitors	%	No. of Visitors	%
0 Views					3,606	26%		
1 View			5,799	42%	2,056	15%	5,382	39%
2-6 Views			5,207	38%	4,095	30%	5,494	40%
7-15 Views			1,542	11%	1,908	14%	1,536	11%
16+ Views			1,228	9%	2,111	15%	1,364	10%
Totals			**13,776**	**100%**	**13,776**	**100%**	**13,776**	**100%**

Table 2-5 CWP Participant Visits by Usage Strata and Program Year: Subpopulation of 2010 2011 Participants

Total Visits Stratum	2008		2009		2010		2011	
	No. of Visitors	%	No. of Visitors	%	No. of Visitors	%	No. of Visitors	%
0 Views								
1 View					19,567	42%	18,587	40%
2-6 Views					19,227	41%	19,513	42%
7-15 Views					4,895	10%	4,970	11%
16+ Views					3,199	7%	3,818	8%
Totals					**46,888**	**100%**	**46,888**	**100%**

By combining the estimates in Table 2-2 with the information in Table 2-3 through 2-5 we can also estimate the percentage of 2012 continuing participants in each usage strata based on their year of first access. These estimates are presented below in Table 2-6.

Table 2-6 Continuing Participants in 2012 by First Access Year and Usage Strata

Total Visits Stratum	2008		2009		2010		2011	
	No. of Visitors	%	No. of Visitors	%	No. of Visitors	%	No. of Visitors	%
1 View	339	36%	3,566	36%	13,296	39%	21,782	40%
2-6 Views	351	37%	3,691	37%	13,573	40%	22,868	42%
7-15 Views	135	14%	1,421	14%	3,795	11%	5,824	11%
16+ Views	125	13%	1,314	13%	3,370	10%	4,474	8%
Totals	**950**	**100%**	**9,992**	**100%**	**34,034**	**100%**	**54,949**	**100%**

2.3.2 Estimating the Number of New CWP Participants in 2012

The final piece is to estimate the total number of new CWP participants in 2012. We do this in two pieces:

- First, by estimating the number of customers who would access the website for the first time due to the installation of a SmartMeter™.[10]
- Second, by estimating the number of new users that responded to the email and banner campaign during the summer of 2012.

In total, PG&E installed approximately 694,119 residential SmartMeters™ in 2012. We know from past years that about 6.8% of those customers who get a new SmartMeter™ subsequently participate in CWP that year.[11] Therefore we would expect that in 2012 about 47,200 customers with new SmartMeters would become CWP participants.

PG&E also conducted two email campaigns during the summer of 2012 promoting the My Energy and My Usage web pages. During the August campaign, PG&E was able to track the total number of customers that clicked through to the My Usage site as a percentage of those that logged into My Energy. The percentage was 5.5%. If we apply this same percentage to all of PG&E's 2012 marketing efforts, we can assume the following:

- During the June campaign, 1.3 million customers received an email. Of those receiving an email, 2.5% (or 32,500 customers) logged into My Energy. Of those who logged into My Energy, we can assume that 5.5% (or 1,787 customers) became participants in CWP.
- During the August campaign PG&E tracked 1,934 new CWP participants. (This was the origin of the 5.5% estimate of CWP participants as a share of customers who logged in to My Energy.)
- Finally, during June and July, banners were run on the PG&E website home page promoting My Energy. PG&E tracked 694 customers who logged into My Energy through the banners. Applying the same 5.5% value, we can approximate that 34 customers became CWP participants.
- In total we estimate that PG&E's marketing resulted in 3,755 new CWP participants in 2012.

If we add the 47,200 new CWP participants that were recruited through meter installs, to the 3,755 participants that were recruited through marketing, we estimate a total new participant population of 50,955. Adding this number of new participants to our estimate for continuing participants, we get a total of 151,150 participants for 2012. This is a decrease relative to the 2011 participant population (which was ~199,000) due to the fact that the bulk of the SmartMeter™ deployment occurred in 2011.

Similar to the methods used in the trending analysis above for continuing participants, we also assume that the new participants in 2012 will engage in the website in a similar way to new participants from 2011. That is, 56% of new participants would fall into the 1-View stratum, 34% would fall into the 2-6 View stratum, 7% would fall into the 7-16 View stratum, and 4% would fall into the over 16-View stratum.

In Figure 2-8 and accompanying Table 2-7 we combine the results from new and continuing participants to show the total number of participants in 2012 by year of first access and usage stratum. For example, in the 1-Visit usage stratum, we estimate that there were 68,069 visitors. Of these, we assume that less than 1% were continuing participants from 2008, 5% were continuing from 2009, 20% were continuing from 2010, 32% were continuing from 2011, and 42% were new visitors in 2012. In total, we approximate that 45% of 2012 participants were in the 1-View stratum, 38% were in the 2-6 View, 10% were in the 7-15% stratum, and 8% were in the 16-plus stratum. Chapter 4 describes how we used these results to carry out our impact analysis for CWP.

[10] Customers without SmartMeters are not able to access CWP because the old meters do not collect interval data.
[11] In 2011 2,937,056 residential customers received a smart meter, and 199,155 participated in CWP.

Figure 2-8 2012 CWP Participants by Year of first Access and Usage Stratum

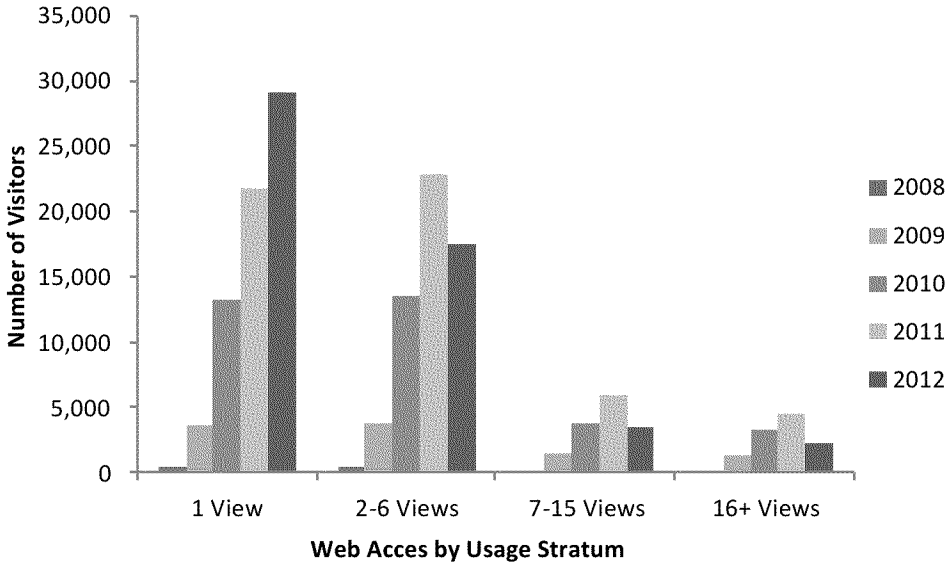


Table 2-7 2012 CWP Participants by Usage Stratum

Total Visits Strata	All 2012	
	No. of Visitors	%
1 View	67,403	45%
2-6 Views	57,671	38%
7-15 Views	14,555	10%
16+ Views	11,521	8%
Totals	**151,150**	**100%**

ENERGY ALERTS PARTICIPANT SURVEYS

During the 2011 evaluation, we attempted to use two separate methods to identify savings for the Energy Alerts program: a direct comparison and a regression an alysis. Neither method was able to detect statistically significant savings for Energy Alerts participants. For the 2012 evaluation, we proposed conducting an online participant survey to help identify the types of customers who are responding to the Energ y Alerts program and who are taking action to conserve energy after receiving an alert. Our hope was that the survey results would enable us to improve the stratification methodology used in our impact analysis sample design, thereby improving our ability to detect savings for the Energy Alerts participants. The survey was also intended to help us to identify reasons why it is very difficult to detect savings, or why customers are or are not responding to the program.

3.1 METHODOLOGY

We designed and fielded a comprehensive survey of a randomly selected representative sample of 2012 Energy Alerts participants. Our goal was to obtain at least 1,000 completed surveys. Our survey approach included eight main steps:

1. Initial team meeting – We met with the PG& E team to discuss the scope of the survey and the proposed timeline.
2. Data request – We requested reports and information based on previously completed surveys, as available, related to the Energy Alerts program. Our intent was to learn from past surveys, if possible, and to avoid asking participants the same questions. We also requested 2012 participant billing data and program data, including dates and times of alerts.
3. Draft Energy Alerts survey – We completed a draft survey and submitted it for review b y all appropriate PG&E personnel. We worked closely with PG&E to ensure that messaging, tone, and look and feel were consistent with other communications from PG&E. Key survey questions related to participants' reasons for signing up for the program, progr am expectations, the amount of alerts participants receive, actions taken as a result of the alerts, program satisfaction, and recommendations for improvement. The survey also contained questions designed to help us understand participants' current level o f knowledge about ways to conserve energy and their willingness to take certain actions or adopt specific behaviors that could help keep them in a lower tier.
4. Survey sample design – We designed our survey sample and stratified it to include participants wh o receive alerts via email and participants who received alerts via SMS text. In the participant population, 68% receive alerts by email and 32% receive alerts by SMS text.
5. Finalize Energy Alerts survey – We incorporated feedback from PG&E staff, tested, a nd finalized the survey instrument.
6. Field survey – We sent the link to the online survey by email to a randomly selected representative sample of participants. We fielded the survey for roughly three weeks. Originally we had planned to send the survey to participants in three batches, but since we received such a high response rate during the first batch, we were able to get the desired number of completes in two batches.

7. Collect survey results – We compiled and analyzed the survey results and presented them to PG&E in the form of a PowerPoint presentation that summarized key findings as well as in an Excel database that contained detailed responses.
8. Incorporate results into impact analysis sample design – We used the findings from the participant survey to inform our sample design for the Energy Alerts impact analysis.

3.2 RESULTS

The participant survey was well received and we were able to obtain more than our targeted number of 1,000 completed surveys. Details related to the survey response follow:

- 1,271 participants in PG&E's Energy Alerts Program completed surveys
- 902 respondents are participants who receive the alerts via email
- 369 respondents are participants who receive the alerts via SMS text
- The data was weighted to accurately reflect the 68%/32% email/text split in the participant population
- Data was collected during the period of February 7 - 27th, 2013
- Average survey length was 9 minutes, 2 seconds

Appendix A summarizes the key findings of the survey and provides banner tables showing results by action taken or not taken.

Our focus for this research was to use the survey results to inform our sample design for the Energy Alerts impact analysis. Specifically, we present results to questions that assess the types of customers that respond to alerts and the kinds of actions they take when receiving alerts.

3.2.1 Action-Takers

Approximately half of survey respondents (54%) indicated they are taking action in response to alerts. Compared to participants who do not take action, key characteristics of action-takers include the following:

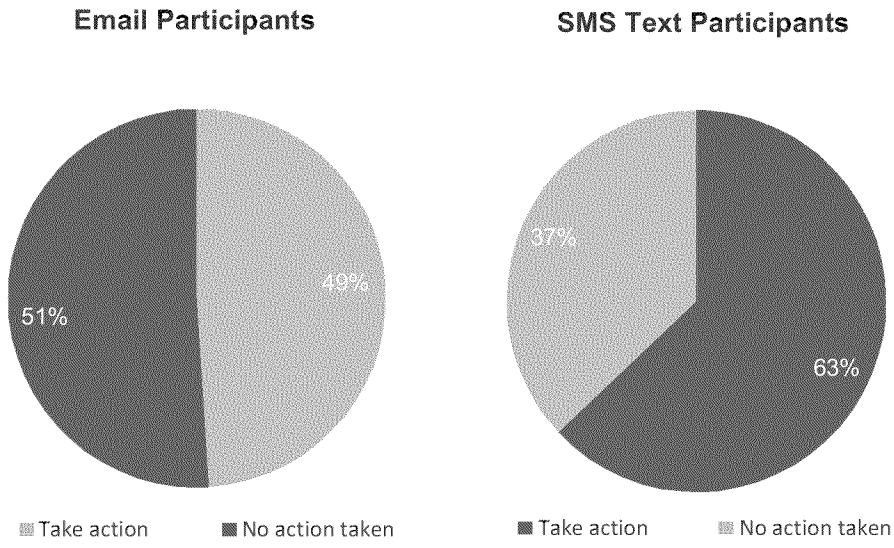
- More likely to receive alerts by SMS text than email (37% vs. 25%) – See Figure 3-1
- More likely to have received five or fewer total alerts in 2012 (24% vs. 16%)
- Have few demographic differences
    - More likely to have a home less than 2,000 square feet (60% vs. 51%)
    - More likely to be female (56% vs. 44%)
    - Less likely to have a college or post graduate degree (57% vs. 72%)
- Find value in the program
    - Much more satisfied with the program (47% vs. 35% top box [12])
    - Find Energy Alerts program more useful (44% vs. 9% top box)
    - More likely to recommend programs to others (44% vs. 12% top box)
    - Want alerts more frequently (24% vs. 13%)
- Want alerts in dollars rather than kWh (80% vs. 68%)

It is interesting to point out that the survey results confirm that the probability of a participant stating that they took action after receiving an alert is not directly related to the number of alerts received each month or to their overall level of usage. However there may be somewhat of an indirect relationship with the total number of alerts received annually with those receiving fewer

[12] Top box percentages are defined as giving a rating of 8 or higher on a 10-point scale.

alerts being more likely to take action. At the same time, many customers may not take any action at all in a particular month if they do not receive an alert in that month.

Figure 3-1 Participants Taking Action when Alert Received



3.2.2 Reasons for Taking or Not Taking Action

When participants were asked why they do or do not take action their verbatim responses were coded as follows:

- Why take action?
  - To lower bill/save money (22%)
  - Alert makes respondent think about energy use (5%)
  - To stay within tier (2%)
- Why don't take action ?
  - Are unable to r educe (13%)
  - Don't know how to reduce (7%)
  - Comfort is important (5%)
  - Insufficient information in alerts (3%)
  - Timing of alerts not sufficient (2%)
  - Not respondents decision (2%)

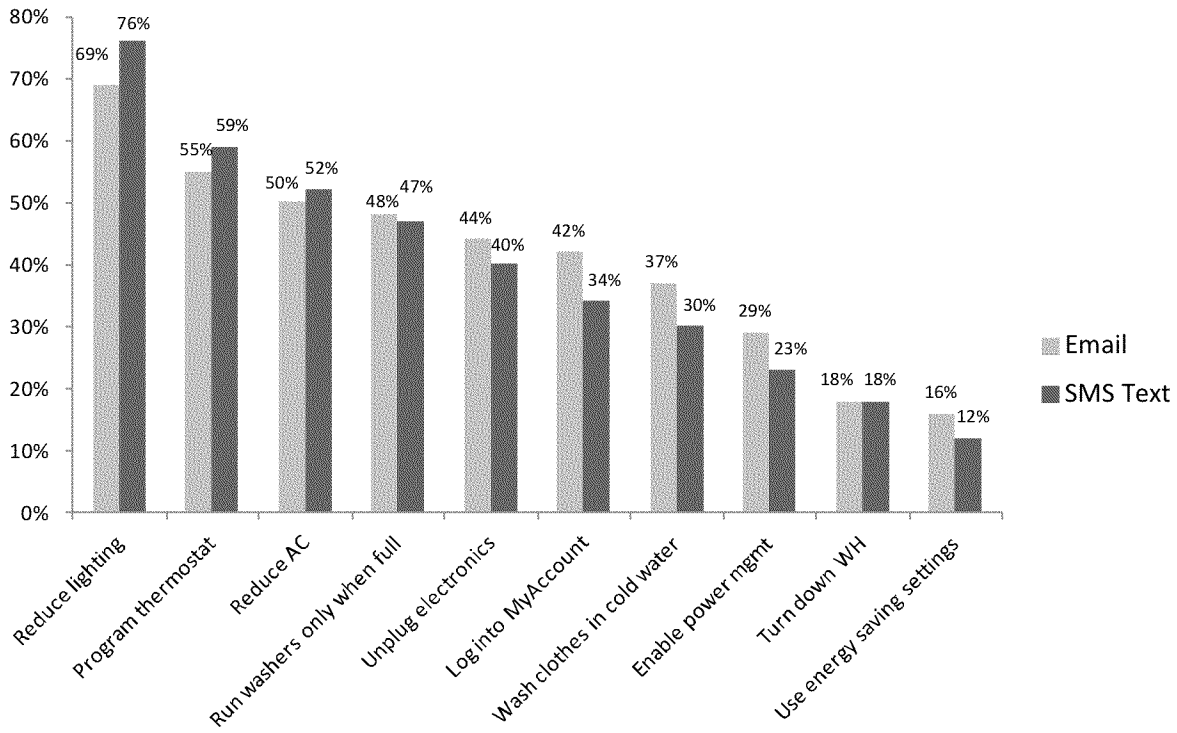
There were also a total of 28% respondents who either did not answer the question , misunderstood the question (e.g., responded with actions taken), or responded that they do not know.

3.2.3 Actions Taken

The survey results show that there is a variety of energy -related actions taken by respondents who reported taking action as a result of r eceiving the alert. Actions related to lighting and heating, ventilation, and air conditioning (HVAC) equipment are the most popular; others actions include washing clothes in cold water, only running washers with full loads, unplugging electronics, and tu rning down water heater temperature settings. Figure 3-2 summarizes the

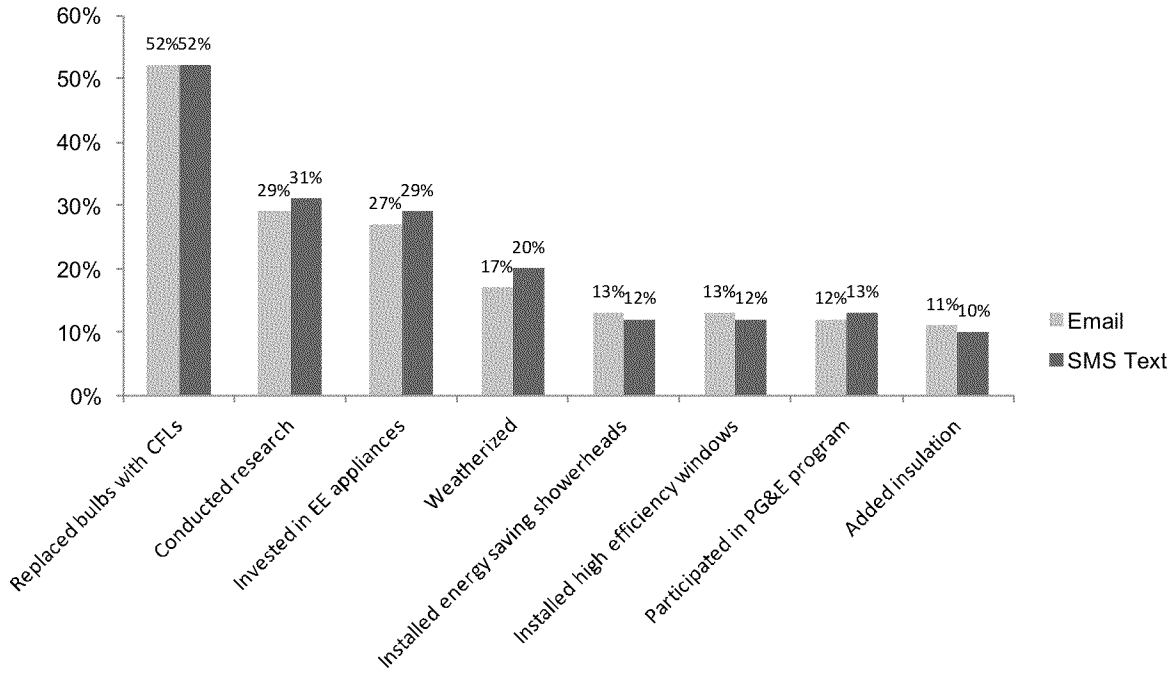
types of actions taken by respondents. The data are broken down by the manner in which partici pants receive alerts: by email or SMS text. For the most part, there are only minor differences between email and SMS text participants, with some actions slightly more likely to be taken by email recipients and others slightly more likely to be taken by S MS text recipients.

Figure 3-2 Actions Taken by Respondents who Reported Taking Action



Some participants responded that they have made some long term changes. However, 31% of all respondents have not taken any long term actions. The most commonly reported long term action is replacing incandescent light bulbs with compact fluorescent lamps (CFLs). Other long term actions include conducting energy efficiency research, investing in energy efficient appliances, weatherizing and adding insulation, installing energy saving showerheads and high efficiency windows, and participating in other PG&E pr ograms. Figure 3-3 illustrates the survey results for long term actions. Once again, the data are broken down by email and SMS text recipients, with nearly indistingu ishable differences in results between the two types of alert methods.

Figure 3-3 Additional Long Term Actions Taken – All Respondents



3.3 CONCLUSIONS

We have drawn the following conclusions based on the results of the survey:

- Overall, just over half the customers claim that they do take action to attempt to reduce their usage in response to alerts. Furthermore, customers feel that their actions help them stay in a lower tier longer and reduce their energy bills.
- The survey results confirm that the probability of a participant stating that they took action after receiving an alert is not correlated to the number of alerts received each month or to their overall level of usage.
- The survey showed that the probability of a participant taking action is highly correlated with behavioral traits and preferences identified in the survey; unfortunately that information is not available at the population level and cannot be used in the sample design.
- Many customers may not take any action at all in a particular month if they do not receive an alert in that month.
- Some of the more frequently cited actions taken by participants will result in very small changes in monthly energy usage, such as reducing lighting or running only full loads of laundry.
- Participants that receive alerts via text message are more likely to take action.
- Participants that received fewer than 5 alerts are more likely to take action.

Based both on our inability to detect savings last year, and the results of the survey, we assume that while customers are responding to alerts, overall average savings at the population level is very small, perhaps as small as one percent. Through collaborative discussions with PG&E and after reviewing the survey results, we proposed a new sample design and a two pronged approach for conducting the impact analysis of the Energy Alerts program. Chapter 4 describes our sample design and analysis methodology.

ANALYSIS METHODOLOGY

This section describes the analysis methodology for the evaluation. It begins by describing the overall analysis approach for CWP and Energy Alerts. Next, it describes the sample design for both the CWP and Energy Alerts programs and the matching strategy used to match sample treatment customers to control customers. Finally, it describes the method used to estimate the impact of both programs by direct comparison.

4.1 OVERALL ANALYSIS APPROACH

For the 2012 program year we focused on improving the precision of the estimates in order to be able to detect hypothesized changes in monthly consumption in the 1% to 3% range. We focused on two aspects of the analysis that substantially increased precision.

- **Sample size** – For program year 2011 we attempted to use interval data to increase the precision of our estimates; however, using interval data limited our analysis in two ways. First, in order to be part of the analysis sample participants were required to have at least 120 days of pre-treatment interval data. Second, the overall size of the sample was limited by our ability to process, validate and clean the interval data. In this evaluation, we chose to match on pre-treatment billing data rather than interval data which allowed us to increase the sample size substantially. Very large samples, with greater than 10,000 participants, are commonly used by Opower and others in the industry to estimate the effects of informational programs that are as small as 1%. We adopted this "super-sized" sample approach and moved from samples of 6,000 and 3,000, to samples of 20,000 and 34,000 for CWP and Energy Alerts respectively.
- **Improved matching strategy** – For program year 2011 we detected a small but persistent bias in our match for both CWP and Energy Alerts. The bias in CWP was smaller, on the order of 1% to 1.5%, but with very small anticipated impacts this bias can make the difference between being able to detect savings, and undetectable savings. In this evaluation we used an improved matching strategy that significantly decreased any observable bias in the match.

In addition it is important to recall that dual participation is not accounted for in this analysis. Because we are not able to estimate impacts for dual participants we are unable to determine what portion of the Energy Alerts savings is incremental due to CWP participation, and what portion of CWP savings is incremental due to Energy Alerts participation. While savings estimates do accurately reflect the savings of those customers that participated in each of the programs, we cannot add those two savings estimates together without double counting.

4.1.1 CWP Evaluation Summary

Because there is no information regarding participants for 2012 we relied heavily on the information used to evaluate CWP in program year 2011. The first step of the analysis was presented in Chapter 2. We analyzed the participation trends and developed an estimate of the number of participants by year of first view and usage stratum for 2012.

Our next step was to refine the 2011 analysis in order to obtain more accurate savings estimates. We first repeated the 2011 analysis with the original sample, but used the improved matching strategy to obtain a closer match between the treatment and control group. We then compared the monthly usage of the control customers, to the treatment customers. In this first analysis, the monthly usage was calculated from interval data. At this point, the analysis clearly showed a deviation between the treatment and control groups during the treatment period;

however, due to the smaller sample size we were not able to obtain statistical significance for that estimate. Therefore, we conducted a secondary analysis using only calendarized billing data, and increased the overall sample size to nearly 20,000 participants. [13] As we hypothesized, this increased sample did allow us to estimate statistically significant savings at the population level.

4.1.2 Energy Alerts Evaluation Summary

As discussed above, the initial phase of the Energy Alerts evaluation included a comprehensive participant survey. The survey covered aspects of awareness, satisfaction, preferences, and energy saving actions that resulting from Alerts. One of the most useful findings of the participant survey was that a participant's propensity to take action is not correlated with the number of alerts they receive or their annual or seasonal usage. This finding explained why, in this case, stratification of the sample was not helpful in the 2011 program evaluation and reinforced the need for a very large sample that would be able to detect savings at the population level.

The analysis was performed on two groups of participants, one being a subset of the other. The largest group consisted of approximately 35,000 participants. The participants in this group were limited only by the availability of complete billing data in the pre-treatment period. In the first group, calendarized [14] billing data was used both in the pre-treatment match and in the direct comparison. We also selected a simple random sample of approximately 18,000 participants from the aforementioned group to make the use of interval data in the analysis more feasible. In the sample calendarized billing data was use for pre-treatment matching, but monthly consumption calculated from interval data was used in the direct comparison, which more accurately reflects the true usage of participants in each month.

4.2 SAMPLE DESIGN FOR CWP AND ENERGY ALERTS

In this section we describe, in detail, the sample design for both CWP and Energy Alerts.

4.2.1 CWP Sample Design

As mentioned previously, while the matching achieved in the 2011 evaluation was very close, there was still a small amount of bias in the match with the control group being consistently about 1-2% lower than the treatment group. This made it very difficult to detect small changes in usage, and virtually impossible to detect savings as small as 1% because the treatment group was already about 1% bigger than the control group. In addition to the differences between groups, the sample size was likely too small to detect statistically significant savings on such a small magnitude. In order to improve precision and increase our chances to detect the expectedly small savings, we selected a new, stratified participant sample of 19,921 CWP customers and matched them against the population of My Energy users that had not viewed their interval data. We used a stratification that was identical to the stratification used in the 2011 analysis because we were able to show that as engagement increased, savings also increased.[15] We chose a sample size of approximately 20,000 participants to ensure that we would be able to see savings at the population level, assuming it existed.

We restricted the participant sample and control group pool to only customers with complete pre-treatment billing data. In addition, we excluded the participants who first viewed their interval data in 2008 or 2009 because of a lack of pre-treatment data. Given the limited number of the population participants these customers represent (only about 4% of the entire population); it is highly unlikely that their exclusion will alter the savings estimates of the

[13] We did not obtain interval data for this large sample due to the timeline of the project. It would not have been possible to obtain, validate and estimate savings with the interval data within the allotted time.
[14] Billing data was calendarized using the number of days in each billing cycle and allocating the appropriate proportion of monthly billed consumption to each calendar month. This results in a reasonable estimate of actual calendar month consumption however interval data will still be the most accurate especially in shoulder months and during months with very extreme weather to the extent that a customer's weather sensitivity affects their daily average usage.
[15] Pacific Gas & Electric: SmartMeter Enabled Programs: Program Year 2011 Evaluation, EnerNOC Utility Solutions, 2012.

remaining participants. [16] These restrictions reduced our 2011 participant pool from 199,168 participants to 115,310 participants. Table 4-1 shows the sampling frequency across strata. Because we expect to see statistically significant savings at the two highest use strata (7-15 and 16+), we sampled all available participants in those groups and only sampled 2,500 from each of the other strata. It is also important to note that the distribution of participants across the strata does not change in any substantive way between the entire participant population and the restricted participant population.

Table 4-1 Distribution of CWP Participant Population and Sample Participants by Stratum

Stratum		Population Count	%	Restricted Population	%	Sample Count
5	Continuing User: One View	22,766	11%	11,613	10%	2,500
6	Continuing User: 2-6 Views	23,262	12%	11,241	10%	2,500
7	Continuing User: 7-15 Views	6,104	3%	2,685	2%	2,685
8	Continuing User: 16+ Views	4,884	2%	2,009	2%	2,099
9	New User: One View	89,068	45%	57,805	50%	2,500
10	New User: 2-6 Views	43,279	22%	24,730	21%	2,500
11	New User: 7-15 Views	6,909	3%	3,399	3%	3,399
12	New User: 16+ Views	3,561	2%	1,738	2%	1,738

4.2.2 Energy Alerts Sample Design

The primary goal of the Energy Alerts Participant Survey was to inform the sample design for the 2012 evaluation of the Energy Alerts program. For the 2011 evaluation, we stratified by number of alerts received per season and were unable to detect savings at a statistically significant level, regardless of the number of alerts. We hoped to use the survey, first to confirm that customers were in fact taking action as a result of the alerts, and second to help identify participants that take action and conserve energy after receiving an alert. Based on the conclusions presented above in Section 3.3 we assume that while customers are responding to alerts, overall average savings at the population level is very small, perhaps as small as one percent. Through collaborative discussions with PG&E and after reviewing the survey results, we proposed a new sample design and a two pronged approach. The first step was to match all of the treatment customers for which we had complete billing data during the pre-treatment period. Then, we were able to analyze the data in two ways:

- First, we compared the monthly calendarized billing data of the entire matched treatment population with the control group.
- Second, we selected a very large sample of treatment customers and compared the two groups using monthly interval data. We chose to select a sample for the interval data comparison due to the difficulty in validating interval data for nearly 70,000 customers.

[16] Excluding these customers would only affect the savings if they responded to the CWP website in a significantly different way than other participants who have used the website for a shorter duration.

PG&E provided enrollment and alert notification data for every cu stomer who was enrolled in the Energy Alerts program as of December 31, 2012. In total 92,458 customers were enrolled in the program during 2012. Of those participants, about 77 percent (71,459) received at least one alert during 2012. We assume that parti cipants who signed up for Energy Alerts but did not receive any alerts are very unlikely to save any energy due to enrollment in the program. Of the participants who received at least one alert during the program year, 44 percent (31,328) had at least 12 months of good quality pre -treatment billing data. We included all 31,328 customers in the analysis that incorporated billing data only.

For the analysis that incorporated interval data, we selected a sample of participants to make the validation of the interval data more manageable. One of the considerations when determining sample size was the number of customers that actually received an alert in a given month, vs. the total number of participants in that month. We wanted to ensure that the overall sample was large enough, but we also wanted to ensure that at least 10,000 customers were receiving alerts, on average, during the summer mont hs. This would ensure that enough customers were actually receiving the treatment (alert) during the months we anticipated seeing the most savings. Table 4-2 shows t he monthly alert statistics for the Energy Alerts participants in 2012.

Table 4-2 Monthly Alert Statistics

Month	Total Participants	Number Alerted	Percent Alerted	Number of Alerts	Alerts per Customer
1	84,181	44,680	53%	82,045	1.84
2	85,391	36,705	43%	53,582	1.46
3	86,296	36,578	42%	58,167	1.59
4	86,962	39,125	45%	65,389	1.67
5	87,609	43,398	50%	81,302	1.87
6	88,260	47,439	54%	82,190	1.73
7	89,080	50,325	56%	100,651	2.00
8	90,003	52,992	59%	116,228	2.19
9	90,748	46,844	52%	86,529	1.85
10	91,333	44,530	49%	80,961	1.82
11	91,860	43,812	48%	75,255	1.72
12	92,458	48,491	52%	88,545	1.83

Across the 4 summer months, about 55% of the participants received an alert. Because our sample was random and representative of the population, we assumed that about 55% of our sample will have received an alert in each of the four summer months. Therefor e, we needed a total sample size of about 18,000 to ensure that approximately 10,000 participants would actually be receiving an alert in each of the summer months.

In addition we used a simple random sample design vs. a stratified sample design to allow for simplicity and flexibility in the analysis. In addition, since we allowed the sample to be representative of the population without stratification and because the sample was so large, we could look at different subgroups without having to pre -selecting specific stratification variables. The two subgroups we ultimately decided to analyze included participants by notification type, text vs. email. We also analyzed those who received more than 5 alerts annually, vs. those that received fewer than 5 alerts annually.

Table 4-3 shows the distribution of the entire population, the restricted population, and the simple random sample across groups.

Table 4-3 Distribution of Energy Alerts Participants and Sample Participants by Subgroup

	Population	%	Restricted Population	%	Sample	%
5 Alerts or less	18,696	26%	4,521	14%	2,427	15%
More than 5 Alerts	52,763	74%	26,807	86%	14,109	85%
Total	**71,459**	**100%**	**31,328**	**100%**	**16,536**	
Email Recipients	46,670	68%	21,785	72%	11,460	72%
Text Recipients	22,110	32%	8,281	28%	4,382	28%
Total	**68,780**	**100%**	**30,066**	**100%**	**15,842**	

The most notable aspect of Table 4-3 is that, unlike in the CWP sample above, the billing data restriction eliminated more customers that received 5 alerts or less and fewer customers that received more than 5 alerts. In the population about 26% of participants received 5 or fewer alerts in 2012, however in our restricted population only 14% of participants received 5 or fewer alerts in 2012. In order to account for this different we weighted the restricted population and the sample to reflect the distribution of participants in the population.

4.2.3 Potential Sample Bias

Imposing any type of limitation on a sample can introduce bias. In this case, because we limited the sample to participants with adequate historical data we may have introduced bias. 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 are 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. [17]

CWP Comparison of Restricted and non-Restricted Participant Populations

Table 4-3 presents a comparison of the percentage of participants with various demographic characteristics between the overall participant population and the restricted participant population.

[17] In this case we excluded participants due to a lack of data and in order to measure the bias we would need to obtain the exact data that was the basis of the exclusion, therefore in this case especially it is extremely difficult to know how different the excluded customers energy or savings is from those who were included in the analysis.

Table 4-4 CWP Comparison of Population to Restricted Population

Characteristic	CWP Population	Restricted Population
CARE	18.4%	14.6%
Non-CARE	81.6%	85.5%
Coastal	47.7%	43.5%
Inland	52.3%	56.5%
Single Family	75.6%	84.4%
Multifamily	24.4%	15.6%

As we might expect, by restricting the participants to those with complete billing data, thereby capturing those that remain in the same residence longer, we see lower percentages of both CARE and multifamily customers in the restricted population. This means that these two groups are 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 and CARE customers we are able to analyze.

It can also be useful to examine the relationship between key stratification variables and demographic characteristics. In Table 4-5 below, we show the percentage of customers with different characteristics by stratum. For example, 58% of all CARE participants only viewed the CWP website one time during 2011. When we compare the number of participants by strata with each characteristic, we can see that the number of times a participant views the website is not highly correlated with either their dwelling type or their CARE status. This supports the conclusion that CWP savings is not correlated with the characteristics we could compare here, and therefore excluding more CARE and multifamily participants in unlikely to introduce a significant bias.

Table 4-5 CWP Correlation Between Views and Demographic Characteristics

Characteristic	one view	2-6 Views	7-15 Views	16+ views
CARE	58.5%	32.0%	5.9%	3.6%
Non-CARE	56.5%	33.2%	6.3%	3.9%
Coastal	59.8%	32.1%	5.3%	2.8%
Inland	53.6%	34.0%	7.3%	5.0%
Single Family	55.8%	33.4%	6.6%	4.2%
Multifamily	60.1%	31.9%	5.2%	2.8%

Energy Alerts Comparison of Restricted and non-Restricted Participant Populations

Table 4-6 presents a comparison of the percentage of participants with various demographic characteristics between the overall participant population and the restricted participant population.

Table 4-6 Energy Alerts Comparison of Population to Restricted Population

Characteristic	Energy Alerts Population	Restricted Population
CARE	18.3%	14.5%

Non-CARE	81.7%	85.5%
Coastal	43.4%	45.5%
Inland	56.6%	54.5%
Single Family	87.5%	91.6%
Multifamily	12.5%	8.4%

Similar to what we saw in the CWP program, by restricting the participants to those with complete billing data, thereby capturing those that remain in the same residence longer, we see lower percentages of both CARE and multifamily customers in the restric ted population. This means that these two groups are underrepresented in our sample. We used weighting based on the number of alerts to ensure that we will accurately reflect the savings for those multifamily and CARE customers we are able to analyze.

In Table 4-7 below, we show the percentage of customers with different characteristics by number of alerts. For example, 25% of all CARE participants received fewer than 5 alerts on average in 2012. When we compare the number of participants by strata within each characteristic, we can see because the number of alerts is highly correlated with a customer's energy consumption, substantially more multifamily participants re ceive fewer than 5 alerts annually in comparison to single family participants. This is a concern, because we are excluding more multifamily participants, and those participants are more heavily concentrated in one particular stratum. Unfortunately, the ve ry justification for their exclusion in fact limits our ability to determine the effect of excluding these participants from the analysis. However we can be confident that population weighting will accurately reflect the savings of those participants included in the analysis, and we are implicitly making the assumption that the savings of the included and excluded participants is the same.

Table 4-7 Energy Alerts Correlation Between Views and Demographic Characteristics

Characteristic	5 or fewer Alerts	More than 5 alerts
CARE	25.5%	74.5%
Non-CARE	21.8%	78.2%
Coastal	25.9%	74.1%
Inland	19.9%	80.1%
Single Family	19.2%	80.8%
Multifamily	45.6%	54.4%

4.3 CREATING THE MATCHED CONTROL GROUPS

The energy savings associated with these programs will be estimated by comparing energy use of participating customers with a carefully selected control group of non-participating customers. A stratified matching technique was used to construct a control group thatis very similar to the participant group in all observable ways, except for being exposed to the program treatment. 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 separate d from the systematic differences between treatment and control customers. Matching participants to the control group can help eliminate bias for any observable

characteristic. Using only those customers who have accessed My Energy for the CWP 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.

After last year's analysis, we identified two potential sources of bias in the match. We hypothesized that the seasonal weighting may have introduced bias, so we created an un-weighted distance metric to diminish its effects. We also found that control group customers systematically had more pre-treatment interval data than participants. Given that we used a blend of billing and interval data to create the average daily usage variables, possibly affecting the integrity of the distance metric, we chose to only use calendarized billing data for all subsequent matching attempts. Finally we requested and included additional pre-treatment billing data in the matching process. Previously, we only had pre-treatment data going back to January 2010; this year we included pre-treatment billing data to January 2009 to help improve the match for those customers who began using CWP in 2010.

The matching strategy used in the PY2011 evaluation employed a combination of filters and distance metrics. For each treatment customer, a subgroup of a large pool of non-participant control group candidates was chosen that shares the participant's characteristics as described by a series of filters. Those filters included geography (zip code), AC propensity, participation in SmartAC™, electric heat, and CARE. Use of the filters resulted in a smaller group of control group candidates that matched the treatment customer exactly for those characteristics defined by the filters. Then within this group, each treatment customer was matched with the "closest" control group candidate, based on a distance metric that was a weighted sum of the following: average summer weekday, average summer weekend, average winter weekday, and average winter weekend usage.

After testing various methods, we established a new procedure for creating the matched control groups for both the Energy Alerts and the CWP participants. [18] The optimal matching method uses less restrictive filters than last year, creating buckets only by dwelling type, i.e., single and multifamily, and by coastal and inland as determined by CEC weather zone and employs a modified Euclidean distance metric using 12 months of calendarized pre-treatment billing energy. The less restrictive buckets capture only high level demographic characteristics, but have the added benefit of allowing us to more closely match on energy. In addition, a better match is possible due to there being more control group pool customers for each participant to match with. This is not due to the total size of the control group pool, but to the size of each grouping "bucket." If, for example, we have 100 participants and 1,000 customers in the control group pool, each participant would have more potential matches in a one-bucket grouping (1,000) than in a two-bucket grouping (500).

Both CWP and Energy Alerts are fully deployed programs in which participants can enroll or un-enroll freely. This means that pre-treatment periods are customer specific. In order to avoid creating too many groups based on enrollment, we created distinct enrollment windows. Based on this segmentation, pre-treatment periods were defined as the 12 months before the start of the enrollment window. For CWP, however, the pre-treatment period associated with the December 2009 – May 2009 enrollment window is only 11 months long because we did not have billing data for December 2008. To keep summer months together, we split years into two six-month blocks, from December to May and from June to November, where all months but December belonged to the same year. Figure 4-1 and

Figure 4-2 below show the enrollment windows in dark blue and their associated pre-treatment periods in light blue for Energy Alerts and CWP respectively.

[18] We tested several analysis techniques including un-weighted Euclidean distance approach with the same inputs as last year, multiple propensity score matching procedures using calendarized monthly billing energy, and eventually settled on a modified Euclidean approach using monthly energy.

Figure 4-1 Enrollment Windows (Dark Blue) and Associated Pre-Treatment Periods (Light Blue) for Energy Alerts

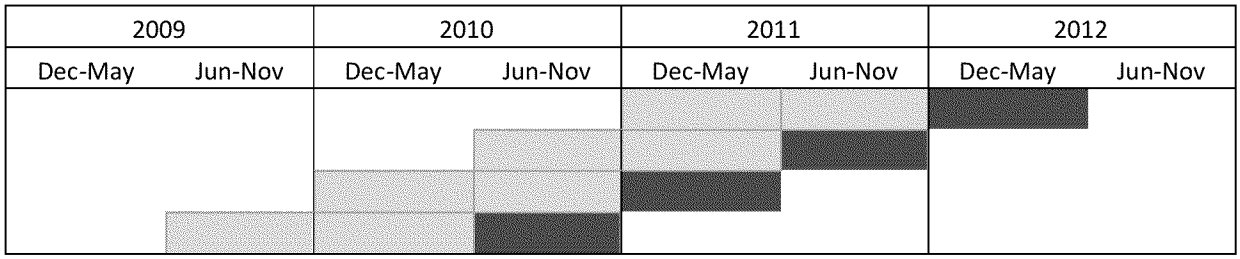
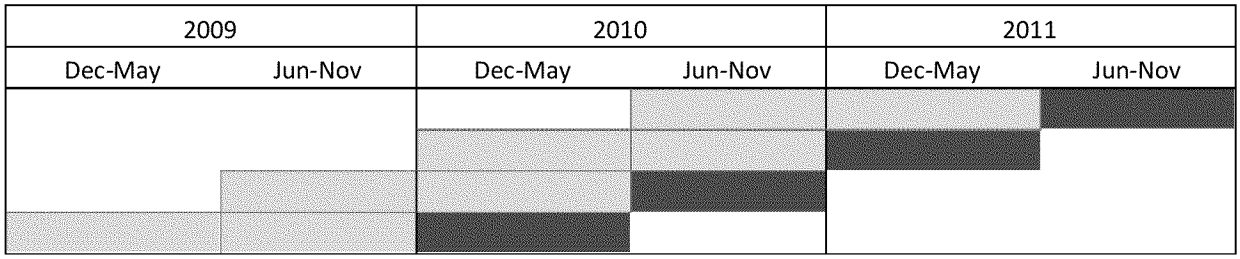


Figure 4-2 Enrollment Windows (Dark Blue) and Associated Pre-Treatment Periods (Light Blue) for CWP



Control group candidates are allocated to each enrollment group based on pre -treatment data availability. Within these groups, each participant is compared to every control group candidate that shares its demographic characteristics —dwelling type and geogr aphy (coastal versus inland). The comparison is made on monthly pre -treatment energy using the Euclidean distance formula. For every participant, a match is selected based on the pairing that yields the minimum distance value, signaling that they are the m ost similar. While we ensured that control group customers were not matched with more than one participant last year using an iterative method, in this evaluation we found it unnecessary, because the overlap is minimal, and unfeasible, because of the enrol lment-based grouping, this year. In this year's evaluation we simply excluded the pairs where one control customer was matched to more than one treatment customers. This lead to the exclusion of less than 3% of all CWP matches, less than 1% of all populati on Energy Alerts matches, and 0.6% of all sample Energy Alerts matches.

4.4 ESTIMATING ENERGY SAVINGS

To estimate savings, we use a direct comparison of monthly energy between the treatment and the matched control group for both Energy Alerts and CWP. These groups are so similar in terms of energy in the pre -treatment period that we can attribute any observed differences in consumption during the analysis period, which is 2012 for Energy Alerts and 2011 for CWP, to the program.

As shown in Figure 4-1 and

Figure 4-2, there are customers who start participating well into the analysis period. We account for this by only including data for participants and their control group matches for all months after the enrollment month. This ensures that we only analyze months during which participants are exposed to the treatmen t.

We then estimate average monthly energy during the analysis period for the Energy Alerts and CWP treatment and control groups and create 90% confidence intervals around the difference of the estimates. If we determine that the difference in consumption is statistically significant, this indicates that we can be 90% certain that the actual savings value for the population falls within the confidence interval and is not equal to zero.

We use calendarized billing data to assess program impacts and repeat th e analysis using interval data aggregated to the monthly level for the Energy Alerts sample only. Because we found that the billing restriction disproportionally affected lower usage customers, those receiving fewer than 5 alerts per month, we included wei ghts that reflect the population distribution of alerts when estimating the program level impacts. For CWP, on the other hand, because we stratified based on the number of views, we use case weights throughout the analysis when aggregating to anything othe r than the stratum -level impacts. In addition to program-level impacts, we evaluate impacts by transport type and 2012 alert frequency for Energy Alerts and analyze savings by frequency of views and year of first access for CWP. The statistically significa nt monthly estimates can be added together over the course of the year to estimate the annual per participant impact.

IMPACT RESULTS

5.1 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 monthly pre-treatment energy use of the treatment and control customers on the same graph and comparing the monthly load shapes. Recall that the pre-treatment period varies and is determined by the enrollment window discussed above in Chapter 4. Comparing monthly usage gives us a good idea of how well customers are matched. The subsections below include results for the CWP and Energy Alerts treatment and control groups.

5.1.1 Customer Web Presentment Matching Results

Table 5-1 explains the two guidelines used to stratify the participants: the participant's year of enrollment into the program and the number of times interval data was accessed in 2011. We exclude participants who enrolled in 2008 and 2009 (except for December enrollees) because of a lack of pre-treatment data.

Table 5-1 CWP Stratification Description

Stratum	Year of Enrollment	Number of Access in 2011
5	2010	Once
6	2010	2 to 6
7	2010	7 to 15
8	2010	> 16
9	2011	Once
10	2011	2 to 6
11	2011	7 to 15
12	2011	> 16

We determine the closeness, or observable similarities, between the customers involved in the match by plotting monthly energy use in the pre-treatment period. We matched all of the 19,921 participants in our sample. Customers were matched on 12 months of pre-treatment data (or 11 months in the special CWP case noted in Section 4.3). Figure 5-1 through Figure 5-4 below show average monthly energy use for CWP treatment and control customers for the pre-treatment months, the six month enrollment window (See

Figure 4-2), and up to 12 treatment months. This shows that the match performs very well, with almost identical usage between the two groups during the pretreatment months and a small but definite deviation between the two groups as the treatment group drops below the control group during the treatment period.

Figure 5-1 CWP Sample Monthly Pre-treatment Usage Comparison using Billing Data: Enrollment Window December 2009 through May 2010

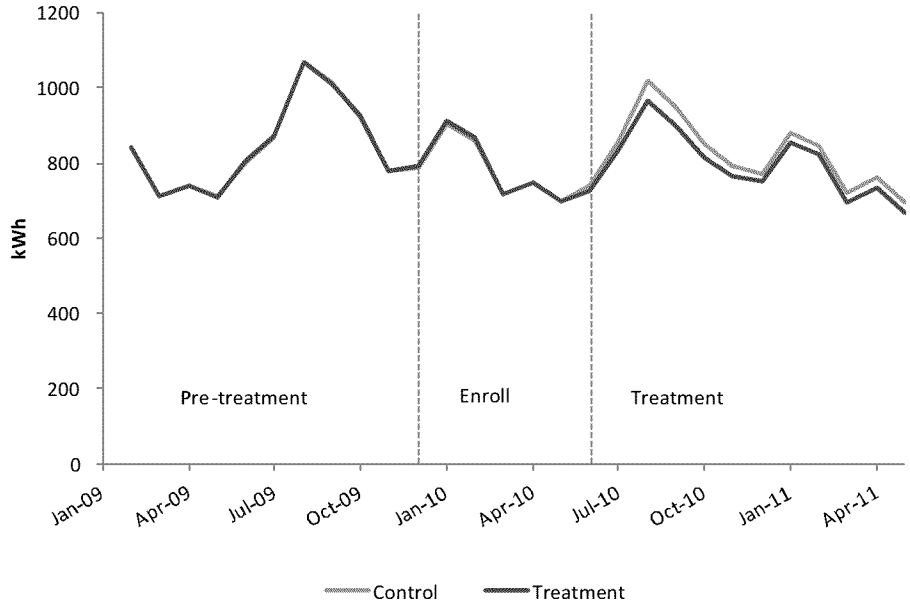


Figure 5-2 CWP Sample Monthly Pre-treatment Usage Comparison using Billing Data: Enrollment Window June 2010 through November 2010

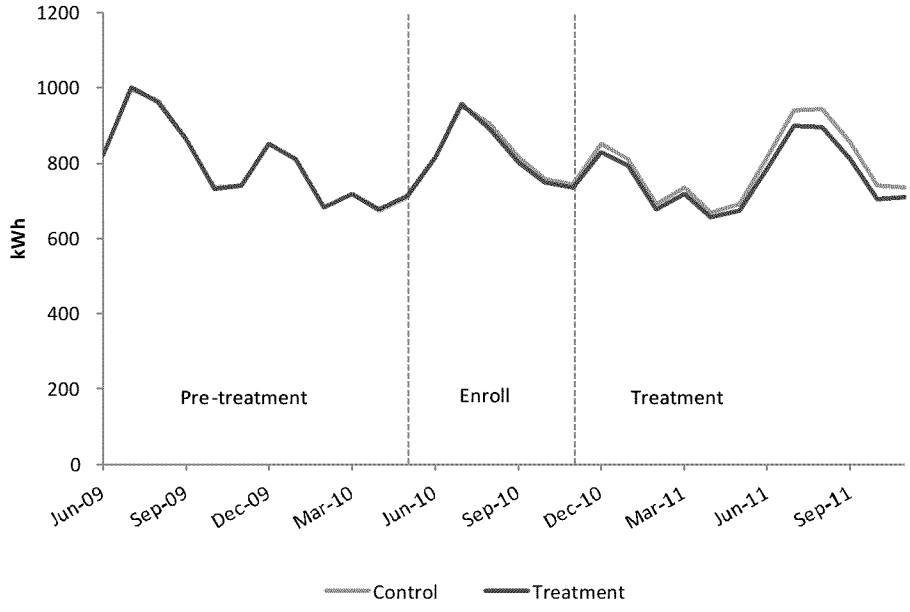


Figure 5-3 CWP Sample Monthly Pre-treatment Usage Comparison using Billing Data: Enrollment Window December 2010 through May 2011

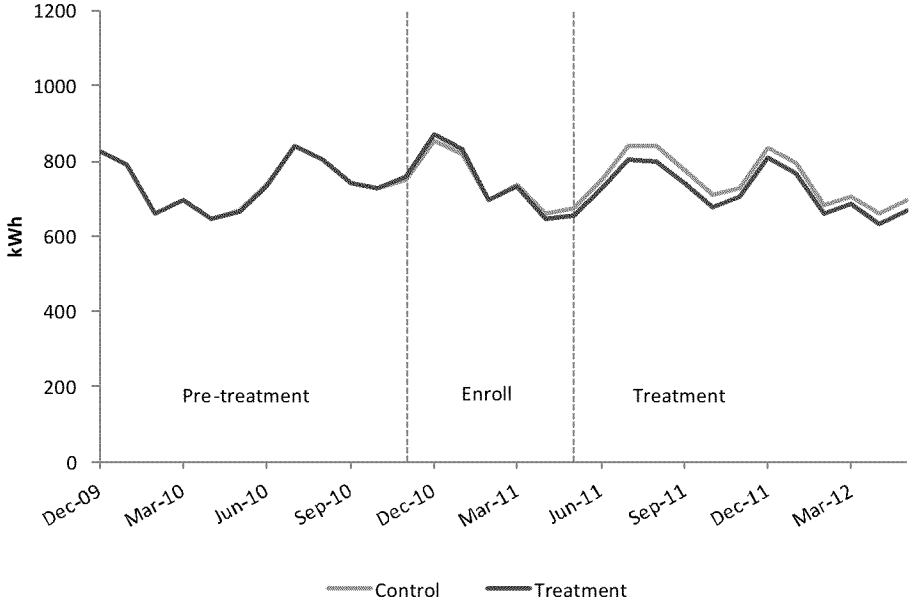
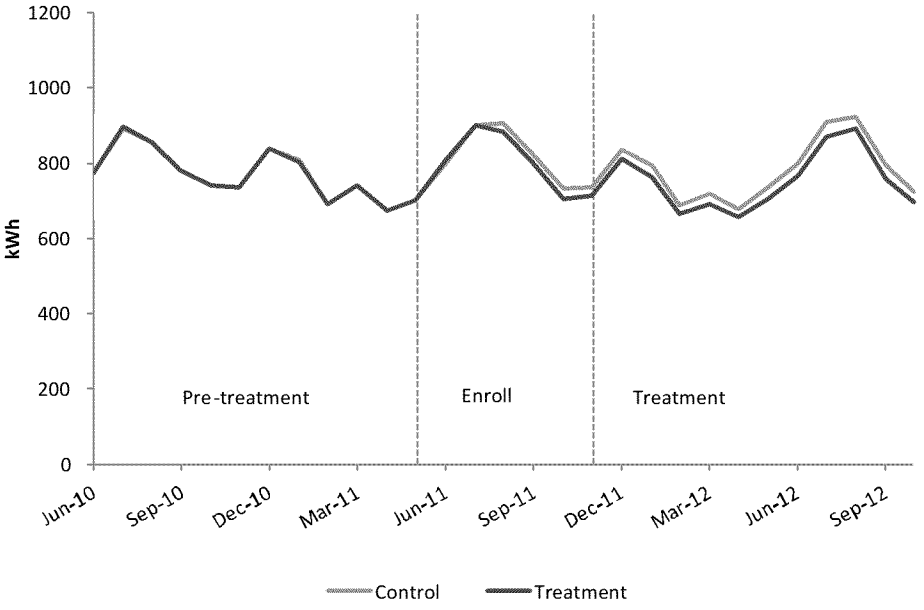


Figure 5-4 CWP Sample Monthly Pre-treatment Usage Comparison using Billing Data: Enrollment Window June 2011 through November 2011



5.1.2 Energy Alerts Matching Results

In evaluating Energy Alerts for PY2012, we first evaluated the entire population of treatment customers with acceptable pre -treatment billing data. Second, we selected a simple random sample (rather than a stratified sample) of 18,000. For this sample, we obtained interval data on which to perform the direct comparison.

Again, we determined the closeness of the match by looking at the monthly energy use in the pre-treatment period. Figure 5-5 though Figure 5-8 plot average energy u se for the 12 pre - treatment months, the enrollment window (See Figure 4-1), and up to 12 months of treatment

data. These charts are created using the same method of including pre -treatment months as described for CWP above. Again, this shows that the match perform s very well, with almost identical usage between the two groups during the pre -treatment months and a small but definite deviation between the two groups as the treatment group drops below the control group during the treatment period.

Figure 5-5 Energy Alerts Population Monthly Pre-treatment Usage Comparison using Billing Data: Enrollment Window June 2010 through November 2010

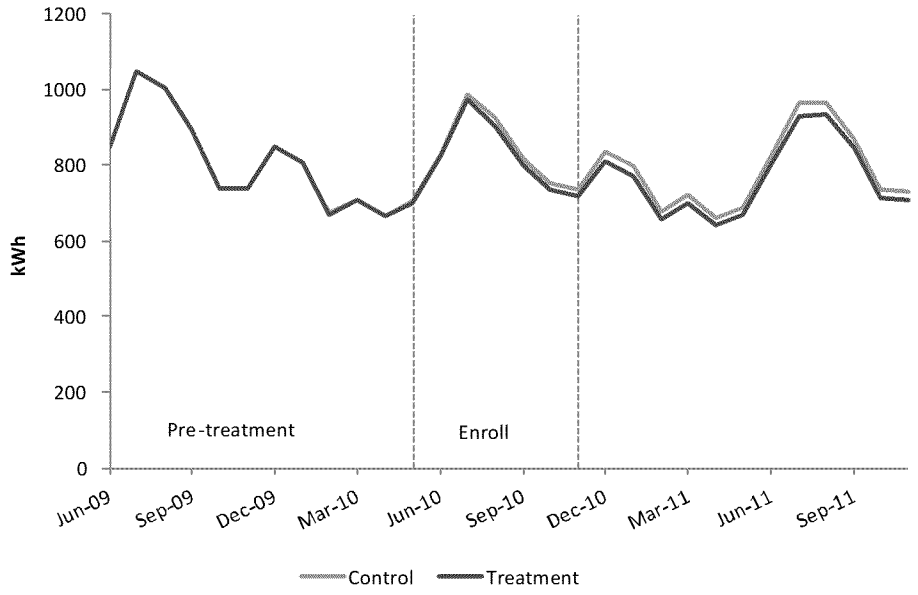


Figure 5-6 Energy Alerts Population Monthly Pre-treatment Usage Comparison using Billing Data: Enrollment Window December 2010 through May 2011

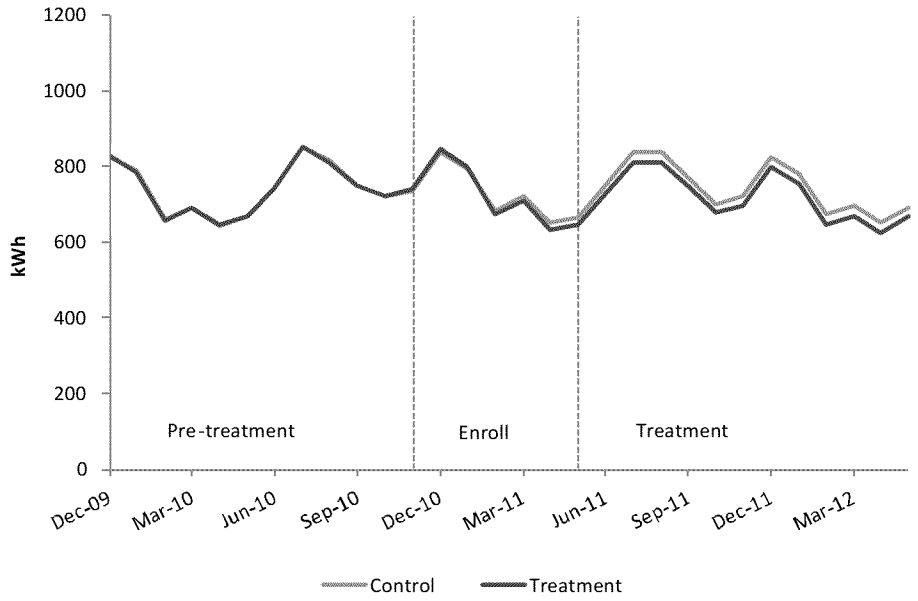


Figure 5-7 Energy Alerts Population Monthly Pre-treatment Usage Comparison using Billing Data: Enrollment Window June 2011 through November 2011

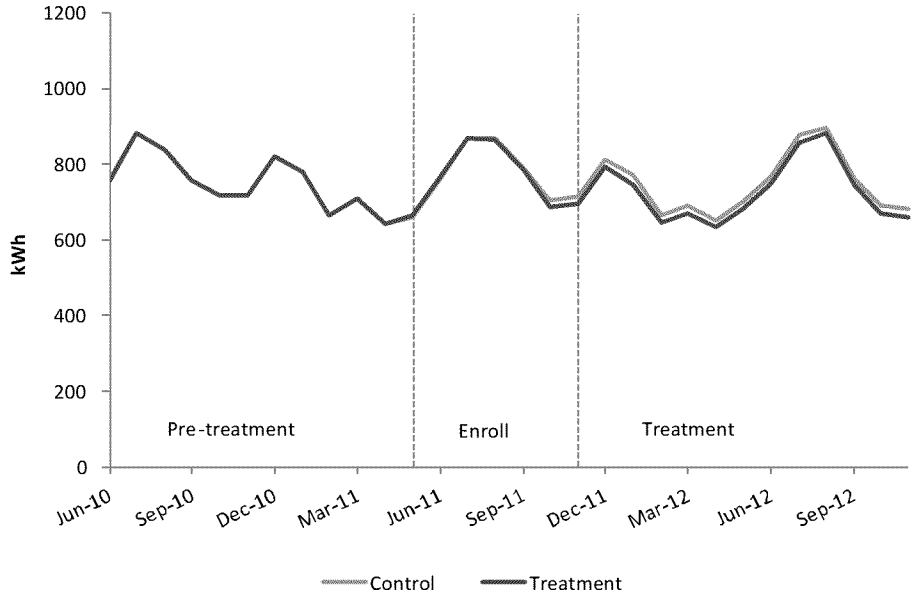
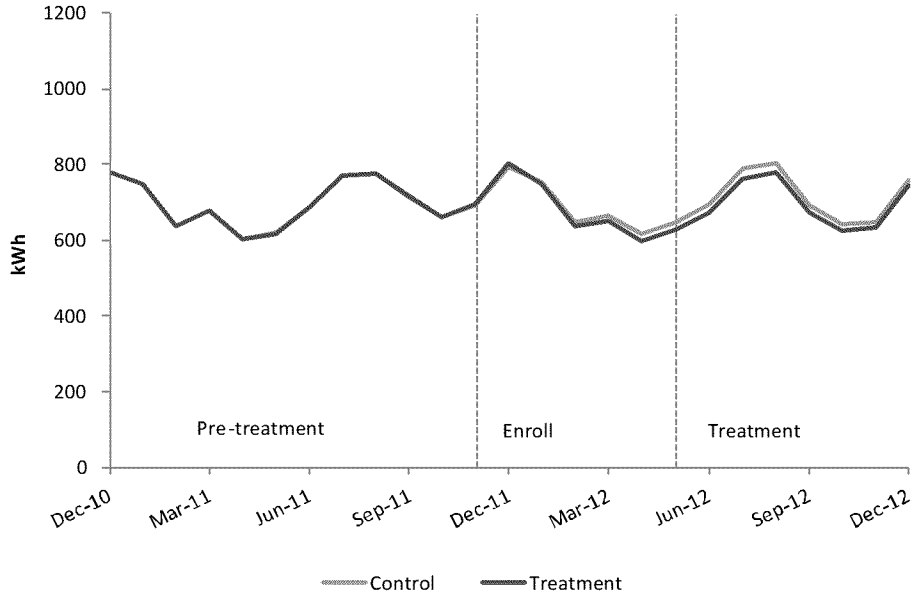


Figure 5-8 Energy Alerts Population Monthly Pre-treatment Usage Comparison using Billing Data: Enrollment Window December 2011 through May 2012



5.2 CUSTOMER WEB PRESENTMENT RESULTS 2011

The impact analysis for the CWP program demonstrated savings for CWP customers in the 2011 program year at the population level and within the two highest usage strata: those participants accessing the website between 7 and 15 t imes annually, and those accessing the website 16 times or more annually. The following subsections present the per -participant impacts at the population level and by subgroup. Lastly, we present the program level savings for 2012.

5.2.1 CWP Per-Participant Savings

As discussed in the methodology section above, the CWP participants were divided into eight strata: two duration of participation categories by four number of access categories. At the stratum level of our analysis, only the four strata with 7 or more views show statistically significant savings. Table 5-2 lists these four strata. First, we present the results for all participants at the program level; next, we present the results for both new and continuing users; and finally we present the results at the stratum level.

Table 5-2 Strata Showing Statistically Significant Savings

Stratum	Duration of Participation	Number of Access in 2011
7	Continuing User	7 to 15
8	Continuing User	16+
11	New User	7 to 15
12	New User	16+

Program Level Results

Table 5-3 shows the weighted average per customer monthly differences between the control and treatment groups for all participants and the percent impact at the overall program level for the 2011 program year. A positive difference indicates savings in the treatment group, and a negative difference indicates higher usage in the treatment group. Statistically significant differences are highlighted in blue. At the program level, 11 of the 12 months can be considered statistically different from zero; all of those differences are positive and are, on average, about 14 kWh or 1.8%. The total annual savings represents the sum of all the statistically significant monthly impacts.

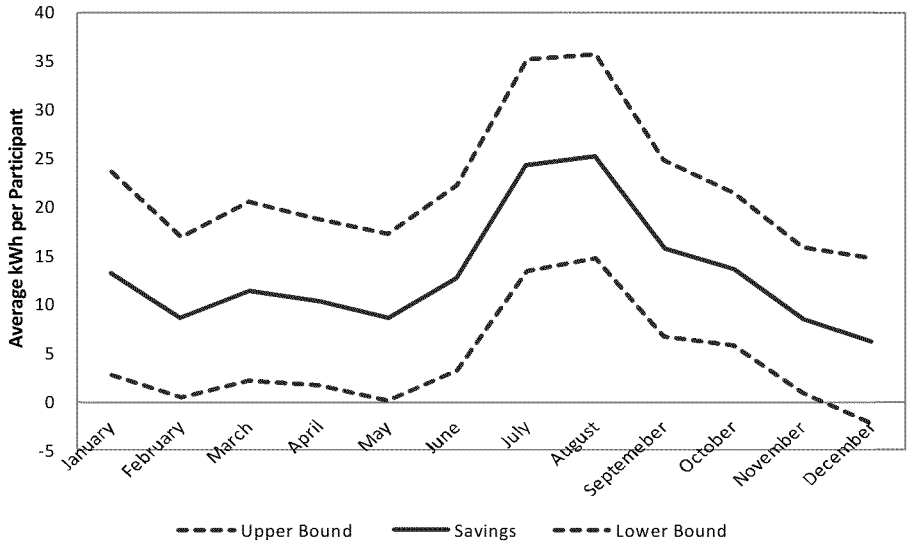
Table 5-3 Difference between Treatment and Control: All CWP Participants (using billing data)

Month	All Participants n= 19,921	
	Savings	% Impact
January	13.2	1.7%
February	8.7	1.3%
March	11.4	1.6%
April	10.3	1.6%
May	8.7	1.3%
June	12.8	1.7%
July	24.4	2.9%
August	25.2	3.0%
September	15.8	2.0%
October	13.7	2.0%
November	8.4	1.2%
December	6.3	0.8%
Annual Total	**152.2**	**1.8%**

Figure 5-9 below illustrates the monthly difference between treatment and control groups presented in Table 5-3 graphically, including the upper and lower 90% confidence intervals.

Months January through November show confidence intervals that exclude zero, which indicates statistically significant savings for CWP in those months. December's lower bound is just barely below zero, so we can conclude significant savings in December, but at a lower confidence level.

Figure 5-9 Average per Customer Difference – All Participants



New and Continuing Users

Table 5-4 shows the monthly difference between treatment and control groups for the 2011 program year for all participants split into two subgroups: new and continuing users. The results for the subpopulation of continuing users are weighted averages of strata 5 through 8. Accordingly, the results for the subpopulation of new users are weighted averages of strata 9 through 12. Again, the statistically significant differences are highlighted in blue.

In this subgrouping, we still see statistically significant savings for continuing users (11 out of 12 months). However, we see less significant savings for new users with only 4 significant months out of 11. The significant savings estimates for both groups are about the same. Continuing users saved approximately 17 kWh per statistically significant month, while new users saved approximately 19 kWh; both have an average of 2% impact per statistically significant month. The drop in impact results is due to the inclusion of participants with less than 7 views in 2011 in these weighted averages. Recall that these strata did not show any statistically significant savings, which indicates that their savings are too small to be measured with significance at the stratum level. Despite the drop in average savings per statistically significant month, we can see that the continuing users have more consistent results, perhaps indicating that continuing users save more on average than new users. Again, the total annual savings represents the sum of all the statistically significant monthly impacts.

Table 5-4 Differences between Treatment and Control Group: New and Continuing Users

Month	Continuing Users n= 9,784		New Users n= 10,137	
	Savings	% Impact	Savings	% Impact
January	13.2	1.7%		
February	11.5	1.7%	-0.7	-0.1%
March	13.2	1.8%	7.8	1.1%
April	8.2	1.3%	13.1	2.0%
May	9.2	1.4%	8.2	1.3%
June	13.8	1.8%	12.0	1.7%
July	21.8	2.4%	26.0	3.3%
August	26.7	3.0%	24.2	3.0%
September	20.2	2.5%	13.5	1.8%
October	18.3	2.5%	11.7	1.7%
November	14.0	1.9%	6.1	0.9%
December	20.8	2.5%	0.4	0.1%
Annual Total	**182.7**	**2.1%**	**75.4**	**2.4%**

Figure 5-10 and Figure 5-11 show the differences in Table 5-4 graphically including the upper and lower 90% confidence intervals. Again, both graphs show the statistically insignificant months where the lower bounds go below zero.

Figure 5-10 Average per Customer Difference – All Continuing Users

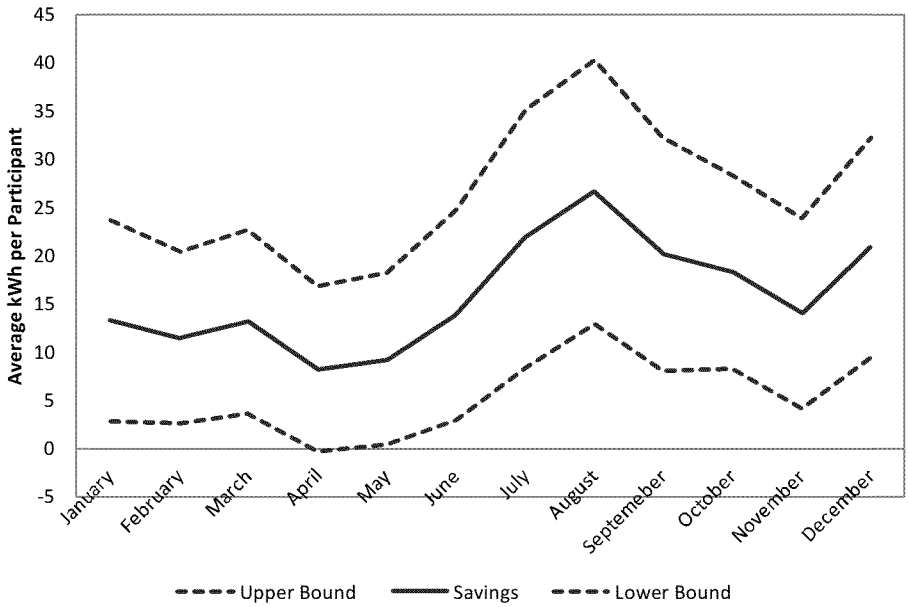
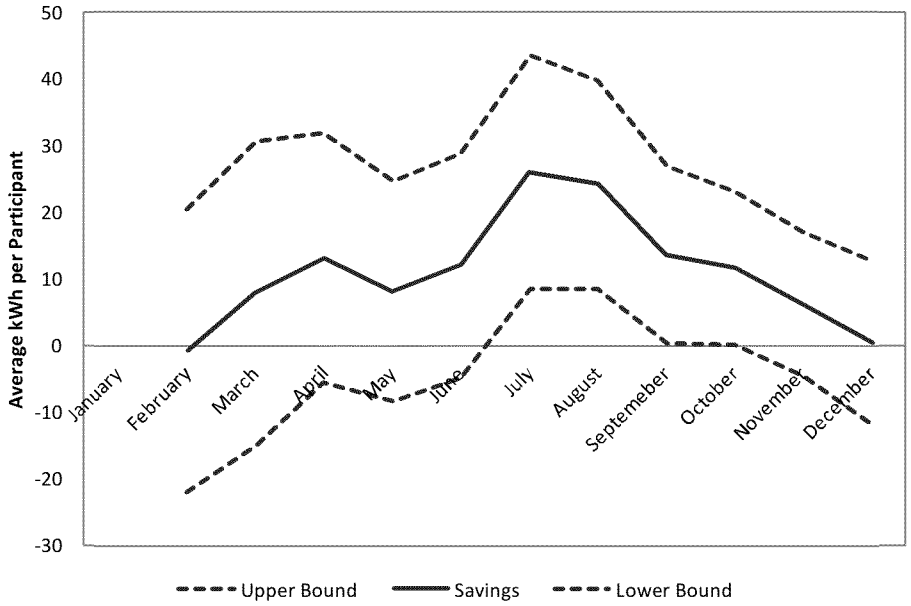


Figure 5-11 Average per Customer Difference – All New Users



CWP Participants with 7 to 15 Views

Table 5-5 shows the monthly difference between treatment and control groups for the 2011 program year for the subpopulation of customers who viewed the web portal between 7 and 15 times in 2011 (strata 7 and 11). Again, the statistically significant differences are highlighted in blue and the results labeled "All Participants" show the weighted average of strata 7 and 11.

In this subpopulation, we can still see significant savings occurring in the treatment customers, but no longer in all treatment months. The savings, averaging approximately 36 kWh (5%) per statistically significant month, are also lower for all participants in this subpopulation. Comparing the new and continuing users, the significant savin gs estimates are about the same. Continuing users saved approximately 40 kWh per statistically significant month, while new users saved approximately 39 kWh; both have an average of 5% impact per statistically significant month. The insignificant savings f or new users in months February, March, and April show the opposite of the results for participants with 16+ views, where these months showed their highest savings. It is possible that the "impact of new awareness" is only applicable to participants with h igh number of views/participation.

Table 5-5 Differences between Treatment and Control Group: Viewed 7 to 15 Times

Month	All Participants n= 6,084		Continuing Users n= 2,685		New Users n= 3,399	
	Savings	% Impact	Savings	% Impact	Savings	% Impact
January	25.6	3.0%	25.6	3.0%		
February	23.0	3.2%	24.7	3.4%	16.1	2.2%
March	21.7	2.8%	25.4	3.3%	12.3	1.6%
April	24.9	3.6%	27.2	3.9%	20.7	3.0%
May	27.5	3.9%	29.5	4.2%	24.5	3.4%
June	32.3	4.0%	36.3	4.4%	27.4	3.5%
July	48.2	5.2%	47.0	4.9%	49.7	5.5%
August	54.7	5.9%	55.6	5.8%	53.9	5.9%
September	49.6	5.8%	53.2	6.1%	46.4	5.5%
October	47.1	6.2%	50.0	6.6%	44.7	5.9%
November	38.6	5.1%	47.9	6.3%	31.4	4.1%
December	41.7	4.8%	54.5	6.2%	31.6	3.6%
Annual Total	**434.9**	**4.5%**	**476.9**	**4.9%**	**309.6**	**4.7%**

Figure 5-12, Figure 5-13, and Figure 5-14 show the differences in Table 5-5 graphically including the upper and lower 90% confidence intervals. Figure 5-14 shows the lower bound going below zero, thus it is possible that our savings estimate is under zero. This is a graphical representation of the difference between the statistically significant and insig nificant savings estimates.

Figure 5-12 Average per Customer Difference – All Participants: Viewed 7 to 15 Times

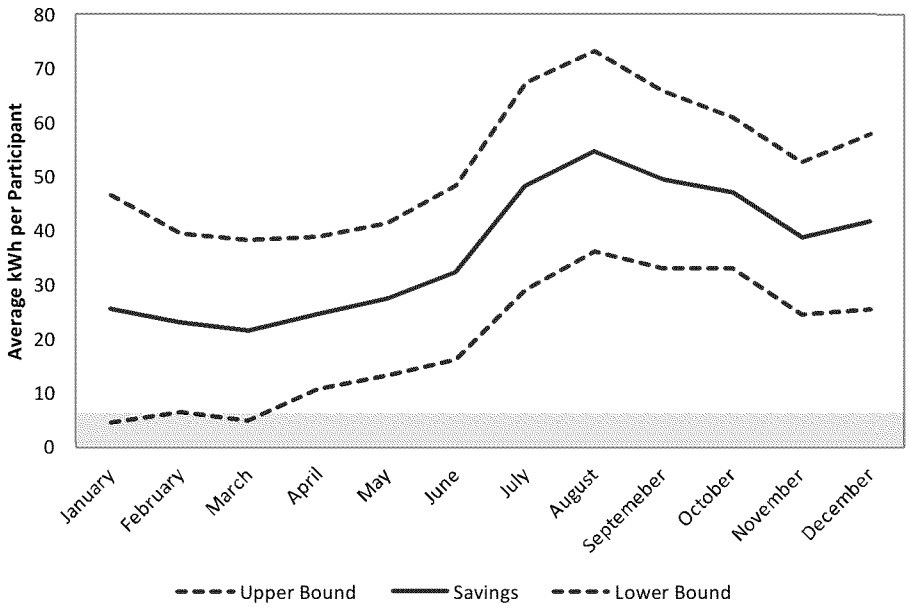


Figure 5-13 Average per Customer Difference – Continuing Users: Viewed 7 to 15 Times

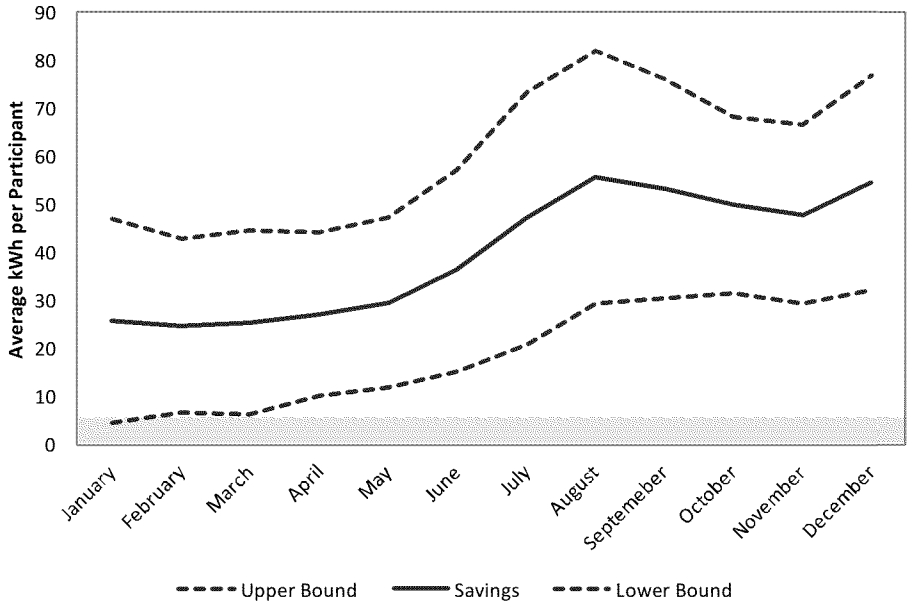
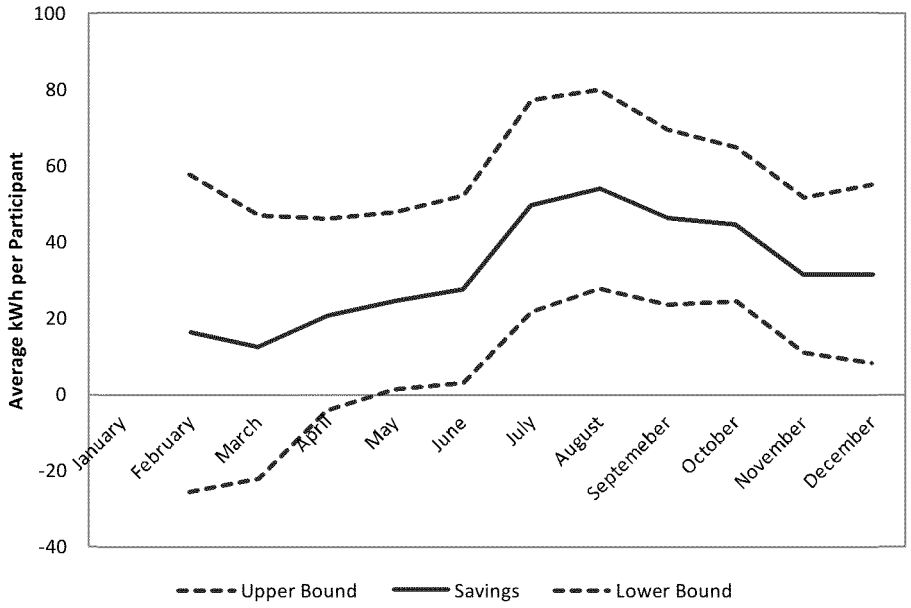


Figure 5-14 Average per Customer Difference – New Users: Viewed 7 to 15 Times



CWP Participants with 16+ Views

Table 5-6 shows the monthly difference between treatment and control groups for the 2011 program year for the subpopulation of customers who viewed the web portal at least 16 times in 2011 (strata 8 an d 12) with the statistically significant differences highlighted in blue. The results labeled "All Participants" show the weighted average of strata 8 and 12.

In this subpopulation, we can clearly see a significant savings occurring in the treatment customers, in all treatment months. The savings is approximately 67 kWh (8%) per statistically significant month for all participants. When looking at the difference between new and continuing users, it is appears that the savings estimates for continuing users are slightly higher, especially in the later months. Continuing users saved approximately 71 kWh per statistically significant month, while new users saved approximately 65 kWh. However, both new and

continuing users have an average of 8% impact per stati stically significant month. This may be caused by the impact of new awareness in new users, as can be seen by the 11% impact in February and March.

Please note that all participants classified as new users do not have available results for January since we assumed the treatment period started in February for these participants.

Table 5-6 Difference between Treatment and Control Group: Viewed 16+ Times

Month	All Participants n= 3,837		Continuing Users n= 2,099		New Users n= 1,738	
	Savings	% Impact	Savings	% Impact	Savings	% Impact
January	55.4	6.3%	55.4	6.3%		
February	57.4	7.6%	52.8	7.1%	82.7	10.5%
March	61.2	7.7%	54.6	6.9%	84.5	10.5%
April	48.7	6.9%	46.5	6.6%	54.3	7.7%
May	47.4	6.5%	52.1	7.1%	37.5	5.3%
June	64.6	7.7%	73.3	8.6%	48.8	6.1%
July	89.9	9.3%	101.3	10.2%	72.1	7.9%
August	104.1	10.7%	114.9	11.5%	89.1	9.6%
September	95.2	10.8%	103.6	11.5%	84.4	9.9%
October	68.7	8.9%	76.2	9.8%	59.5	7.8%
November	55.2	7.1%	59.0	7.6%	50.5	6.5%
December	58.4	6.6%	60.2	6.8%	56.2	6.3%
Annual Total	**806.1**	**8.0%**	**849.8**	**8.3%**	**719.7**	**8.0%**

Figure 5-15, Figure 5-16, and Figure 5-17 show the differences in Table 5-6 graphically including the upper and lower 90% confidence intervals.

Figure 5-15 Average per Customer Difference – All Participants: Viewed 16+ Times

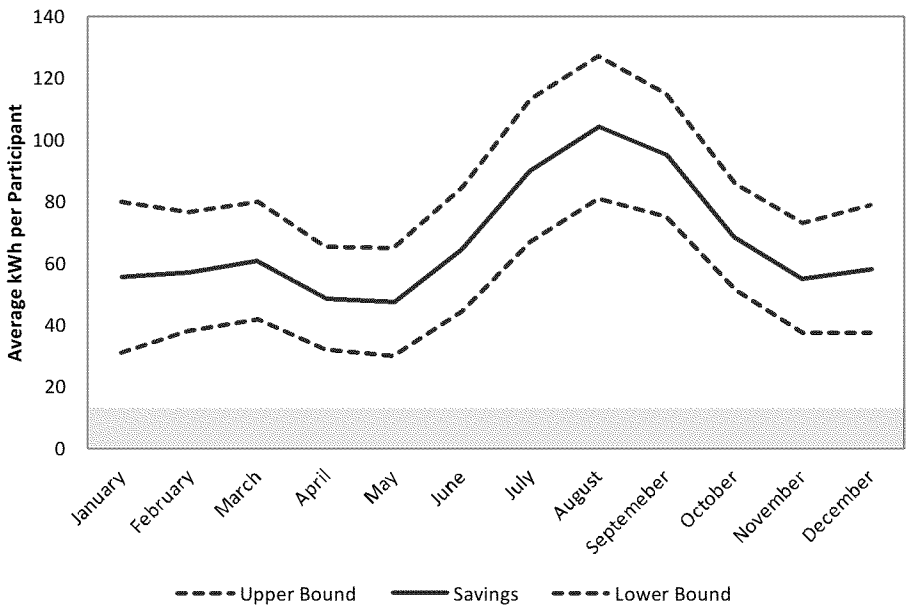


Figure 5-16 Average per Customer Difference – Continuing Users: Viewed 16+ Times

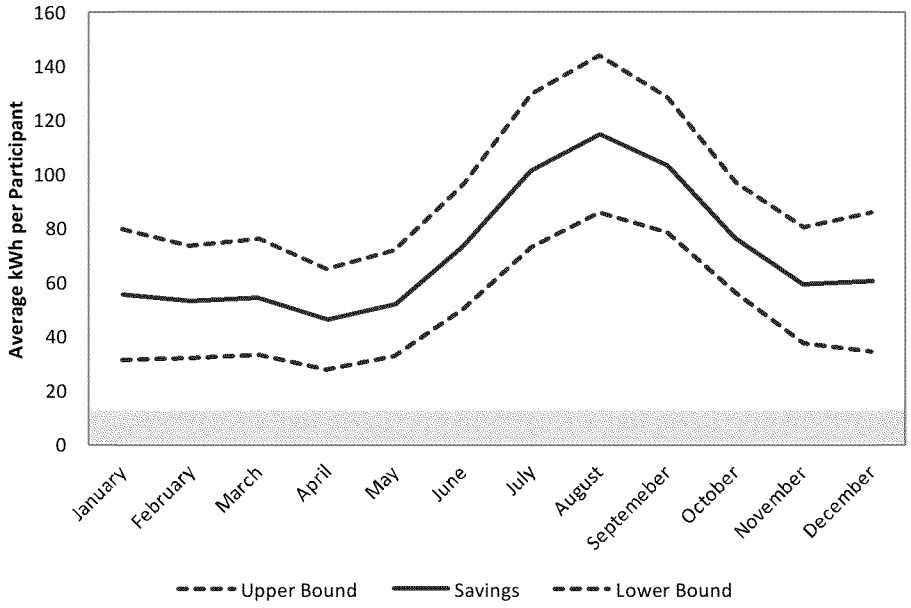
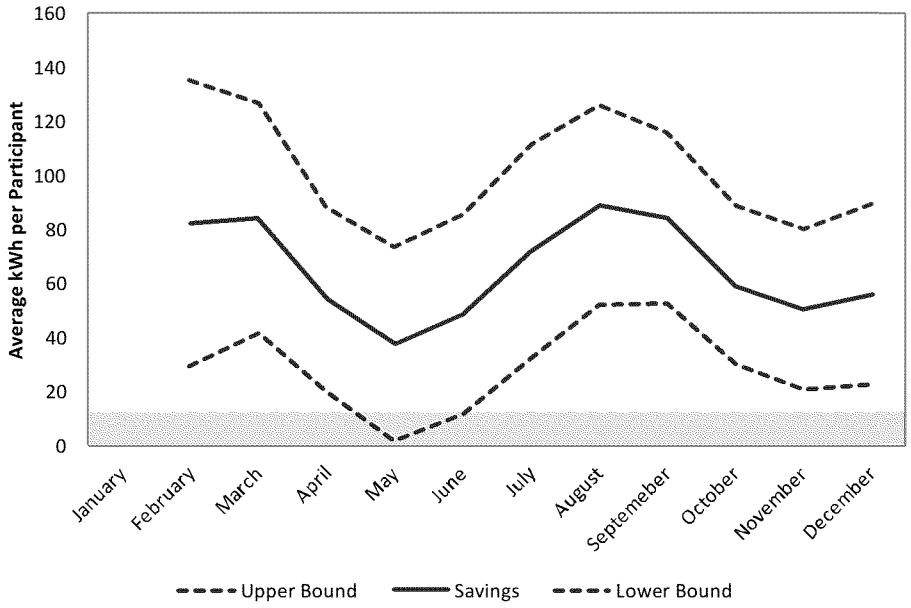


Figure 5-17 Average per Customer Difference – New Users: Viewed 16+ Times



5.2.2 Analysis Comparison Using Interval Data

In Section 4.1.1 CWP Evaluation Summary we discuss the initial analysis that was performed for CWP. In this first analysis we used our improved matching strategy to rematch the 6,000 original sample participa nts from the 2011 evaluation. While the match improved substantially, the limitations due to the requirement of complete pre -treatment billing data and the smaller sample sizes did not yield statistically significant results. However, given the limitation s of the analysis the results are still comparable to what was seen in the billing data and are presented below. Table 5-7 presents a comparison of annual average imp acts by strata and at the population level for both the billing analysis and the interval analysis. While the estimates of annual savings do differ by up to 2.5% they are still quite comparable given the very small sample sizes shown

Table 5-8. The small sample sizes resulted in less stable estimates, and much lower levels of significance which were the main drivers for undertaking the billing analysis.

Table 5-7 Comparison of Annual Average Savings by Strata: Interval vs. Billing Analysis

Data Type	All customers	Continuing Users 7-15 views	Continuing Users 16+ views	New Users 7 - 15 views	New Users 16+ views
Interval data	3.6%	7.0%	6.6%	3.4%	9.1%
Billing data	1.8%	4.9%	8.3%	4.7%	8.0%

Table 5-8 Comparison of Number of Sample Customers by Strata: Interval vs. Billing Analysis

Data Type	All customers	Continuing Users 7-15 views	Continuing Users 16+ views	New Users 7 - 15 views	New Users 16+ views
Interval data	2,645	314	312	310	323
Billing data	14,403	2,685	2,009	3,339	1,738

5.2.3 CWP Program Level Savings Estimates for 2012

Based on the analysis of both the entire sample and the subpopulations presented above, the final step of the impact analysis is to present the cumulative CWP savings for all the participants in the program.

We calculate the annual savings per customer by summing all of the statistically significant monthly savings at the program level (Table 5-3) and multiply the value by the number of participants in the population to estimate the program level savings. Using this approach we obtain an estimate of 152.5 kWh annual savings per customer. Table 5-9 shows the savings estimate for the entire population in program year 2012. In Table 5-10 we present the 2012 savings estimates for participants that are assumed to have viewed the website 7 or more times annually.
Recall that none of the savings estimates for CWP participants presented below account for dual participation in Energy Alerts.

Table 5-9 2012 CWP Program Level Savings

	Number of Participants	Annual Savings (kWh per customer)	Total Savings (kWh)
Continuing Users	100,195	153	15,283,033
New Users	50,955	153	7,772,313
Total	**151,150**	**153**	23,055,346

Table 5-10 2012 CWP Program Level Savings for Participants with > 7 Views per Year

Stratum	Number of Participants	Annual Savings (kWh per customer)	Total Savings (kWh)
Continuing User: 7 to 15 Views	11,175	477	5,329,348
New User: 7 to 15 Views	3,349	310	1,036,811
Total: 7 to 15 Views	**14,524**	**438**	**6,366,159**
New User: 16+ Views	2,211	720	1,591,214
Continuing User: 16+ Views	9,283	850	7,888,239

Total: 16+ Views	**11,494**	**825**	**9,479,453**

Overall the CWP program is estimated to be responsible for 23,055 MWhof energy savings. Not surprisingly the total savings for those more highly engaged participants, 15,845 MWh, represents about 68% of the total program savings but only 17% of the participant population.

5.3 ENERGY ALERTS RESULTS 2012

The impact analysis fo r the Energy Alerts program showed savings at the population level, and at each sub-group level, including method of alert delivery, text vs. email, and the number of alerts, more than 5 annually vs. less than 5 annually. In the subsections below we presen t the per participant impacts at the population level and for each subgroup; we also present the overall program level impacts for 2012.

Recall that two parallel analyses were conducted for the Energy Alerts participants, one using calendarized billing da ta for all program participants with acceptable pre -treatment data, and the other using a smaller simple random sample of interval data which was in turn used to calculate monthly us age. Due to missing monthly billing data for December, we used December in terval data as a proxy for the December billing data to estimate December "billing data" impacts. The data in all tables and figures associated with the Energy Alerts results reflect this use of December interval data in the place of December billing data.

5.3.1 Energy Alerts Per-Participant Savings

We first present the impact estimates for all of the Energy Alerts Participants.

Program Level Savings

Table 5-11 presents the estimated difference (or savings), measured in kWh per customer, between the treatment and control groups for both the analysis using billing data and the analysis using interval data. All cells are shaded orange indicating that all the res ults are statistically different from zero.

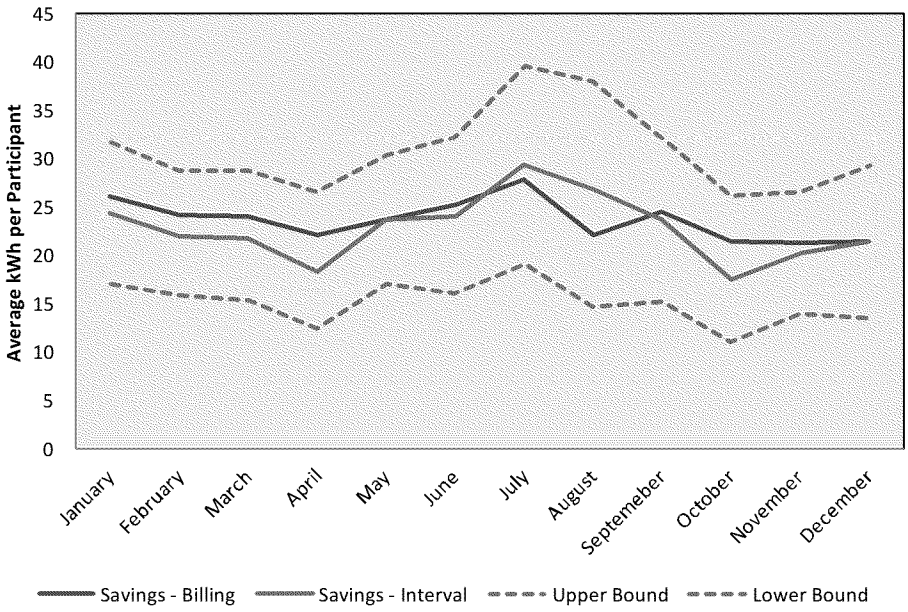
Table 5-11 Differences between Treatment and Control Group: All Energy Alerts Participants [kWh per Customer]

Month	All participants n=31,316 (billing data)	% Impact	All participants n=14,027 (interval data)	% Impact
January	26.1	3.4%	24.3	3.3%
February	24.2	3.6%	22.0	3.4%
March	24.1	3.5%	21.9	3.2%
April	22.1	3.4%	18.3	2.9%
May	23.8	3.4%	23.6	3.5%
June	25.2	3.2%	24.1	3.1%
July	27.8	3.1%	29.4	3.3%
August	22.1	2.4%	26.8	2.8%
September	24.5	3.2%	23.6	3.1%
October	21.5	3.1%	17.6	2.6%
November	21.3	3.1%	20.3	3.1%
December	21.4	2.7%	21.4	2.7%
Annual Total	**284.2**	**3.2%**	**273.4**	**3.1%**

Table 5-11 above shows that regardless of the type of data used to calculate the difference, participants, on average, save between 3.1% and 3.2% monthly relative to nonparticipants. Their savings also appears to be very similar across months of the year with slightly more savings in the winter and shoulder months and slightly less savings in the summer months.

In Figure 5-18 below we present the savings calculated from both the billing and interval data graphically. We also include the 90% confidence intervals for the estimates. Rather than include all four confidence intervals (two upper bounds an d two lower bounds) we only included the outermost bounds of the four. This results in the most conservative measure of precision when considering both estimates. If the lower bound crosses below zero, then the estimate in that month is not considered stat istically significant. In this case, both savings estimates are significant over all twelve months.

Figure 5-18 2012 Monthly Savings Estimate: All Participants



Savings by Alert Delivery Type: Text vs. Email

Next we present the savings estimates for those participants that receive their alerts via text, and for those that receive their alerts via email. Table 5-12 and Table 5-13 show the estimated difference (or savings), measured in kWh per custome r, between the treatment and control groups for both the analysis using billing data and the analysis using interval data. The orange shaded cells indicate months in which the estimated difference is statistically different from zero. The annual values lis ted in the tables include only statistically significant results.

For the email recipients, the results based on both approaches are very similar with average monthly savings estimated between 3.3% and 3.4%, and all estimates being statistically different from zero.

The results for the text recipients are smaller and less significant in both the billing and the interval analysis. The estimated average monthly savings ranges from 2.7% to 2.9% and there are far fewer significant differences using the interval data. The lower level of significance has two drivers. First the sample size used for the interval data is smaller which leads to larger mean variances and therefore to larger confidence intervals, and second, the overall estimated impacts are smaller and harder to detect.

Interestingly the text recipients from the Energy Alerts survey were more likely to state that they took action after receiving an alert than email recipients, 37% vs. 25%. However, the savings estimates shown above seem to contradict th is conclusion somewhat. Both savings estimates are

very small, so it could be that even though text recipients are more likely to take actions, they are also more likely to take actions that result in smaller savings. It may also be a result of differences in perception and reality; perhaps text recipients are more likely to recall taking action than email recipients, although in reality both groups may respond to alerts in very similar ways.

Table 5-12 Differences between Treatment and Control Group: Email Recipients [kWh per Customer]

Month	Email recipients n=21,785 (billing data)	% Impact	Email recipients n=10,127 (interval data)	% Impact
January	26.7	3.5%	26.1	3.6%
February	24.0	3.7%	22.6	3.5%
March	23.0	3.4%	21.5	3.2%
April	21.0	3.3%	18.8	3.0%
May	22.7	3.3%	23.5	3.6%
June	23.8	3.2%	24.8	3.4%
July	27.5	3.2%	31.2	3.7%
August	23.6	2.7%	31.4	3.5%
September	25.8	3.5%	26.6	3.6%
October	21.2	3.1%	20.0	3.0%
November	20.9	3.1%	21.9	3.4%
December	25.2	3.2%	25.2	3.2%
Annual Total	**285.3**	**3.3%**	**293.7**	**3.4%**

Table 5-13 Differences between Treatment and Control Group: Text Recipients [kWh per Customer]

Month	Text recipients n=8,280 (billing data)	% Impact	Text recipients n=3,900 (interval data)	% Impact
January	23.2	2.9%	19.4	2.5%
February	22.9	3.3%	20.3	3.0%
March	25.2	3.5%	22.7	3.2%
April	22.8	3.3%	16.9	2.5%
May	23.7	3.1%	23.7	3.2%
June	25.1	2.9%	22.1	2.6%
July	24.5	2.4%	24.5	2.4%
August	14.1	1.4%	14.2	1.3%
September	18.6	2.2%	15.3	1.8%
October	19.2	2.6%	11.1	1.5%
November	20.4	2.8%	15.7	2.3%
December	11.1	1.3%	11.1	1.3%
Annual Total	**225.7**	**2.9%**	**165.4**	**2.7%**

In Figure 5-19 and Figure 5-20 below we present the savings calculated from both the billing and interval data graphically. We also include the 90% confidence intervals for the estimates. Rather than include all four confidence intervals (two upper bounds and two lower bounds) we only

included the outermost bounds of the four resulting in the most conservative measure of precision when considering both estimates. If the lower bound crosses below zero, then the estimate in that month is not considered statistically significant.

Figure 5-19 2012 Monthly Savings Estimate: Email Recipients

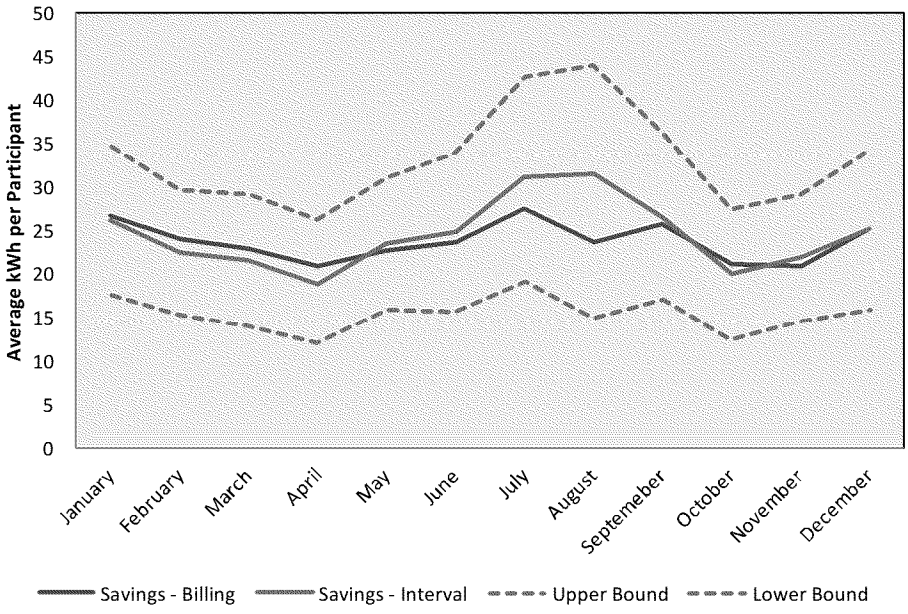
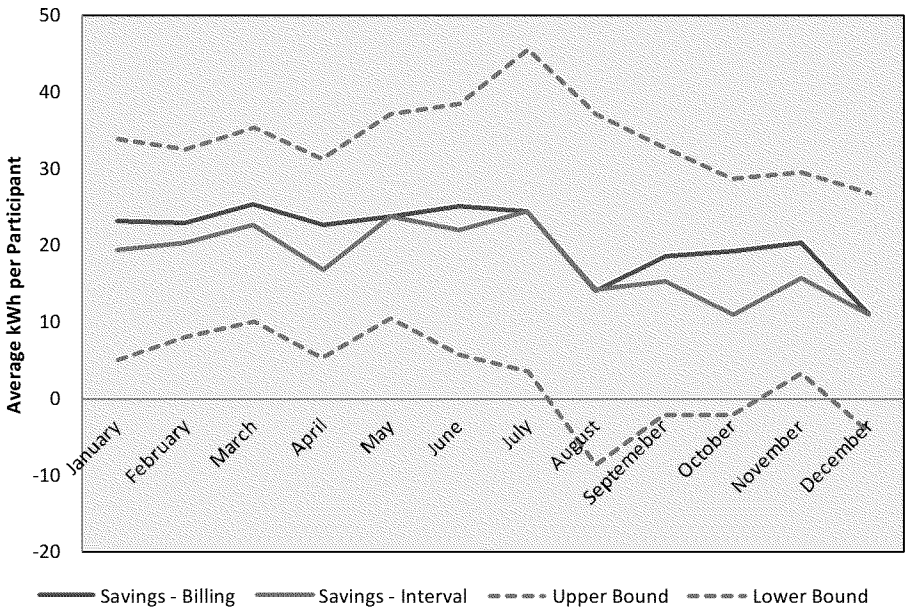


Figure 5-20 2012 Monthly Savings Estimate: Text Recipients



Savings by Number of Alerts

Finally we presen t the savings estimates for those participants that receive fewer than five alerts annually and for those that receive greater than 5 alerts annually. Table 5-14 and Table 5-15 show the estimated difference (or savings), measured in kWh per customer, between the treatment and control groups for both the analysis using billing data and the analysis using interval data. The orange shaded cells indicate months in which the estimated difference is

statistically different from zero. The annual values listed in the tables include only statistically significant results.

Table 5-14 Differences between Treatment and Control Group: Fewer than 5 Alerts [kWh per Customer]

Month	Fewer then 5 alerts n=4,264 (billing data)	% Impact	Fewer than 5 alerts n=1,966 (interval data)	% Impact
January	48.2	9.4%	42.4	8.4%
February	41.8	9.5%	38.9	9.0%
March	44.3	9.7%	43.6	9.7%
April	43.4	10.4%	44.2	10.7%
May	50.6	11.7%	53.4	12.6%
June	56.8	12.2%	61.3	13.0%
July	69.3	13.0%	78.4	14.3%
August	71.3	13.0%	86.4	14.9%
September	65.1	13.9%	73.5	15.6%
October	55.1	12.6%	55.3	12.8%
November	53.1	11.8%	54.3	12.3%
December	58.8	11.0%	58.8	11.0%
Annual Total	**657.9**	**11.5%**	**690.4**	**12.0%**

Table 5-15 Differences between Treatment and Control Group: More than 5 Alerts [kWh per Customer]

Month	More than 5 Alerts n=25,201 (billing data)	% Impact	More then 5 Alerts n=12,061 (interval data)	% Impact
January	18.1	2.1%	18.6	2.2%
February	17.4	2.3%	16.6	2.3%
March	16.4	2.1%	14.8	2.0%
April	13.9	1.9%	9.9	1.4%
May	13.3	1.7%	14.2	1.8%
June	12.7	1.4%	12.4	1.4%
July	11.9	1.2%	13.7	1.4%
August	3.6	0.4%	7.5	0.7%
September	9.5	1.1%	7.2	0.8%
October	8.7	1.1%	5.4	0.7%
November	9.6	1.2%	9.2	1.2%
December	9.1	1.0%	9.1	1.0%
Annual Total	**140.5**	**1.6%**	**118.6**	**1.6%**

In line with the results of the Energy Alerts participant survey, those who receive fewer alerts actually take more action and save more energy. In this case, both the interval and the billing analysis show significant average monthly savings ranging from 11.5% to 12.0%. At first these results indicating that those who receive fewer alerts and have lower average monthly usage would save more energy may seem counterintuitive. However, this group of customers is likely to be between Tier 2 and Tier 3 for much of the year, and for these customers, not only is the

incentive to cut back to remain in Tier 2 higher, but the less frequent alerts may actually be more effective because customers do not become desensitized to alerts over time. In addition it is interesting to note that most survey participants felt it would be more useful to be able to set their own threshold for an alert which might reduce the frequency of alerts, and make the alerts more effective for higher usage customers.

The participants that receive more than 5 alerts annually, on average, save much less than those who receive fewer alerts. Some of the summer estimates based on the interval data are not significant; again this is likely due to a combination of reduced sample size and smaller estimates.

In Figure 5-21 and Figure 5-22 below we present the savings calculated from both the billing and interval data graphically. We also include the 90% confidence intervals for the estimates. Rather than include all four confidence intervals (two upper bounds and two lower bounds) we only included the outermost bounds of the four resulting in the most conservative estimate of precision when considering both estimates. If the lower bound crosses below zero, then the estimate in that month is not considered statistically significant.

Figure 5-21 2012 Monthly Savings Estimate: Fewer than 5 Alerts

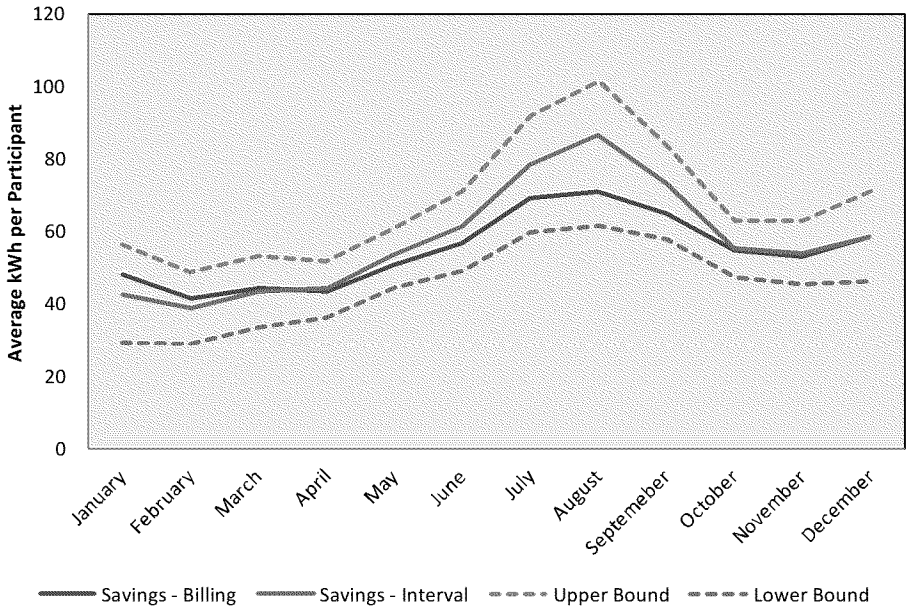
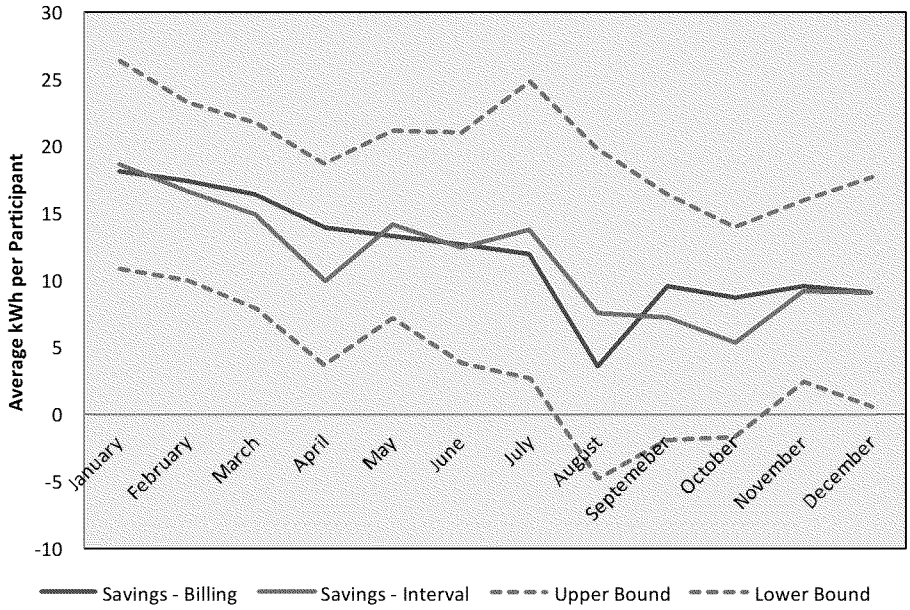


Figure 5-22 2012 Monthly Savings Estimate: More than 5 Alerts



5.3.2 Energy Alerts Program Level Savings Estimates 2012

Based on the analysis of both the entire sample and the subpopulations presented above, the final step of the impact analysis is to present the cumulative Energy Alerts savings fo r the entire program.

We calculate the annual savings per customer by summing all of the statistically significant monthly savings at the program level (Table 5-11) and multiply the value by the number of participants in the population that received at least one alert in 2012 to estimate the program level savings. We get an estimate of 284 kWh annual savings per customer. Table 5-16 shows the savings estimate for the entire Energy Alerts population in program year 2012.
Overall, we estimate the Energy Alerts program is responsible for about 20,294 MWhof energy savings. As observed for the CWP program, a relatively small number of participants in the Energy Alerts program are contributing the majority of the program savings. The total savings from those receiving fewer than 5 alerts in 2012, 12,301 MWh, accounts for about 60% of the program savings, while the participants represent only 26% of the total population.

Table 5-17 presents the 2012 savings estimates by subgroup for both alert delivery type and number of alerts. Recall that none of the savings estimates for Energy Alerts participants presented below account for dual participation in CWP.

Table 5-16 2012 Energy Alerts Program Level Savings

	Number of Participants	Annual Savings (kWh per customer)	Total Savings (kWh)
2012 Energy Alerts Program	71,459	284	20,294,356

Overall, we estimate the Energy Alerts program is responsible for about 20,294 MWhof energy savings. As observed for the CWP program, a relatively small number of participants in the Energy Alerts program are contributing the majority of the program savings. The total savings from those receiving fewer than 5 alerts in 2012, 12,301 MWh, accounts for about 60% of the program savings, while the participants represent only 26% of the total population.

Table 5-17 2012 Energy Alerts Program Level Savings by Alert Delivery Type and Numberof Alerts

Stratum	Number of Participants	Annual Savings (kWh per customer)	Total Savings (kWh)
Email Recipients	46,670	284	13,254,280
Text Recipients	22,110	284	6,279,240
Total (excludes phone recipients)	**68,780**	**284**	**19,533,520**[19]
Fewer than 5 alerts	18,696	658	12,301,968
More than 5 alerts	52,763	140	7,386,820
Total	**71,459**	**284**	**19,688,788**[20]

[19] Excluded phone recipients and therefore will not equal overall total in Table 5 -16

[20] Annual savings per group excludes statistically insig nificant months and therefore will not equal overall total in Table 5 -16

KEY FINDINGS AND RECOMMENDATIONS

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

6.1 KEY FINDINGS

The most significant finding of the impact evaluations for Energy Alerts and CWP is that both programs showed small but statistically significant saving at the population level this year. We summarize the key savings estimates for each of the programs belo w:

- Assuming no changes in saving behavior as a result of participation in CWP over the last year, on average the 2012 CWP participants saved about 1.8% of their total annual energy usage relative to non -participants. This results in approximately 23,055 M Wh of energy savings for CWP participants in 2012.
- More engaged CWP participants save more energy. Those with the highest engagement level, 16 or more views annually, saved approximately 8% of their total annual energy usage relative to non -participants. T hose with the second highest engagement level, 7 to 15 views annually, saved approximately 5% of their total annual energy usage relative to non-participants.
- Less engaged CWP participants are also highly likely to be saving between 1% and 3% annually, ho wever we could not detect those savings with statistical significance at the stratum level.
- On average, the Energy Alerts participants are saving approximately 3.2% of their total annual energy usage relative to non -participants. This results in approxima tely 20,294 MWh of energy savings in 2012.
- It appears that contrary to the participant survey results, Energy Alerts participants that receive alerts via text actually save slightly less, on average, than participants that receive their alerts via email. T he difference however is small, ranging from 3.3% to 3.4% for email participants, and falling to 2.9% to 2.7% for text participants.
- As indicated by the survey results, participants that receive 5 alerts or fewer annually save significantly more energy th an participants receiving more alerts. On average those receiving fewer alerts save between 11.5% and 12.0% annually, while those that receive more alerts save approximately 1.6% annually.

Additional non -savings related findings are included below:

- For CWP customers, higher levels of engagement yielded higher savings. Customers that viewed the website more than once showed some small savings that were not significant, and the savings increased steadily with the number of views annually.
- Even with a lack of participant data for 2012, the improved 2011 per customer estimates and the trending analysis performed using 4 years of historical data provide the best possible estimate of savings for 2012 participants.
- For Energy Alerts participants, receiving alerts less frequently rather than more frequently has a positive impact on savings.
- Energy Alerts participants are taking actions to reduce usage in response to alerts based on their responses to the Energy Alerts participant survey.

- Participants who took the Energy Alerts survey indicated that the ability to receive alerts in dollars rather than kWh would make the alerts more useful. In addition, the ability to set their own alert threshold would make alerts more useful and reduce the overall number of alerts.
- While interval data is technically more accurate, the savings were very similar for both programs regardless of the data being used, calendarized billing data or monthly interval data.

6.2 RECOMMENDATIONS FOR FUTURE PROGRAM YEARS

Based on the evaluation activities conducted for both Energy Alerts and CWP we present the following recommendations for future program years:

- In subsequent evaluations, evaluators should continue to select very large samples, near 20,000 participants, and use the improved matching approach in order to obtain the necessary precision to detect impacts.
- We recommend that PG&E encourage CWP participant engagement in order to increase per participant savings. More highly engaged customers save significantly more energy than less engaged customers. This could be done by highlighting the estimated savings of those highly engaged customers in CWP marketing and education.
- PG&E may wish to increase marketing efforts surrounding CWP. We estimated that participation dropped nearly 25% from approximately 200,000 customers in 2011 to 150,000 customers in 2012. Furthermore, without meter installs driving new participants, participation is likely to continue to decline in subsequent years.
- PG&E may wish to allow Energy Alerts participants to set their own alert threshold to reduce the number of alerts and make the program more useful. Participants that received fewer alerts were more likely to take action and saved more energy; this may be in part because those that receive more alerts become desensitized to them over time, and the later alerts are less useful or meaningful for them.
- While the improved matching strategy significantly improved the quality of the match between the treatment and control customers, it also necessitated excluding a large percentage of the population from the analysis based on availability of pre-treatment interval data. We found using these criteria caused a disproportionate number of lower usage and/or multifamily participants to be excluded from the analysis. While we can use weighting to correct the population impacts to accurately reflect the savings for those participants included in the analysis, we are unable to measure savings for those excluded participants. We recommend exploring alternate matching strategies, provided that we can obtain a sufficient match, which might allow us to capture the impacts of those excluded customers.
- Improved matching strategies and very large samples were able to demonstrate savings in both CWP and Energy Alerts for the first time in this evaluation. In light of the substantial savings, we recommend that future evaluation years carefully consider dual participation both between CWP and Energy Alerts and between each program and Home Energy Reports (HERS).

ENERGY ALERTS SURVEY RESULTS AND SELECTED BANNER TABLES

PG&E Energy Alerts Participant Survey_March 21 2013.pdf

Banner Table_Action takers.xlsx

About EnerNOC

EnerNOC's Utility Solutions Consulting team is part of EnerNOC's Utility Solutions, which provides a comprehensive suite of demand -side management (DSM) services to utilities and grid operators worldwide. Hundreds of utilities have leveraged our technology , our people, and our proven processes to make their energy efficiency (EE) and demand response (DR) initiatives a success. Utilities trust EnerNOC to work with them at every stage of the DSM program lifecycle – assessing market potential, designing effect ive programs, implementing those programs, and measuring program results.

EnerNOC's Utility Solutions deliver value to our utility clients through two separate practice areas – Implementation and Consulting.

- Our Implementation team leverages EnerNOC's dee p "behind -the -meter expertise" and world -class technology platform to help utilities create and manage DR and EE programs that deliver reliable and cost -effective energy savings. We focus exclusively on the commercial and industrial (C&I) customer segments , with a track record of successful partnerships that spans more than a decade. Through a focus on high quality, measurable savings, EnerNOC has successfully delivered hundreds of thousands of MWh of energy efficiency for our utility clients, and we have t housands of MW of demand response capacity under management.
- The Consulting team provides expertise and analysis to support a broad range of utility DSM activities, including: potential assessments; end -use forecasts; integrated resource planning; EE, DR, and smart grid pilot and program design and administration; load research; technology assessments and demonstrations; evaluation, measurement and verification; and regulatory support.

The team has decades of combined experience in the utility DSM industry. The staff is comprised of professional electrical, mechanical, chemical, civil, industrial, and environmental engineers as well as economists, business planners, project managers, market researchers, load research professionals, and statisticians. Utiliti es view EnerNOC's experts as trusted advisors, and we work together collaboratively to make any DSM initiative a success.

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