Opinion **Dynamics**

PY2013 Statewide AC Cycling Programs Process Evaluation – Integrated Report

FINAL

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Table of Contents

Tables of Tables

Table of Figures

1. Executive Summary

This study is a joint process evaluation by Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E), evaluating three Air Conditioning (AC) Cycling programs currently offered in California: PG&E's Residential SmartAC program, SCE's Summer Discount Plan (SDP) program, and SDG&E's Summer Saver program. AC Cycling programs are demand response (DR) programs in which participants allow the utility to control—or cycle—their AC units through a direct load control device on each AC unit or active temperature offsets for programmable thermostats, often during the summer . All three are mature programs that have been in operation between eight to 30 years. In total, these three programs have half a million enrolled participants across California.

At a high level, the objectives of this study included (1) documenting the administration and delivery strategies of each utility's AC Cycling program; (2) assessing the effectiveness of program administration; and (3) evaluating participant experience with the programs and their DR events.

1.1 Findings

Program Delivery and Delivery Strategies

There are several similarities between the three programs' design and delivery. All three rely on load control switches or programmable thermostats to communicate with the participant's AC unit, and employ a "set it and forget it" as their primary delivery strategy. There are many distinct features including:

- **Technologies:** While all programs employ one-way communication control devices, PG&E also uses thermostat offsets and has adaptive load switches. SCE primarily uses legacy load switches, but recently started a thermostat pilot. SDG&E primarily uses legacy load switches.

- **Duty Cycles:** SCE and SDG&E offer multiple duty cycle options ranging from 30% to 100%. PG&E offers one default option.

- **Length of Events:** Event start and end times, duration and frequency varied across all three programs.

- **Notifications:** Not offered at PG&E; offered as an opt-in for nonresidential customers at SCE; offered as an opt-in to all customers at SDG&E.

- **Incentives:** PG&E offers one-time incentive payments at installation. SCE offers monthly bill credits based on tonnage during summer months. SDG&E offers bill credits in December.

Overall, our evaluation revealed that the IOUs are implementing the three programs as they designed, and are triggering AC Cycling events on days with peak temperatures or demand. We compare program delivery features in Table 1 (in the next chapter). We also describe the details of program delivery for each utility at the beginning of each utility-specific chapter.

The Participant Experience

The participant experience is generally characterized by limited knowledge of the programs' design features, low awareness about when events occur given limited notification of events and communication with participants once they enrolled given its "set it and forget it program design."

Generally, satisfaction levels are high. Residential participants rated overall satisfaction 8.0 on a 0 to 10 scale for PG&E, 8.3 for SDG&E and 8.5 for SCE. Nonresidential participants in SDG&E territory gave a lower average rating of 7.4.

Interestingly, while overall satisfaction is high among all three programs, each program had distinct differences in satisfaction between the sub-groups studied. Dually enrolled participants tend to be more satisfied. Residential participants are generally more satisfied than nonresidential ones. Residential customers who choose maximum duty cycle tended to be more satisfied as well. The opposite was the case among nonresidential participants where those with lowest duty cycle options reported higher satisfaction levels.

The Effectiveness of Program Administration

The effectiveness of the program focused on several key areas, including:

- **Are the load control technologies effective?** The technology seems to be working, with failure rates being in the same range as other similar programs across the country. However, the one-way communicating load control devices were selected many years ago at program inception, and may limit the utilities' ability to use the AC Cycling programs for ancillary services and other grid-regulation functions as well as reduce expected participant load contribution during events due to failure rates.

- **Are there problems with the length, duration, or strategies of the duty cycles?** Participants generally are satisfied with the programs, and generally were not aware of the length and duration of the events. Characteristics of events (start/end times and duration) varied significantly across and within programs.

- **Is the notification strategy the optimal one?** There is some evidence that those who are receiving notifications are more satisfied with the program (based on dually enrolled participants in other DR programs and those who signed up for opt-in notification, where available). Notably, when participants are notified of a DR event (not necessarily AC Cycling), they appear to take several actions to reduce energy consumption. These include turning off lights and delaying use of appliances (this may be due to price signals or the desire to qualify for bill credits associated with the program for which they receive notification). Overall, participants do not appear to be adversely affected by AC Cycling events. Notably, the pros of notifying participants are that it might lead to additional savings, while the cons include the fact that participants might feel discomfort and leave the program. Our research did not clearly indicate which strategy is best.

- **Are participants free riding? Could they be doing more?** Our research did show some evidence of "free riding" at the highest 100% duty cycle option where a minority report that they typically do not use their AC unit during likely event days.

- **Are participants taking actions that lead to snapback?** About one-fifth to one-sixth of participants noted that they would likely turn down their thermostat after an event or pre-cool their premise had they been aware of an AC Cycling event.

- **Should the programs offer event override?** Many customers who left the program reported did so because they were unable to override events (SCE and SDG&E). Many of these lapsed customers noted that they might have stayed with the program if they had that option. Where overriding events is possible (PG&E SmartAC and SCE for a limited number of participants with an override enabled load switch), only a small percentage of their participants overrode their participation in an AC Cycling event. Participants want this option and offering it would lead to potential reduction in opt-out rates.

■ **Are participants paid too much?** Satisfaction with the program incentive structure were consistent across three programs despite their marked differences. In addition, participants generally do not notice events or do not feel bothered by them. Therefore, it is possible that incentives could be reduced without a significant decrease in satisfaction or participation levels. However, it is important to recognize that incentives to maintain enrollment may be different from those needed to enroll customers to the program.

■ **Are marketing costs in line?** Marketing costs for DR programs vary by the stage of the program, with newer programs having much higher marketing costs than "mature" programs that are focusing on replacement of attrition. In general, marketing costs are slightly higher than industry average practices.

1.2   Recommendations

An overall evaluation objective was to provide recommendations to improve the effectiveness of the program execution. Opinion Dynamics recommends the following:

■ **Ensure that QA/QC Processes Take Advantage of Available Smart Meter Data:** Use existing smart meter data to screen for failed devices, replacing current method of conducting random sample inspections to identify and replace failed devices. Interval smart meter data enables identification of whether a participant customer has consistently not contributed load reduction to the event. Absence of a measurable load drop over multiple events called at different times could indicate that a switch may have failed, or that the customer does not contribute load ("free rider"). This option may be limited where most events are sub-Lap and where participants are not exposed to multiple events in a given season. This will both reduce costs and increase the reliability of maintaining the program capacity.

■ **Use Available Information to Actively Target Participants More Likely to Provide Load Reduction:** Use data analytics to understand, identify, and target participants that have a load profile (peak load during likely event days) that would enable them to contribute load during AC Cycling events. Conversely, also use this approach to avoid participants that are likely to be low performers. In other words, targeting should be by geography and participant profile, with an emphasis on harsher climates (avoiding coastal ones), and that have a load profile that indicates AC usage during likely event days.

  ■ **Mine advanced meter data to identify optimal customers** who are likely to provide load reduction during event days by reviewing their load profile for the following characteristics: peaky load during likely event days (indicating both existence of and use of HVAC unit), and a minimum baseline load (so they can actually contribute cost-effective load during events). Also in geographies where there are clear weather differences, target customers who are actually using load—those in inland areas.

  ■ **Update customer profiles** to determine whether they have participated previously in the AC Cycling program (thus are not necessarily likely to participate again), or participated in other utility programs (thus have a propensity to participate in additional programs).

  ■ **Focus on geography—map locations of target customers** and select areas with high locational market prices (LMP), and T&D constraints. While the IOUs are bound to make programs available throughout their service territory, it is more cost-effective given fixed costs (acquisition, enrollment, maintenance) and variable (incentive payments) to sign up customers who actually contribute load. Avoid marketing to areas that are in mild climates, unless there is a locational constraint.

- ■ **Map historical sub-Lap event needs** (which may indicate a persistent localized constraint) and target these geographic areas first.

- ■ **Consider Notification and Educational Outreach about the Programs:** If the utilities choose to keep the program as currently designed and thus <u>not</u> use this program for ancillary and other grid-regulation services, consider notifying participants of events, as this may increase both satisfaction and load reductions (where participants may engage in additional energy-saving behaviors).

- ■ **Revisit incentive structure:** based on relatively similar satisfaction ratings across programs and specifically incentives offered by the program, it may be that a multi-year incentive structure and/or the magnitude of the incentive could be revised without significant adverse effect on enrollment and participant levels. We recommend that the programs revisit their incentive structure to consider reducing them.

- ■ **When a customer moves, consider defaulting the new resident into the program:** Most lapsed customers left the program due to moving our of their premises. Even when they notify the IOU, the load switch stays in place as an inactive, stranded asset. The IOUs should consider defaulting customers as participants, notifying them that they are pre-enrolled, giving them program information as well as clear information that would enable them to opt-out if they wanted. Currently, the SDG&E Summer Saver program flags vacated residential premises, and sends program information to new residents communicating to them they are an active program participant. The letter outlines the program benefits as well as provides clear information on steps and contact information should the new occupant want to opt-out of the program. This approach reduces attrition of participation due to customers moving.

- ■ **Upgrade Technology to Allow for New Uses:** Consider using this program for ancillary and other grid-regulation services. This would require both an upgrade to the program-offered technology and updates to the program design to allow for events outside of the time windows set for a mostly summer cycling program. The SCE SDP and the SDG&E Summer Saver programs have technology agreements that will soon expire making this a propitious time to revisit technology choice. Options include:

  - ■ **Short-term, lower cost: Replace load switch one-way door with a two-way communication chip.** At its most basic design, generally the load switch is a simple device with two main sections (exceptions exist): (1) a high-voltage box that connects with the wires and coils of the HVAC system to enable on- and off-cycling and (2) a low-voltage door where the one-way paging chip resides. To upgrade devices to two-way communication without incurring the significant capital cost of upgrading all devices, the programs should consider, where feasible, replacing the low-voltage door on load switches with a door that contains a two-way communication chip. IOUs can incorporate this into already established protocols where utilities randomly test a sample to replace failed devices, or whenever utilities roll trucks to address a customer service call.

  - ■ **Medium-term, higher cost: Replace load control devices with upgraded two-way communicating devices.** That can provide demand response programs more flexibility and options to use the program as a supply side resource. This would require a significant capital investment into the program.

  - ■ **Long-term: Leverage the "Internet of Things"** to offer DR services, rather than a technology to enable a DR program. In the past few years, Internet adoption and usage has become prevalent in most of California. Statewide, an estimated 72.9% of all households subscribe to fixed broadband services. Out of households that have been determined to have geographic

access to fixed broadband services, an estimated 74.6% subscribe.[1] Several technology devices self-register to wireless access or provide push notifications to customers upon approval. These same devices often have an identified address that allows them to register in a given network. Given these options, the utilities should study whether they should be providing a program that offers demand response services, rather than a technology to enable these services. Some utilities have versions of this option in pilot phases, generally within the nonresidential segment.

Upon installation of these identifiable technologies (such as thermostats), the customer could receive a notification asking whether they wanted to sign up for utility demand response programs. If so, their device could be registered at the time of installation as a participating customer. The utility would not lose that customer because they changed/upgraded their HVAC system (as the new device would seek to register), or because they did not like the device selected by the utility, or because the load switch cycling on and off adversely affected their learning thermostat. Some companies specialize in integrating the maze of competing communications mechanisms, hardware platforms, device protocols, software languages, and data formats by bridging these technical differences by making multi-system integration transparent for end users. These companies interconnect the Web of Things through API, drivers and interface library link products, protocols, and relevant data over the web. This creates advantages and compelling interfaces to empower device control, monitoring, data acquisition, and service—regardless of platform, protocol, environment, or manufacturer—to allow utilities to extend reach to more devices, and offer more value to commercial and residential customers over the Web.

- **Duty cycle options:**

  - **Provide clear information about duty cycle options (SDG&E). C**lear knowledge about duty cycle options (where relevant) may allow participants to select a higher-level duty cycle. Program materials should more clearly explain the trade-offs included in the multiple duty cycle options for residential and small nonresidential customers. Also, account representatives should clearly explain these trade-offs when marketing this program to large nonresidential customers.

  - **Offer additional duty cycle option (PG&E):** Consider introducing a higher duty cycle option to capture load of participants who would be willing to provide it.

Additional program-specific recommendations are in Chapter 4 of this document.

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[1] California Public Utilities Commission California Broadband Report: http://www.cpuc.ca.gov/NR/rdonlyres/7D2EFC43-A4E3-46CE-BE3B-18E765CF4D08/0/California_Broadband_Report__June_2011_CPUCmmCLEAN.pdf.

2.   Introduction

California is increasingly relying on demand response (DR) resources to meet its procurement and climate goals. Along with energy efficiency, it is first in the loading order of new energy resources detailed in the California Energy Action Plan I and II. In 2012, IOU demand response programs provided almost 5% of total energy capacity available to the California electric grid.[2]

In a May 2013 report,[3] assessing lessons learned from demand response programs, Commission staff raised issues regarding the design, performance, and forecasts of the IOU-administered programs. While several of the discussions were due to differences between the forecast and evaluated results, some issues referred to potential program design flaws, non-performance by program participants, and/or program operations, which paved the way for the process evaluation this report addresses.

On September 19, 2013, the California Public Utilities Commission (CPUC) opened a new rulemaking on demand response, R.13-09-011.[4] The rulemaking document describes the issues the proceeding means to address over the next several years. The CPUC explains that the ultimate goal is to "enhance the role of demand response programs in meeting the state's long-term clean energy goals while maintaining system and local reliability."[5]

2.1   Program Descriptions

The three programs are cycling programs primarily using load control switches. PG&E offered programmable thermostats from 2009 to 2011 (no longer available to new customers, but still active in the program) and SCE initiated a thermostat pilot with 1,300 devices. The load switch devices are either adaptive or direct control and all technologies have one-way communicating devices.

The load switches cycle the participant's AC unit for predetermined periods of time during a limited number of hours. Programmable thermostat operate based on a temperature offset, leading to shifting and/or reducing energy consumption, easing pressure on the grid, during periods of high energy demand, when wholesale prices reach a threshold level, or to ease local grid pressures due to restrictions in energy supply or transmission and distribution (T&D) constraints.

The three IOUs' AC Cycling programs are long-running, mature programs that have been in operation for eight to 30 years. The AC Cycling programs reached their peak enrollment around 2010. While all three programs have target loads that are then "translated" in number of target customers to arrive at the desired load, they all operate considerably below their original target and have adjusted their expected capacity (de-rated) over time. This is driven by a combination of sufficient capacity in the grid system (due to low current and future natural gas prices), program saturation levels among target population, budget limitations on program expansion, and upcoming expiration of long-term contracts with technology vendors and implementers/aggregators (which have limited options for program design changes).

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[2] California Independent System Operator, "2012 Annual Report on Market Issues and Performance at 30." http://www.caiso.com/Documents/2012AnnualReport-MarketIssue-Performance.pdf.
[3] California Public Utilities Commission, "Staff Report: Lessons Learned from Summer 2012 Southern California Investor Owned Utilities' Demand Response Programs," May 2, 2013. http://www.cpuc.ca.gov/NR/rdonlyres/523B9D94-ABC4-4AF6-AA09-DD9ED8C81AAD/0/StaffReport_2012DRLessonsLearned.pdf
[4] California Public Utilities Commission, Order Instituting Rulemaking Proceeding: R.13-09-011. http://delaps1.cpuc.ca.gov/CPUCProceedingLookup/f?p=401:56:9380455335038::NO.
[5] California Public Utilities Commission, "OIR in R.13-09-011," September 19, 2013, page 2. http://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=77151993.

Originally conceived as emergency programs wherein the program triggered events only during system emergencies, the overtime included economic dispatch, where events are triggered when locational marginal prices exceed a target level. The PG&E SmartAC and SCE SDP programs also sub-Lap (targeted to specific substations within the grid) to address local emergencies such as T&D overloads, supply constraints, or other localized similar situations.

This process evaluation focused on PY2013, which depending on the program, ranges from May/June through September/October. All three programs called AC Cycling events during PY2013.

We provide a high-level description of each program next.

PG&E's Residential SmartAC Program

The Residential SmartAC program is a voluntary demand response program in which PG&E installs a device at a customer's premise that can temporarily disengage the customer's air-conditioning unit or raise the temperature at the thermostat when PG&E remotely activates the load control device. PG&E activates the devices in order to reduce its system peak demand during emergency or near-emergency situations, for economic dispatch, or during limited program testing. This program acts as a demand-side resource to PG&E to help maintain service reliability for all electric customers, defer construction of additional generation facilities, and reduce environmental pollutants. This program is generally limited to 100 hours per year. The program is available to individually metered residential customers with single-stage central electric AC units that generally operate during PG&E's summer peak periods.

SCE's Summer Discount Plan Program (SDP)

The SCE SDP program is a long-running program that installs load switches in residential and nonresidential premises. In addition to emergency- or reliability-based triggers for AC Cycling events, the program has also recently started events for economic dispatch. Curtailment event trigger criteria include California Independent System Operator (CAISO) declaration of a Stage 2 Emergency, and SCE declaration of a Category 1, 2, or 3 Storm Alert that may jeopardize the integrity of SCE's distribution facilities, as well as when wholesale power prices exceed a target level. In 2009, SCE added an additional emergency-based trigger to the program to allow the CAISO to call SDP upon issue of a Warning Notice and when a Stage 1 Emergency is imminent, provided the CAISO has exhausted all other options to prevent further degradation of its operating reserves. Customers receive an incentive payment based on the tonnage of their AC unit during the summer months. SCE offers this program to all customer segments within their service territory.

SDG&E's Summer Saver Program

SDG&E implements the Summer Saver program through an aggregator, Comverge, Inc. Schools and residential and small commercial customers that use up to a maximum of 100 kW on average during a 12-month period are eligible to participate in the Summer Saver program. The SDG&E Summer Saver program is a "Day-of" demand response program. Before 2013, this program did not notify participating customers of events. Starting in 2013, customers may sign up to receive a phone notification of events. Customers receive an annual bill credit on their SDG&E bill at the end of the event season for program enrollment based on AC tonnage and cycling options selected. While customers do not receive event-specific incentives, the Summer Saver load control devices qualifies as an enabling technology and thus customers receive a bill credit for Peak Time Rebate, should their energy consumption fall below their established baseline. SDG&E offers this program to all residential customers and to nonresidential customers with peak demand loads not exceeding 100 kW.

2.2 Program Comparisons

While the three AC Cycling programs are similar at a high level, their program designs are quite distinct. Therefore, direct comparisons across programs are tenuous. Table 1 highlights the major differences among the three AC Cycling programs.

Table 1. Differences across AC Cycling Programs

AC Cycling Programs	PG&E SmartAC	SCE Summer Discount Plan	SDG&E Summer Saver
Residential Participants	X	X	X
Small Nonresidential	5,500 previously enrolled (closed to new enrollments)	X	X
Large Nonresidential	Not available	X	Not available
Technology Offerings	■ Adaptive Load Switch ■ Programmable Thermostat	■ Direct Load Switch	■ Direct Load Switch
Event Triggers	■ Emergencies ■ Economic dispatch ■ Sub-Lap ■ System testing	■ Emergencies ■ Economic dispatch ■ Sub-Lap ■ System testing	■ Emergencies ■ Economic dispatch ■ System testing
Duty Cycle Options	■ All: 50%	■ Residential: 100% and 50% ■ Nonresidential: 100%, 50% and 30%	Residential: 100% and 50% Nonresidential: 50% and 30%
Implementers / Contractors / Aggregators	Scheduling and conducting installations, maintenance ■ GoodCents	Scheduling and conducting installations, maintenance ■ GoodCents ■ NRG	Aggregator model ■ Comverge
Number of 2013 Events	■ 4 sub-Lap ■ 1 test systemwide	■ 6 systemwide	■ 12 sub-Lap residential events (11 within the event period, 1 in the fall) ■ 4 systemwide nonresidential events
Event Periods	■ Varied: three in the evening about 3-4 hours duration; one in the afternoon 1.5 hours in duration ; one day long system-wide test event to 10 sub-groups in 1.5 hours rotation	■ Varied: most residential in late afternoon, with most with 2 hours duration; all nonresidential 1 hour in duration	■ All events to all segments four hours in duration
Incentive Structure	■ One-time incentive payment at installation	■ Summer monthly credits that vary according to duty cycle selection, AC tonnage controlled, and whether customers choose the option to override events	■ Bill credit calculated based on duty cycle option in at the end of year
Dually Enrolled	■ SmartRate program (opt-in rate) ■ Overlap between SmartRate program on certain days, but not event start/end time	■ Power Save Days (voluntary opt-in for bill credit) ■ Some overlap in event days	■ Reduce Your Use Days (voluntary opt-in for bill credit) ■ No overlap in event days

AC Cycling Programs	PG&E SmartAC	SCE Summer Discount Plan	SDG&E Summer Saver
Event Notification	■ Not offered for SmartAC-only customers ■ Dually enrolled with SmartRate customers (25% of program) receive notification (for SmartDays events)	■ Offered on an opt-in feature (small percentages have signed up for it) ■ Offered for Power Save Days events	■ Offered on an opt-in feature (small percentages have signed up for it) ■ Offered for Reduce Your Use events
Event Override	■ Any event, by phone or online	■ Generally not allowed ■ Residential: new load switches have override capabilities but small percentages have it ■ Nonresidential: no override option allowed	■ Not offered
Leaving Program	■ Participants can leave and re-enroll anytime but are told minimum participation is one-year	■ 12-month moratorium on enrolling participants who left the program	■ Participants can leave and re-enroll anytime
Customer Communication	■ Program spring newsletter ■ Thank you, end of season postcard	■ None	■ Pre-season reminder letter

While direct comparisons across programs are tenuous, we have structured this report to present program-specific information using a common framework. The report structure is as follows:

■ Chapter 3: Description of the research objectives, data sources, and evaluation methods used

■ Chapter 4: Integrated summary across all three programs

■ Chapter 5: PG&E SmartAC program process evaluation

■ Chapter 6: SCE Summer Discount Plan program process evaluation

■ Chapter 7: SDG&E Summer Saver program process evaluation

■ Appendices A through C: Sampling plans for PG&E SmartAC, SCE Summer Discount Plan, and SDG&E Summer Saver programs

■ Appendices D through F: Participant and lapsed surveys demographics and firmographics for the PG&E SmartAC, SCE Summer Discount Plan, and SDG&E Summer Saver programs

■ Appendix G: List of programs used for benchmarking analysis

■ Appendix H: Bibliography

3. Methods and Assumptions

This chapter describes the research objectives, assumptions and methods, and data sources used to conduct the process evaluation of each AC Cycling program.

3.1 Research Objectives

At a high level, the objectives of this evaluation include:

1. Documenting the program administration and delivery strategies

2. Assessing the effectiveness of program administration

3. Evaluating the customer experience with the program and events

4. Reviewing marketing costs per enrolled customer, and determining the range of appropriate costs for AC Cycling programs

While this is a statewide research effort, the three programs have distinct design differences. Therefore, we conducted the evaluation tasks in parallel but separately by program. Where commonality existed, we asked consistent questions to stakeholders and customers, and took care to ensure that the structure for each program process evaluation was consistent for ease of content comparison. Further, given the nature and design of the programs, selected research questions applied to particular programs only.

Table 2 below outlines the evaluation's research objectives and their applicability by program. The RFP and contracted scope of work document list these research objectives. We have grouped them by the four high-level research objectives listed above.

Table 2. Research Objectives by AC Cycling Program

No.	Question	PG&E SmartAC	SCE Summer Discount Plan	SDG&E Summer Saver
Main Objective #1 - Document the program administration and delivery strategies				
1	Has the program historically been implemented compared to design?	X	X	X
2	What are the criteria to call an event?	X	X	X
3	What is the balance between system need and customer satisfaction when calling events?	X	X	X
4	Does the program proposal have to change to reflect customer participation in demand response events? How?	X	X	X
5	What is the standard customer support procedure to deal with generalized failure of equipment during events?	X	X	X
6	What process do the IOUs follow to test and deploy control devices?	X	X	X
Main Objective #2 - Assess the effectiveness of program administration				
7	How do DR event trigger criteria reflect system needs?	X	X	X
8	Do marketing materials accurately depict the program and its proposal?	X	X	X
9	What are the barriers for maximizing program utilization?	X	X	X
10	Does the program event period and proposed duration match system needs (e.g. has the peak changed, is there more than one peak, etc.)?	X	X	X

No.	Question	PG&E SmartAC	SCE Summer Discount Plan	SDG&E Summer Saver
11	Are there elements of program design and/or customer behavior that exacerbate snapback effects and reduce overall savings (e.g., do customers turn down thermostats after an event, leading to larger snapback)?	X[1]	X	X
12	What is the relationship between cycling period and snapback?	X[1]	X	X
13	Are there industry benchmarks/best practices for testing and/or deploying devices?	X	X	X
14	If so, do the IOUs meet those benchmarks and best practices?	X	X	X
15	What improvements can be made to increase control device reliability and minimize the risks of failure?	X	X	X
16	Recommend an effective way to deliver savings results to the dually enrolled customers.	X		
17	How effective are event notifications?			X
Main Objective #3 - Evaluate the customer experience with the program and events				
18	Do customer satisfaction and comfort vary by event duration?	X	X	X
19	Do customers become fatigued when there are events on consecutive days? Why or why not?	X	X	X
20	Do customers know when an event is in progress?	X	X	X
21	Do customers know how long events will last?	X	X	X
22	Do customers know what the effects of an event are?	X	X	X
23	Are customers aware of different triggering conditions for events?	X	X	X
24	Does awareness of trigger conditions have any impact on their willingness to participate?	X	X	X
25	When and why do customers decide to override the program?	X	X	X
26	When and why do customers drop out of the program?	X	X	X
27	How satisfied are customers with the incentives they receive and the cycling strategy employed by their IOU?	X	X	X
28	Are there alternative incentive schemes and/or cycling strategies that they would find more appealing?	X	X	X
29	How do satisfaction /scheme preferences vary across IOU customers?	X	X	X
30	Are customers aware of the procedure when they sign up?	X	X	X
31	What improvements can be made to increase customer satisfaction in the event of an equipment failure during an event?	X	X	X
32	How many customers are reminded by the newsletter sent in the spring that they are in the SmartAC program?	X		
33	Of customers dually enrolled in the SmartAC and SmartRate programs, what percent relies on PG&E to auto-cycle on SmartRate event days, and how many simply turn off their AC?	X		
34	For those that auto cycle, are customers under the impression that PG&E has determined the 50% specifically for them?	X		
35	Do customers prefer the convenience of having someone control their AC or maintaining the control of their AC by opting in/out of events?			X
36	What are customers' reasons for participation (incentive, environment)?	X	X	X
37	Does allowing customers to opt-in to receive event notifications affect retention numbers?			X
38	For those who leave the program or override events, why?			X
39	Was the program explained correctly to customers, or were there unexpected surprises?			X
Main Objective #4 - Review marketing costs/enrolled customer; determine range of appropriate costs for AC Cycling programs				
40	Review the marketing costs per enrolled customer and determine the range of appropriate costs for AC cycling programs.	X	X	X

3.2   Data Sources

Table 3 highlights the data sources requested and used to conduct the process evaluation.

Table 3. Data Request

No.	Data Type	PG&E	SCE	SDG&E
PROGRAM GENERAL INFORMATION				
1	Program description	X	X	X
2	Program theory and logic model, if available	NA	NA	NA
3	Program design changes, if any over time	X	X	X
4	Program 2013 line budgets (e.g., marketing, incentive payments, etc.)	X	X	X
5	Incentive levels (amount in $, when paid, etc.)	X	X	X
6	Program implementation plans	X	X	X
7	Program marketing materials	X	X	X
8	Dates of marketing campaigns	X	X	X
9	Recent (2011-2013) past program impact evaluations	X	X	X
DR EVENTS				
10	Dates of 2013 DR events	X	X	X
11	Duration (start and end times) of DR events	X	X	X
12	Designation of DR events (test, systemwide, localized)	X	X	X
13	Trigger for DR events (temperature, wholesale prices, test, etc.)	X	X	X
14	Average external temperature where DR events were called	X	X	X
SYSTEM PEAK INFORMATION				
15	Times of system peaks during the 2013 summer period	X	NA	X
16	Average system load	X	NA	X
17	Peak system load	X	NA	X
PROGRAM TRACKING DATA				
Customer Information				
18	Account ID (or unique identifier)	X	X	X
19	Participant type (active versus lapsed)	X	X	X
20	Date of enrollment in program	X	X	X
21	Technology installation rate (if different from enrollment date)	X	X	X
22	If lapsed, date of opting-out of program	X	X	X
23	Customer name	X	X	X
24	Customer phone number	X	X	X
25	Customer address	X	X	X
26	Customer ZIP code	X	X	X
27	Customer climate zone (or alternatively, a list of climate zones by ZIP)	X	X	X
28	Customer type (residential, nonresidential)		X	X
29	For nonresidential, NAICS code (or other designation of business type)		X	X
Program Design Information (applicable only to specific programs)				
30	Program enrollment status (AC Cycling only or dually enrolled)	X		
31	Technology installed (PCT vs. thermostat)	X		
32	Program design (base vs. enhanced)		X	
33	Duty cycle selection		X	X
34	Incentive amount paid	X	X	X
35	Any other program design designations	X	X	X
36	For nonresidential, AC tonnage		X	X
Implementer Information				
37	Implementer contact name	X	X	
38	Implementer company's name	X	X	
39	Implementer contact information - Address	X	X	
40	Implementer contact information - ZIP code	X	X	

No.	Data Type	PG&E	SCE	SDG&E
41	Implementer contact information - Phone number	X	X	
42	Implementer contact information - Email	X	X	
Aggregator Information				
43	Aggregator contact name			X
44	Aggregator company's name			X
45	Aggregator contact information - Address			X
46	Aggregator contact information - ZIP code			X
47	Aggregator contact information - Phone number			X
48	Aggregator contact information - Email			X
DR IMPACT INFORMATION (BY CUSTOMER IF AVAILABLE)				
49	Snap back/snapback information	NA	NA	NA
50	DR load dropped	NA	NA	NA
51	Designation of which customers participated in AC Cycling events, PER EVENT (especially in the event of localized tests/DR events)	X	X	X

NA= requested but not available

3.3   Methods

Opinion Dynamics evaluated the programs as currently designed and implemented. In addition, we have documented program design changes over time to provide context for current program design. Table 4 documents the tasks conducted to support addressing the research objectives.

Table 4. Evaluation Approaches

Evaluation Task	Description

Program Staff Depth Interviews	■ PG&E SmartAC program
	   ▪ Program manager and staff interviews
	   ▪ Implementer interviews
	■ SCE Summer Discount Plan program
	   ▪ Program manager and staff interviews
	   ▪ Contractor interviews
	   ▪ Account representatives interviews
	■ SDG&E Summer Saver program
	   ▪ Program manager and staff interviews
	   ▪ Aggregator interviews

Stakeholder Depth Interviews	■ Depth interviews with 12 AC Cycling programs across the county for benchmarking of failure rates and marketing costs per enrolled customer ■ Technology Experts: Google, Trilliant Networks, Invensys, Cooper Power Systems
Program Materials Review	■ Program descriptions ■ Program handbooks and operating plans, where available ■ 2011, 2012, and 2013 impact evaluations, where available
Database Review	■ All three programs
Participant Surveys	■ PG&E: 328 ■ SCE: 138 residential; 126 nonresidential ■ SDG&E: 198 residential; 90 nonresidential
Lapsed Customer Surveys	■ PG&E: 68 ■ SCE:71 residential; 40 nonresidential ■ SDG&E: 96 residential; 45 nonresidential

Appendices A through C have detailed explanations of the sampling strategy used for the active and participant lapsed surveys. They also include the sample weights, survey response rates and disposition reports.

4. Integrated Summary

This section shows the key findings for each program, followed by a discussion of overarching topics across all three AC Cycling programs. These include:

- Review of technology options (and failure rates);
- Comparison of marketing costs per enrolled customer to other programs across the country;
- Whether to revisit program event notification strategies;
- How to best identify and target optimal customers;
- How to raise awareness of program design features such as duty cycle options that have a direct effect on how much load reduction participants can contribute to the program.

We present each of the AC Cycling key findings next.

4.1 PG&E SmartAC Program Highlights

The PG&E SmartAC Program is generally implemented according to its program design and customers are satisfied with the program. Key highlights include:

- **Program satisfaction:** Program participants provided an overall mean satisfaction rating of 8.0 on a 0 to 10 scale. Dually enrolled participants (with the SmartRate program) are significantly more satisfied with the program and with various program elements than SmartAC-only participants.

- **Differences between SmartAC-only and dually enrolled participants:** Dually enrolled participants are more likely to report engaging in additional energy-saving behavior during events (85% compared to 70% of SmartAC-only participants), and are more aware of program design features.

- **Awareness of program design features:** Most SmartAC-only participants estimate the typical event length to be 2 hours, whereas dually enrolled participants report event lengths that mirror those of the SmartRate program (consistently called between 2 p.m. and 7 p.m.). Neither group accurately reported, however, program design features and event frequency, largely because these varied considerably in PY2013 and across years. It is, however, likely that some dually enrolled participants confuse the SmartRate and SmartAC programs because they receive frequent notifications from the SmartRate events and may pay more attention to them given the price risk. Among SmartAC-only participants, more inland participants (20%) reportedly knew about the maximum possible number of events than did coastal (0%) or midrange participants (5%).

- **Motivation to participate in the program:** Participants reported that the primary reason for joining the program was due to expected bill savings.

- **Energy-saving behavior during AC Cycling events:** A large proportion of dually enrolled participants (43%) report turning off their AC units altogether upon notification of SmartRate events. They were also likely to report engaging in additional energy saving behavior such as turning off lights, using power strips and delaying use of appliances.

- **Recollection of AC Cycling events**: With the exception of two systemwide test events, all AC Cycling events were sub-Lap reaching between 5,000 to 35,000 participants. Therefore, most participants did not experience multiple AC Cycling events, 97% of participants experienced at least one AC Cycling event. However, only about one-quarter (27%) recalled experiencing a PY2013 event. Some highlights include:

■ Dually enrolled participants (35%) were more likely to recall events than SmartAC-only participants (25%) (we posit it is because the first group receives SmartRate event notifications and may be linking the two programs).

■ Those with programmable thermostats (41%) also were more likely to recall events, given that this device blinks during event periods.

■ Inland participants recalled events at a higher rate than coastal participants (mostly because most events were called in inland areas, although also possibly because many do not rely on the cooling services of their AC unit , and are thus less likely to experience (and contribute load to) events.

■ **Snapback effects:** More than two-thirds (69%) stated they would not pre-cool ahead of an event, and more than half (58%) of those who recalled AC Cycling events said they would not change their thermostat setting after events.

■ **Reasons for leaving the program:** The most frequently stated reasons for leaving the program were technology issues (30%), including the perception that the load switch was incompatible with or adversely impacted the HVAC unit, and AC Cycling event issues (23%), including feeling hot or uncomfortable during event days. About half of dually enrolled lapsed customers (45%) stated they would have stayed in the SmartAC program if they had not been exposed to higher peak prices associated with the SmartRate program. These customers reportedly left both programs.

■ **Preponderance of programmable communicating thermostat (PCT) users among lapsed customers:** The proportion of lapsed customers with programmable thermostats who left the program (60%) is much greater than the number of lapsed participants in the population (14%), suggesting that the PCT technology could be linked to leaving the program. Lapsed customers with PCTs most frequently cited the control device as the top reason for leaving the program (26%).

■ **Event days compared to system peaks:** Three of the five AC Cycling events occurred on the three highest peak days of the 2013 summer period. For the most part, the event triggers address conditions that could lead to system peak. It is important to note that except for the systemwide test events, the remaining three events occurred to address targeted and localized system conditions, which is a desired feature of an AC Cycling program.,.

Detailed data and recommendations for the PG&E SmartAC program are included in Chapter 5 of this report.

4.2   SCE Summer Discount Plan Program Highlights

The SCE SDP program is a long-running AC Cycling program and it is implemented according to its program design. Key highlights include:

■ **Program satisfaction—residential:** Residential participants rate overall satisfaction as 8.5. Satisfaction with specific program elements ranges from a mean score of 7.5 to 9.2. Satisfaction scores changed based on participant's duty cycle option, where Maximum Savings (100%) participants rate their satisfaction higher (mean of 9.1) than Maximum Comfort (50%) participants (8.4). Coastal participants give a higher overall program satisfaction score (9.2) and are more satisfied with incentive levels (9.0) and the expected event length (8.8) than midrange participants.

■ **Program satisfaction—nonresidential:** Average satisfaction scores for program-specific components range from 7.5 to 8.6 among nonresidential participants. Good Value (50%)

participants consistently give lower satisfaction scores compared to other customers in average satisfaction with SCE, technology ratings, expected event length, and event frequency.

■ **Awareness of program features—number of events:** As previously mentioned, the SDP program is set up as a "set it and forget it," where residential participants receive no notification of SDP events, and nonresidential have the option to opt-in to receive notification only (reportedly selected by less than 9% of nonresidential participants). Therefore, overall awareness of the number of SDP events (as well as start/end times and typical event duration) is generally low. When participants do report understanding program design features, they often provide features of other DR programs where they may receive notification (e.g., Power Save Days program) rather than the SDP program specifically.

■ **Motivation to participate in the program:** The majority of participants note electric bill savings as the primary motivator for joining the program (68% and 58% of residential and nonresidential participants, respectively).

■ **Recollection of events:** In PY2013, the SDP program called 12 residential and 4 nonresidential events. SDP events had varied start/end times, and most were sub-Lap. Therefore, most participants only experienced a subset of events. Half of residential (49%) and nonresidential participants (48%) reported they would assume there was an event if they experienced discomfort; if it were a hot day; changes in their AC unit (noise reduction); or through notifications of other DR programs for dually enrolled customers.

　■ Nonresidential: Small nonresidential participants are more likely (53%) than large nonresidential participants 26%) to notice a SDP event.

　■ Residential: Only 10% of inland Maximum Comfort (50%) residential participants recalled a SDP event. Among 100% duty cycle participants, recollection is lowest among participants in coastal areas.

■ **Noncontributors:** Program staff expressed concern that participants who select 100% duty cycle options may do so because they are less likely to use their AC unit to begin with, thus they may be "free riders" as a result. Some of the data supports this hypothesis, where approximately one-sixth (14%) of residential 100% duty cycle participants reported they would not notice an event since their AC unit is mostly not used. This may be an issue since the SDP program pays ongoing incentive payments, some potentially going to customers who do not contribute load reduction.

■ **Override of events:** Historically, the program did not allow for overriding of events. It now offers a load switch that enables overriding, but only a minuscule portion of the residential participant population (about 1% according to SCE) has override-enabled devices. This option is not available to nonresidential customers. We asked participants whether they would accept a lower incentive payment for the option to override events (an option already available to new customers). Almost two-thirds of residential participants said they have no interest in overriding events in exchange for a lower incentive, and only 16% said they would take up this choice. Among nonresidential participants, 37% would like this option. Yet many participants leave the program because they are not able to override an event. For the SDP program, customers who leave cannot rejoin the program for another 12 months, thus essentially requiring a participant to leave the program when in some cases they may have simply wanted to override a single event.

■ **Snapback effects:** The majority of residential (74%) and nonresidential (68%) participants said they would not change their thermostat setting after an event or pre-cool their facility ahead of event had they been aware of them. Only 16% of residential participants reported changing their

thermostat setting, and 22% of nonresidential participants reported precooling their facility in anticipation of events.

■ **Reasons for leaving the SDP program:** After moving, discomfort levels during events are the primary reason customers leave the program (12% of residential and 13% of nonresidential). About 10% of residential and 4% of nonresidential participants noted technology issues. Small nonresidential participants, inland (all segments) also left the program at a higher rate than other segments.

■ **Customers unaware that they left the program:** A minority of lapsed customers believed that they were still enrolled in the program (7% and 15% of residential and nonresidential lapsed customers, respectively). While this may be in part because the person who opted-out of the program may not have been the one surveyed (although our survey script specifically tried to identify the decision-maker in the household or facility), these numbers are meaningful.

■ **Event days matching system peaks:** SCE did not provide specific data on system peak. However, its residential events were sub-Lap; therefore, they were meant to address local constraint, for economic dispatch, or for test purposes. While we do not have data for a direct comparison, the SDP events occurred for the most part on hot temperature days (85°F and higher) and simultaneously with other demand response events, which is an indication of a likely system peak.

Detailed data and recommendations for the SCE Summer Discount Plan program are included in Chapter 6 of this report.

4.3 SDG&E Summer Saver Program Highlights

The SDG&E Summer Saver program is a long-running AC Cycling program and is implemented according to its program design. Highlights include:

■ **Program satisfaction:** Overall program satisfaction is high (mean of 8.3) for residential and moderately high (7.4) for nonresidential participants. Residential 100% duty cycle participants are the most satisfied with the program overall, their duty cycle option, incentive levels, the program technology, the number of events and their expected length, and with SDG&E. They are also more likely to recommend the program to others.

■ **Program engagement:** The 100% duty cycle participants are more aware of selected program design features, and are less likely to engage in behaviors that lead to snapback effects (such as lowering the thermostat after an event). They are more likely to engage in energy-saving activities when aware of a Summer Saver event beyond simply letting their AC unit cycle.

■ **Motivation to participate:** A majority of residential participants name bill savings (55%) or incentive payments (20%) as their main motivation to participate in the program. More inland 100% duty cycle participants joined the program expecting bill reductions. More 50% duty cycle participants joined for the program's environmental benefits. The top three drivers for participation among nonresidential participants are incentive payments (35%), environmental benefits (23%), and the expected reduction in the energy bill (21%).

■ **Knowledge of program design features—event triggers:** Participants typically understand that AC Cycling events occur during periods of peak energy demand, but awareness for underlying event triggers is low. Two-thirds (65%) of residential participants and half (54%) of nonresidential participants name avoiding power outages as the reason why SDG&E calls Summer Saver events. Few participants name high-energy prices (8% of residential, 9% of nonresidential) or emergencies or natural disasters (both 1%) as reasons why events are called.

■ **Knowledge of program design features—event days and duration:** Awareness of program design features (such as maximum event days and event duration) is low among participants. Approximately half of residential (42%) and nonresidential (53%) participants cannot estimate the number of events called during a typical summer, and the majority of residential (82%) and nonresidential (94%) participants report that they do not know how many events SDG&E can call per season. One-third of residential participants (34%) and only 15% of nonresidential participants estimate the typical duration of an AC Cycling event to be 3-5 hours, which corresponds to the actual average event duration in 2013.

■ **Event notification:** Historically, the Summer Saver program did not offer event notification. The program started opt-in event notification in 2013. SDG&E reports that only a small percentage of its active participants signed up for event notification. In general, awareness of this opt-in option is low among residential (15%) and nonresidential (18%) participants. However, those who are aware tend to exhibit a high propensity to sign up for opt-in notification. That is, 59% of residential participants who were aware of the notification option opted-in. However, this was not the case for nonresidential participants, as only 14% of those aware opted-in to this program feature.

■ **Event recollection and response:** While most residential (82%) or nonresidential (86%) participants are typically at their premise during summer afternoons, only half of all residential (50%) and nonresidential (54%) participants noticed at least one of the six Summer Saver systemwide events. In the absence of receiving event notification, three-quarters of residential participants (75%) who recalled events believed they were ongoing because they felt discomfort, especially those in inland areas. Nevertheless, the majority of those (70%) who noticed an event reported undertaking additional energy-saving actions such as unplugging appliances or delaying use of appliances (clothes washers and dishwashers). Among nonresidential participants who noticed events, half (53%) reported turning off unnecessary lights.

■ **Consecutive event days:** Only one-fifth of all participants (21% residential, 22% nonresidential) recalled consecutive event days. Participants report a low likelihood of leaving the program due to experiencing three consecutive event days (mean of 2.1 for residential and 3.0 for nonresidential participants on a 0 to 10 scale).

■ **Reduce Your Use Alert:** Overall, one-fifth (22%) of residential participants also signed up for the Reduce Your Use (RYU) Alert (a voluntary program with opt-in notification), the share being higher among 100% duty cycle (30%) than 50% duty cycle participants (14%). SDG&E called one RYU event on a Saturday following three consecutive Summer Saver events. Most RYU participants (74%) state they have no problem with consecutive events, nor back-to-back Summer Saver and RYU days, if deemed necessary by SDG&E.

■ **Snapback effects:** More than two-thirds of residential (69%) and nonresidential (66%) participants who noticed events reported that they have never lowered the thermostat in the aftermath of an event to cool down the house or premise.

■ **Reasons for leaving the program:** One-third of the residential customers (34%) and one-quarter of nonresidential lapsed customers (23%) primarily left the program due to a lack of comfort during events, while another third (residential and nonresidential both 37%) left the program for external factors unrelated to the program, such as moving or illness.

■ **Opportunities to customers who want to leave the program:** The majority of residential (78%) and nonresidential (86%) lapsed customers did not change their duty cycle option after first signing up for the program. However, almost half (44%) of residential and one-third (34%) of nonresidential lapsed customers would have accepted a lower incentive payment in exchange for the ability to override event participation. The share of those willing to accept a lower incentive is significantly

higher among 50% duty cycle (58%) than 100% duty cycle participants (26%). Allowing participants to override events may help to retain some customers who may otherwise leave the program.

Detailed data and recommendations for the SDG&E Summer Saver program are included in Chapter 7 of this report.

4.4 Overarching Topics

In this section, we discuss common topics across all three AC Cycling programs. Specifically, we address:
- Technology options
- Processes for monitoring technology failure rates
- Targeting the optimal participant
- Notification strategies
- Multiple duty cycle options

4.4.1. Technology Options

All three programs offer one-way communicating load control devices. The decision to install a one-way device was made at the time of program design, often eight or more years ago. Notably:

1. At the time of program inception, generally the program triggers for AC Cycling events included only emergency purposes. Therefore, there were years when no AC Cycling events occurred except for test purposes ; and

2. Given the large capital investment associated with installing thousands of load control devices, technology purchasing agreements were typically long-term (i.e., spanning a decade in most cases). These agreements have limited the program's ability to perform technology upgrades in part backed by the desire to depreciate the assets over time. However, some utilities are coming to the end of these contracts and are considering options for the future.

Compared to currently available options, the one-way capability comes with significant limitations, including lack of visibility in various aspects including:

- **Lack of visibility into available load.** Given that program cannot ping the units, there may be widespread malfunctioning devices limiting expected load contribution during AC Cycling events. These may be due a number of reasons including device failure, replacement, or removal by HVAC contractor upon unit maintenance. That translates into fewer-than-expected devices contributing load reduction during an AC Cycling event.

- **Increased cost in QA/QC.** The programs have a QA/QC process to randomly inspect load control devices to identify and replace failed units. This is costly—as it requires truck rolls to premises with functioning devices—and inefficient—as actually failed units may not be identified in a timely manner. Some programs have commenced to leverage smart meter data to identify failed devices by identifying customers that do not respond to multiple events. While more targeted, this may miss customers who do not experience one or more event (likely in a sub-Lap situation).

- **Allocation of program incentive payments to customers who do not contribute load reduction.** When a customer has a failed device but remains an active program participant, he or she receives incentive payments irrespective of whether the premise contributes load reduction during event days, unnecessarily increasing program costs (SCE and SDG&E only).

■ **Limited ability to become a supply side resource**. Demand response resources are increasingly able to provide load beyond their traditional role as emergency and wholesale price programs. Depending on their design, they can be more flexible and nimble programs, and can address supply side issues such as ancillary services, frequency regulations, and makeup of shortfall created by intermittency of renewable energy resources. Using demand response this way yields grid stabilization as well as monetary value for bidding into ancillary services in five-minute increments, grid frequency regulation (20-minute increments), and regulation of renewables power intermittency (as needed). As currently set up (technology and program design), the AC Cycling programs are not intended to evolve to also serve as supply side resources.

Opinion Dynamics recognizes that combined, the three AC Cycling programs have over half a million installed load control devices, therefore any upgrade and/or replacement option represents a significant capital investment. We present some alternatives for consideration so the programs can keep up with the evolution of demand response programs, so they choose to do so.

The traditional demand response model (for AC Cycling and other types of programs) is where IOUs provide a technology to customers in exchange control of the customer's AC unit (or other appliances).. Utilities may have to address whether providing a specific (or limited option set) of technologies is an optimal way to implement demand response programs. At program inception, the Internet and communication protocols were still evolving, and significant changes have occurred in the past few years, evidenced by the availability of various technology options, definition of open communication protocols, and customers' familiarity and interaction with technology. These factors are converging and the high-technology industry has been focused recently on establishing the "Internet of things"[6] (evolving to be named as the "web of things"[7]).

These are important considerations, as market forces will likely converge to potentially hinder customers' ability to participate in AC Cycling programs as currently designed, for the following reasons.

For thermostat devices:

■ Customers have a wide choice of programmable thermostat choices at affordable prices. Also, available AC units—especially efficient ones—are often installed with an associated and often free (or nominally free) thermostat. DR programs based on thermostat offerings essentially replace existing programmable thermostats that may have been selected by a customer with one selected by the IOU, which may not have the same features or may have less functionality than the previously installed thermostat.

■ Customers who upgrade/replace/repair their HVAC system may have the thermostat replaced by a technician during installation/service, essentially removing the customer from the

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[6] The **Internet of Things** (**IoT**) refers to uniquely identifiable objects and their virtual representations in an Internet-like structure. Radio-frequency identification (RFID) was seen as a prerequisite for the Internet of Things in the early days. If all objects and people in daily life were equipped with identifiers, they could be managed and inventoried by computers. Equipping all objects in the world with minuscule identifying devices or machine-readable identifiers could transform daily life. According to Gartner, there will be nearly 26 billion devices on the Internet of Things by 2020. According to ABI Research, more than 30 billion devices will be wirelessly connected to the Internet of Things (Internet of Everything) by 2020.

[7] The **Web of Things** is an evolution of the Internet of Things, in which everyday devices and objects are connected by fully integrating them to the Web. Examples of smart devices and objects are wireless sensor networks, ambient devices, household appliances, RFID or NFC tagged objects, etc. Unlike in the many systems that exist for the Internet of Things, the Web of Things is about reusing the Web standards to connect the quickly expanding eco-system of embedded devices built into everyday smart objects. Well-established standards and blueprints (such as URI, HTTP, REST, Atom, etc.) are used to access the functionality of the smart objects.

program. The programs have tried to get around this issue by attaching a sticker label on the AC unit (and sometimes thermostat) asking for a contractor/customer to contact them before disconnecting a unit, but that does not necessarily mean they do so.

■ Customers who invest in high-end thermostats may not want to lose the functionality by having it replaced with one picked by the utility program.

For load switch devices:

■ New "learning" thermostats use an AC system typical consumption pattern to self-program. If a customer experiences AC Cycling events during which their AC systems are cycled on and off, that will feed into the "learning" thermostat, throwing off desired thermostat set-point levels. This may potentially lead customers with learning thermostats to no longer want to participate in cycling types of programs

4.4.2. Processes for Monitoring Technology Failure Rates

Switches can "fail" for a number of reasons, such as a defect in the switch, or if the device was removed when an HVAC unit was upgraded or repaired. We established these failure rates by using the following:

1. Depth interviews with 12 utilities across the country that have AC Cycling types of programs (including with load switches or thermostats).[8] Appendix G shows detailed information about the participating utilities. Many program managers and technology vendors consider technology failure rates proprietary information, and as such, many refused to report on it.

2. Failure rates from recent load impact evaluations from data loggers installed on participating AC units to measure run time, and indicated whether a device was still installed or malfunctioning.[9]

3. Interviews with AC Cycling program managers and/or their implementers and aggregators.[10]

Nationwide, we found that load switch failure rates range from 6% to 15% annually. The three AC Cycling programs' expected failure rates fall within this band for load switches as follows:

■ PG&E SmartAC: load switch failure rate is self-reported at 6%. However, PG&E has developed a model based on the analysis of every participants' SmartMeter data since 2012 to identify potential device failures where PG&E randomly selected 200 participants for a validation test and inspected their devices. Those results were then compared against inspection on load switches of 200 control participants. The model successfully predicted non-functioning devices 80% of the time. Failure rates on control group inspections resulted in 12% observed failure rate. PG&E inspected 1,600 additional sites during 2014 to further validate the model and develop cost estimates for an extensive maintenance program it will propose in program years 2017-2019.

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[8] Entergy Summer Advantage program; Xcel Saver's Switch program; PEPCO Energy Wise Rewards program; Georgia ProvPower Power Credit program; MidAmerican Summer Saver program; Commonwealth Edison AC Cycling program; NIPSCO AC Cycling program; IPL ACLM program; Duke Energy EnergyWise program; PSEG Cool Customer; Reliant Energy program; BGE Smart Energy Rewards program.

[9] Freeman & Sullivan, 2012 Load Impact Evaluation for Pacific Gas and Electric Company's SmartAC Program, April 2013; Opinion Dynamics, IPL EM&V Report PY2011; Opinion Dynamics, NIPSCO EM&V Report PY2012; interview with Program Managers, Interviews with Comverge.

[10] PG&E SmartAC program; SDG&E Summer Saver program; SCE Summer Discount Plan program; IPL ACLM program; NIPSCO AC Cycling program; Comverge, Cooper Power Systems, Mad Dash.

Failure rates for the programmable thermostats ranged from 35% to 50% primarily however due to corrupt paging signals or difficulties in the paging signals penetrating exterior walls to reach the thermostats, rather than technically failed devices. This was the primary reason the PG&E program discontinued offering programmable thermostats.

- SCE SDP: Failure rate is about 15%, calculated based on metering of a sample of participant homes for the impact report.

- SDG&E Summer Saver: program staff estimate a failure rate of 7%, but until recently the program aggregator randomly inspected 20% of installed load switches to identify and replace failed devices. SDG&E has commenced leveraging smart meter data to pinpoint participants who consistently do not respond to events, thus identifying their switch as having potentially failed. They outsource this task to a data analytics firm. It also randomly inspects up to 20% of its devices annually to identify and replace failed load switches.

4.4.3. Targeting Optimal Participants

We conducted a benchmarking study with 12 utilities to understand the range of marketing costs for AC Cycling programs that have been in place for at least five years, and for the most part reached the participant/capacity targets.

In general, a specific metric (such as marketing costs per enrolled customer) is not readily available or shared by utilities. Various program managers shared this data provided that their specific program not be identified; therefore, we present averages of costs data provided. Marketing costs were highly dependent on the maturity level of a program and related marketing efforts. Table 5 below shows typical marketing strategies depending on the program maturity level.

Table 5. Marketing Strategies Given Program Maturity Level

Marketing	New Programs (Implemented within the Last Five Years)	Mature Programs (In Place for Five Years or Longer)
Goal	■ Participation/capacity growth	■ Participation/capacity maintenance
Approach	■ Active solicitation and marketing	■ Marketing to replace premises that leave program through attrition
Strategies	■ Primarily direct mailers, supported by bill insert ■ Focus groups to test effectiveness of market messages ■ Outbound calling following direct mailer campaigns	■ Primarily bill inserts ■ Primarily leverages already designed / market-tested messages and collateral materials

The table below shows average marketing costs per enrolled customers only.

Table 6. Average Marketing Costs per Enrolled Customer

Medium	Average Cost per Lead/Order
Benchmarked Utilities	
Direct Mail	$51.40
Email	$55.24
Postcard	$54.10
Telemarketing - House List	$78.00
Telemarketing - Prospect List	$190.00
Paid Search/Pay-Per-Click (Internet Advertising)	$52.58
Print Advertising	$60.50
Television (Cost per thousands of homes, does not include production costs)	$24.76

Medium	Average Cost per Lead/Order
Program Data	
■ SDG&E	■ $35 per enrolled customer for telemarketing efforts ■ $69 per enrolled customer for direct mail campaigns
■ PG&E	■ $68 per enrolled customer for direct mail efforts
■ SCE	Data not provided

4.4.4. Notification Strategies

The "set it and forget it" program design essentially means that once customers enroll they no longer need to actively engage with the program. For the most part, participants do not receive notification of events (SCE and SDG&E offer limited opt-in notification as of 2013), and participants cannot override events (except for PG&E participants and a small percentage of those enrolled in SCE's program).

This approach seemed appropriate at program inception, when events occurred only to address system emergencies. Over time, the programs have evolved to include economic dispatch and to address sub-Lap constraints, resulting a higher frequency of events. Program staff expressed concern that if customers receive now-frequent notification of events, they are more likely to want to override the event or leave the program, leaving behind stranded assets.

However, this is counterbalanced by the fact that sub-Lap events target a subset (often relatively small) of participants. That is, some participants at PG&E SmartAC participants were not exposed to any 2013 events besides system testing. SCE SDP participants, on average, experienced half of the 2013 events. When asked whether they were aware of any ongoing events, participants where either unaware, assumed an event occurred simply because it was a hot day, felt discomfort, or noticed a change in their AC unit (e.g., noise reduction, stops blowing).

Given the lack of widespread notification and the variable times and circumstances when events occur, awareness of ongoing events is low. Dually enrolled customers in PG&E's SmartAC program tend to describe SmartRate program event durations and start and end times as being similar to those of the PG&E SmartAC program, because they do receive notification for SmartAC but do for SmartRate. Interestingly, however, we found that participants who are dually enrolled in programs that provide notification of events (and have a price signal in the form of TOU rates or bill credits for demand reduction) report higher levels of satisfaction with the AC Cycling program. They also tend to be more likely to engage in energy-saving behaviors during events (when they report being aware of an ongoing event) beyond simply letting their AC unit cycle.

This may be an indication that the programs may be missing an opportunity to contribute more load to the grid simply by notifying customers of events. However, there is the trade-off that participants who are more aware of the frequency of events may be more likely to leave the program altogether (evidenced by the fact that lapsed customers tended to report higher awareness levels of program events rather than active participants).

4.4.5. Multiple Duty Cycle Options

The SCE SDP and the SDG&E Summer Saver programs offer multiple duty cycle options as well as the ability to change their selection at any time. Awareness of multiple options is low, and that once signed up, only a small minority of participants ever change their selection.

■ SCE SDP: only half of residential (50%) and nonresidential (48%) participants are aware the program offers multiple duty cycle options. Opinion Dynamics found that participant awareness of

multiple duty cycle options is low. Few (7% and 4% of residential and nonresidential participants, respectively) have selected alternate options.

■ SDG&E Summer Saver, awareness is even lower where 30% of residential and only 11% of nonresidential participants are aware the program offers multiple duty cycle options. Notably, more residential 100% duty cycle participants are aware of options and are more likely to state that duty cycle options were clearly explained upon enrollment (63% compared to 45%). This suggests that some 50% duty cycle participants may have chosen the lower-risk option. However, a different picture emerges in the nonresidential sector, where significantly more 30% duty cycle participants said that options were clearly explained. They may have chosen the 30% duty cycle to minimize the impact on their business.

■ PG&E SmartAC offers one duty cycle option. This potentially reduces how much load shed these participants can contribute to the system (if they would be satisfied with a higher duty cycle level), or increasing their likelihood of leaving the program (if they would feel too much discomfort compared to a lower duty cycle option).

Participants' selection of a duty cycle option has a direct effect on expected load drop from that customer. Thus, ideally, customers who are interested and able to provide maximum load should enroll in the highest duty cycle option.

In the next chapters, we present specific findings from the AC Cycling programs.

5.   PG&E SmartAC Program Process Evaluation

This chapter provides the detailed process evaluation findings and recommendations for the Pacific Gas and Electric (PG&E) Residential SmartAC program. In this chapter, we address the following research objectives:

- Document program description and processes
- Describe PY2013 AC Cycling events
- Report on overall program satisfaction
- Discuss awareness of the program and events, including notification of program events and participant communications
- Describe participant reactions to events and engagement with the program, including action during events and snapback effects
- Assess reasons for why customers left the program
- Recommend program improvements

Note that this chapter provides details of all PG&E-specific findings. The highlights of this chapter are also included in the integrated section of the report in Chapter 4.

5.1   Program Description

The SmartAC program is a voluntary DR program where PG&E installs a device at a participant's premise that can temporarily disengage the participant's AC unit or raise the temperature at the thermostat when PG&E remotely activates the device. The program provides a service option for individually metered residential customers with single-stage central electric AC units that generally operate during PG&E's summer peak periods.

PG&E activates load control devices to reduce its system peak demand during emergency or near-emergency situations, or during limited program testing. This program acts as a demand side resource to PG&E, to help maintain service reliability for all electric customers, defer construction of additional generation facilities, and reduce environmental pollutants.

The SmartAC program had an initial target load shed capacity of 305 MW, as mandated by the Public Utilities Commission (PUC), based on expected impact values per participating premise in 2006. This equated to installing approximately 432,000 load control devices within residential and small nonresidential participant premises in the PG&E service territory by December 31, 2011. In 2011, PG&E applied to maintain the resource (backfill for attrition only) for funding years 2012-14 in the midst of the SmartMeter roll-out, two-way technology communication platform unrest, and in light of concerns in the erosion of paging coverage. The level achieved as of December 31, 2011, which was identified as the maintenance level, was 97 MW and was based on CPUC protocols (ex ante 1-in-2 weather years).

As of November 2013, the program had 181,976 active load control devices (approximately 147,000 load switches and 24,000 programmable communicating thermostats (PCTs). The program has installed over 270,000 devices since inception. The difference between total installed devices and the active devices represents the impact of attrition due to customers who have moved from their properties, turned to the medical baseline rate or have asked to leave the program; approximately 15,000 to 20,000 customers annually, on average. Program efforts focus on maintaining the overall value of the resource of 97 MW.

Further, based on the PY2013 impact evaluation, on average the program provided ex-post impact values in aggregate of 96.8 MW.[11]

The SmartAC program historically has been available to both residential and small commercial customers. Nonresidential installations represent only 6% of all installed devices. In 2011, the CPUC denied PG&E's application to continue marketing the nonresidential segment of the SmartAC program. Table 7 shows an overview of the active participant population by customer segment and climate zone within the PG&E service territory as of December 2013.

Table 7. Overview of Customer Participation by Customer Segment and Climate Zone

Program Segment	Climate Zone	Total Unique Customers	Count of Unique Devices		
			Load Switches	PCTs	Total Devices
Residential SmartAC-Only	Coastal	803	802	64	866
	Midrange	48,923	48,844	6,068	54,912
	Inland	65,025	59,386	11,985	71,371
Residential Dually Enrolled	Coastal	289	296	14	310
	Midrange	18,628	18,705	2,151	20,856
	Inland	20,730	18,911	3,921	22,832
Subtotal Residential		*154,398*	*146,944*	*24,203*	*171,147*
Nonresidential	Coastal	428	46	750	796
	Midrange	2,706	373	4,242	4,615
	Inland	2,628	582	4,836	5,418
Subtotal Nonresidential		*5,762*	*1,001*	*9,828*	*10,829*
Total Participants		160,160	147,945	34,031	181,976

About 24% of SmartAC program participants are dually enrolled in the PG&E SmartRate program. This tariff-based program is PG&E's voluntary critical peak pricing program, in which participating customers receive a discount on their electricity rate between June and September. In exchange, for up to 15 SmartDays called between May and October, participants face a surcharge on the electricity rate between 2 p.m. and 7 p.m., enticing them to reduce electricity consumption and thus, drop load during critical peak times. AC Cycling events generally also occur on SmartDays, as those are the days the electric grid typically experiences high demand. However, AC Cycling events start and end times vary significantly, and do not necessarily overlap with SmartDays periods. In PY2013, SmartDays were more prevalent than AC Cycling event days.

5.2   Program Design Features

Table 8 highlights the program design as of PY2013 for the PG&E SmartAC program.

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[11] Nexant, 2013 Load Impact Evaluation for Pacific Gas and Electric Company's SmartAC Program, April 1, 2014

Table 8. PG&E SmartAC Program Design Characteristics

Category	Description
Program inception year	2006
Program period	May 1 through October 31
Technologies offered	The program has offered three types of one-way communicating devices: ■ Programmable communicating thermostats ■ Adaptive load switches
Event period	■ Varies and can initiate at any time of the day ■ Average start times for the 2013 events varied significantly, with one day-long test event (rotating for 1.5 hours among participating customers), three evening events (close to or after 6 p.m.), and one event in the middle of the afternoon
Event duration	■ 2 to 6 hours (maximum permissible by the tariff is 6 hours per customer per day) ■ Duration for the 2013 events ranged between 1.5 and 4 hours
Event limitations	Events can be called for a maximum of 6 hours with an annual limit of 100 hours
Exclusions	None
Duty cycle options for load switches	Adaptive switch and UtilityPro PCTs with Cooper Power proprietary TRUE CYCLE 2 defaulted at 50% for residential participants and 33% for nonresidential participants
Duty cycle changes	No alternative duty cycle options are provided
Thermostat strategies	None currently used. Experiments in 2009 and 2010 showed less reliable load and customer comfort with temperature ramping
Incentive payments	A one-time payment based on type of load control device installed ■ $50 one for successful installation of a new/reactivation of an existing load control switch ■ $25 for successful installation of a new/reactivation of a PCT (new installations are no longer offered) In addition, dually enrolled participants also receive a discount of $0.03 per consumed kWh through the SmartRate program between May 1 and October 31 at times outside of SmartRate events[12]
Emergency triggers	■ A CAISO Stage 1 condition, during emergency and near-emergency situations ■ Localized system load conditions, or transmission and distribution load conditions ■ PG&E's discretion, provided it adheres to program rules (duration, maximum number of hours in a season, etc.) ■ Dually enrolled participants (with the SmartRate program) can ask for their load control device to be activated during a SmartDay (when it is not coincident with an AC Cycling event day) ■ Program testing
Economic dispatch	■ High day-ahead energy prices of $1,000/MWh or more for the PG&E Default Load Aggregation Point

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[12] They only get the discount when no SmartRate event is called. When a SmartRate event is called, they face a $0.60 surcharge between 2 p.m. and 7 p.m. Source: http://www.pge.com/en/myhome/saveenergymoney/plans/smartrate/index/page.

Category	Description
Events notification	■ Not provided ■ Dually enrolled participants (in the SmartRate program) are notified of SmartDays one day prior to the event, with up to four notifications by phone, text, and/or email per household
Events overrides	■ Allowed at any time without penalty ■ Participants notify the utility online through their account ahead of event, or call a PG&E SmartAC program representative through the toll-free number ■ Opt-outs become active within 5-30 minutes ■ Opt-out procedures are explained in the marketing materials.
Opt-out of program	Yes, at any time
Enrollment options/ customer support	■ 1-866-908-4916 ■ www.pge.com/EasySmartAC ■ Reply postcard ■ Authorized HVAC affiliates
Program implementers	■ GoodCents – device installation, device maintenance, program call center work order management system

5.3   Program Design Changes

Table 9 summarizes major program changes over time.

Table 9. PG&E SmartAC Program Design Changes

Category	Description	Timing
Technology Options	Programmable thermostats offered as a technology option. Discontinued, given that failure rates were higher and observed load impacts were lower than load switches (already installed thermostats for active participants remain in the program).	2009 through 2011
Target Segments	Program originally designed to target both residential and nonresidential customers. As of 2012, program order to cease recruitment of nonresidential customers (already enrolled customers remain in the program).	2012
Event Triggers	Program added locational market economic dispatches for calling events.	2012

Given that this evaluation focuses on the PY2013, the program discontinued actively enrolling nonresidential customers in 2012, and 2013 AC Cycling events targeted only residential participants, the evaluation for the PG&E SmartAC program focuses on residential participants only.

5.4   PY2013 SmartAC Events

This section describes the program events in 2013.

5.4.1.   Event Characteristics

The SmartAC program called five AC Cycling events during PY2013. There were two test events. The remaining three were sub-Lap events targeted to a smaller group of participants (substation). All events typically occurred along system peak times.

■ Two test events occurred on July 1 and September 9 for system testing. During the July 1 event, beginning at 10:00 a.m. the program cycled through 10 equally sized groups of participants, with each group experiencing a 1.5-hour event. Given the randomized start, some devices triggered sooner than others—even within the same group—as it takes about 30 minutes for all devices within the same group to be cycled. During this event, a small percentage of participants (2%, or about 3,200) experienced extended AC Cycling for 24 hours due to programming errors in their devices. The technology vendor, Cooper Power Systems, has since fixed these issues, and according to the vendor, they are not likely to reoccur. The September 9 event was also system wide but targeted about 10% of overall enrolled participants.

■ The other three sub-Lap events reached 5,000 to 35,000 participants depending on event day. Even though these were sub-Lap events, they occurred on high-temperature days, which typically trigger peak consumption levels in the grid.

Table 10 shows the event days, outside temperature, start/end times, duration, and primary trigger for the SmartAC program AC Cycling events and whether they overlapped with SmartRate Days events.

Table 10. PG&E SmartAC Program Demand Response Events

Event Day Statistics	6/7/2013	7/1/2013	7/2/2013	7/3/2013	9/9/2013
Overlap with Smart Rate Events	Yes	Yes	Yes	No	Yes
Type of Event	Sub-Lap	M&E – All	Sub-Lap	Sub-Lap	M&E – 5
Trigger	Emergency	Temperature	Emergency	Emergency	Temperature
5 Station Average Temperature	100	103.6	103.4	104	99
Hours	7 p.m.-10 p.m.	9:30 a.m.- 8 p.m.	6:50 p.m.-10:50 p.m.	5:45 p.m.-9:45 p.m.	1:30 p.m.-3 p.m.
# of Hours	3 hours	1.5 hours per customer rotation	4 hours	4 hours	1.5 hours
# of Devices Activated SMB	0	0	471	342	0
# of Devices Activated RES	~35,000	168,758	8,910	5,374	16,726
Location of Constraint	Livermore		Panama	Middletown, Fulton, Calistoga substations	
Sub-Lap Called (if applicable)	East Bay		Los Padres	NorthCoast and Geysers	
Reason Stated	Substation constraint. Avoid dropping firm load - ES&S called	Systemwide testing	70KV line in the Kern Area (potential transmission overload)	Outages due to capacity issues	

5.4.2. System Peaks versus Event Timing

Figure 1 shows that SmartAC events are generally aligned with system peak days. The program called events in the three highest peak periods during the summer month in early July. The June and September events were the 15th and 16th highest peak days of the summer period, respectively.

Figure 1. DR Events Timing Compared with System Peak
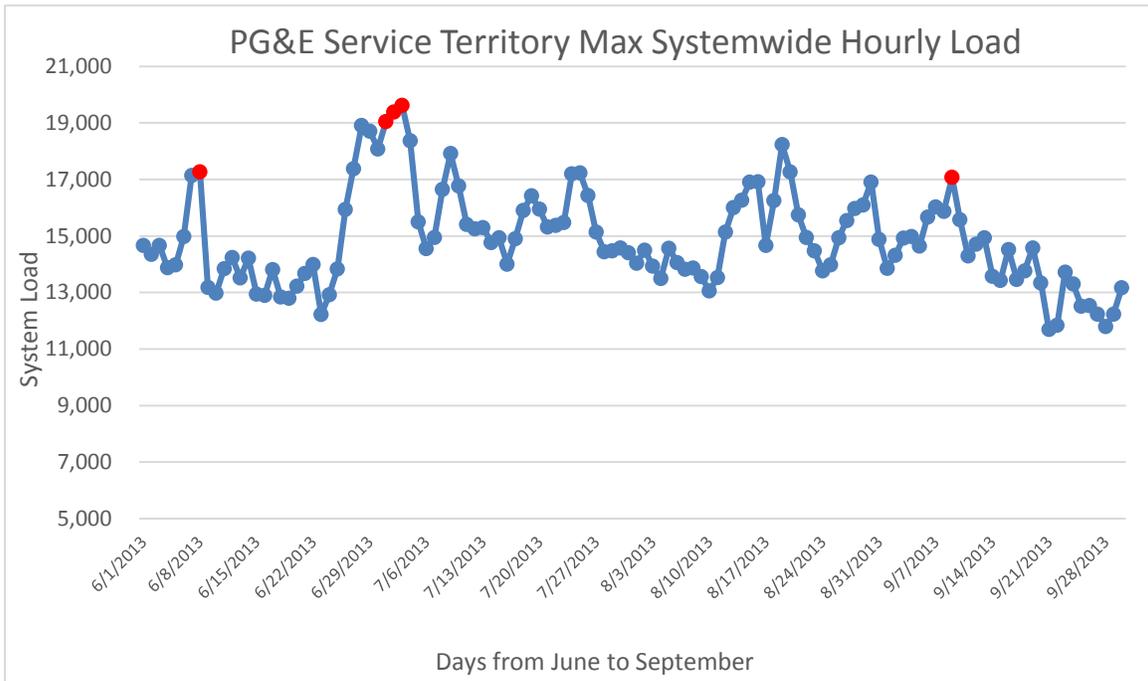
The table below lists the system wide peak times, and their load ranking for the summer period.

Table 11. Comparison of PG&E 2013 System Peaks vs. DR Events Times/Duration

Event Day	Event time	Hour of Day Peak	Ranking of System Peak for the Period	Systemwide vs. Sub-Lap Event
6/7/2013	7 p.m. to 10 p.m.	6 p.m.	15	Sub-Lap
7/1/2013	9.30 a.m. to 8 p.m.	4 p.m.	3	Test event, system wide
7/2/2013	6:50 p.m. to 10:50 p.m.	4 p.m.	2	Sub-Lap
7/3/2013	5:45 p.m. to 9:45 p.m.	5 p.m.	1	Sub-Lap
9/9/2013	1:30 p.m. to 3 p.m.	5 p.m.	16	Test event, system wide

Figure 2 shows a mapping of event durations against the system peak.

Figure 2. System Peak vs. Event Period
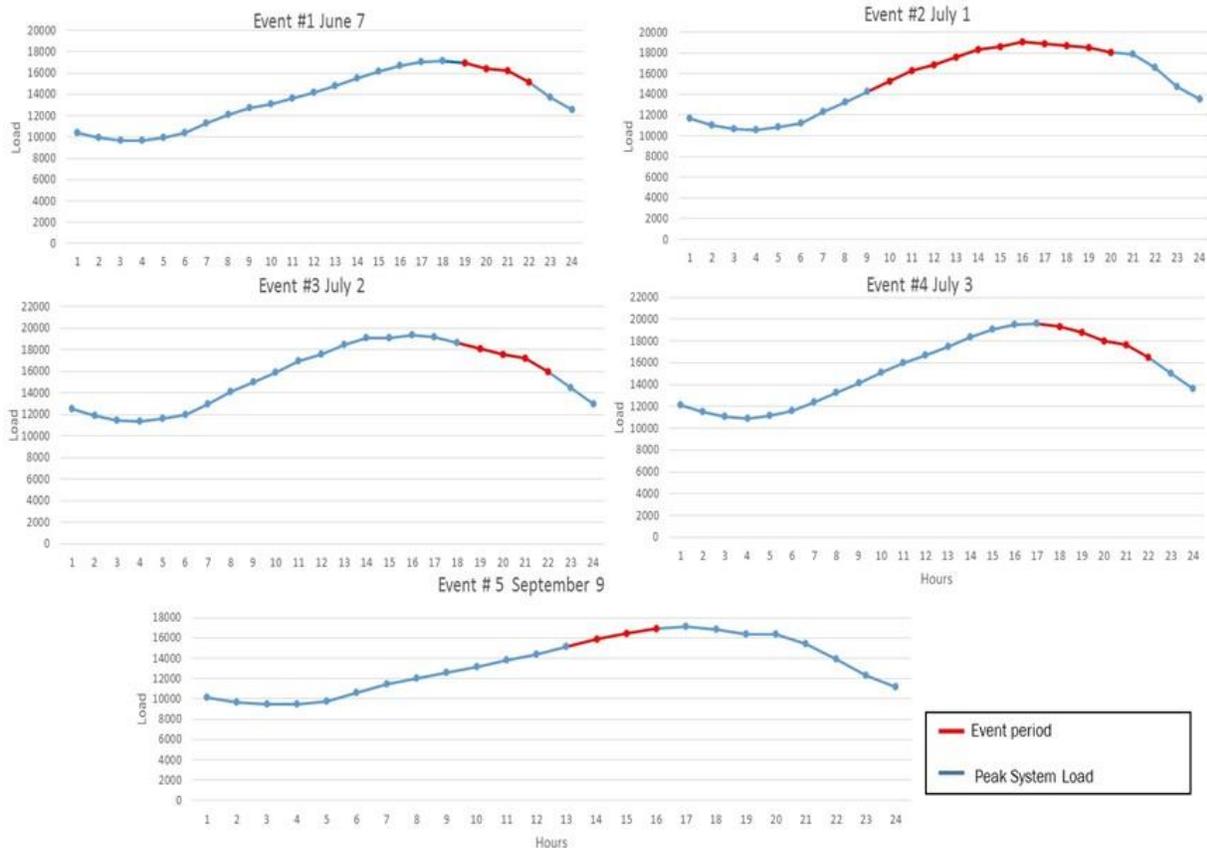
5.5 Program Technologies and Failure Rates

While the program currently services both load switches and programmable thermostats, it offers only one technology option at a time.

Adaptive Load Control Switch

PG&E direct load control switches are all capable of intelligent adaptive control. These devices are installed outdoors, adjacent to the customer's AC unit, which can be on the roof or on the ground. PG&E logs into the head-end control software to schedule event days and choose which load control groups will be called and when. The head-end software sends messages to the two commercial paging servers and the load control switches determine if the message includes instructions for them.

These devices are flash upgradeable. Initially in 2007, the default from the factory was for simple cycle. In 2008, the manufacturer flashed over the air a control strategy of TrueCycle 1. This was a primitive version of adaptive control where the program administrator had to choose "learning days" for the devices to memorize that premises' behavior. In 2011, the manufacturer introduced TrueCycle 2, which was flashed over the air to all devices. This eliminated the need to manually instruct devices to learn hot day behavior.

Adaptive technologies learn how customers' ACs actually operate over time, and then optimize load impacts during events. Adaptive technologies are designed to reduce AC duty cycle by a percentage of

what the duty cycle would have been in the absence of the control event. The adaptive switches address the traditional switch limitation by "learning" the run-time behavior of the unit. The observed duty cycle on these learning days provides an estimate of the expected duty cycle on an event day. The chosen level of control is then applied to the expected duty cycle. The manufacturer of the switch used for the SmartAC program indicates that they generally use a weight of one-eighth for a single learning day. In this scenario, if fewer than eight learning days have been identified, the remaining days included in the mean calculation are assumed to be at the default of 100% duty cycle. Using this approach, a rolling estimate of expected duty cycle for each hour exists for each AC unit.

The actual effectiveness of the adaptive technology in estimating expected duty cycle is difficult to determine. The number and choice of learning days drive the estimate, along with the same-day adjustment. Extreme conditions occur infrequently, so the data on AC unit usage under extreme conditions is sparse. To the extent that mild days are included in the calculation, the adaptive algorithm reflects the "shape" of hourly duty cycles on those mild days. The same-day adjustment may or may not correct for the difference in duty cycle magnitude between mild and extreme days. Any difference in the "shape" of mild and extreme day duty cycles through the afternoon are not adjusted. In the interest of maintaining participant satisfaction, the adaptive switches revert to the default non-adaptive switch mode if the algorithm gives unexpected results.

Programmable Communicating Thermostats (offered from 2007 through 2011)

The program discontinued offering thermostats after load impact evaluation reports showed that the connectivity with the programmable thermostat was limited when compared to the load switch, resulting in lower program cost effectiveness.[13]

Up until 2009, PG&E installed the Honeywell ExpressStat thermostat which was capable of temperature ramping. These devices are capable of controlling household temperature or simple cycling. In 2009, PG&E began installing a more intelligent PCT, the Honeywell UtilityPro, which is capable of temperature ramping, simple cycling or adaptive cycling. For temperature ramping, when activated to event mode, the controllable thermostats increase the cooling set point. The unit may turn off if already in cooling mode. If the unit is already off, it may remain off for a longer period to allow the home to reach the new, higher indoor temperature. Using the thermostat set point as the focus of control puts the premium on controlling the increase in participant indoor temperatures.

The direct control of the thermostat set point has an indirect effect on AC energy usage. How an AC unit responds to the set point increase will be a function of the pre-event cooling regimen, the cycling schedule of the AC unit, house-specific characteristics affecting the rate of indoor heat gain, and the amount of set point increase. The most common scenario involves the AC unit turning off (or staying off) until the indoor temperature reaches the level of the higher set point. For this period, while the house warms to the new set point, program-related savings are 100% of the pre-program usage. Once the new equilibrium is reached, the AC unit returns to the cycling behavior necessary to maintain cooling at this higher set point. As AC usage is fundamentally a function of indoor temperature, usage at the new set point is reduced relative to pre-event usage levels. Thus, for any set point increase, after relatively higher levels of impact during the re-adjustment period, impacts will settle down to a constant, but lower, level of impact reflecting the new (higher) indoor temperature that the thermostat is seeking to maintain.

At program inception, the most common thermostat control strategy was a single set point increase was what was referred to as a "2-1-1" – two degrees Fahrenheit increase in the first hour and a half,

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[13] Freeman & Sullivan, 2012 Load Impact Evaluation for Pacific Gas and Electric Company's SmartAC Program.

one degree in the next and another degree in the next. This strategy was determined by the manufacturer to most closely mimic a 50% cycling strategy.

5.6 Program Implementation

PG&E manages the marketing efforts, initiates the control events, and manages the overall program. GoodCents, the program implementer, handles the dedicated program hotline, enrolls customers, schedules installation appointments, and installs the control devices.

Table 12: Program Implementation

Goodcents Responsibilities	PG&E Responsibilities
■ Schedule the installation of control devices, when a customer requires ■ Perform device testing prior to installation ■ Install the device at the participant's premise ■ Conduct service calls to participant premises upon request ■ Upon request by PG&E, will conduct special inspections of devices to assess functionality and download internal logs. ■ Manage the Call Center operations ■ Integrate with PG&E's demand response management system (DRMS)	■ Program design planning ■ Technology selection ■ Program marketing ■ Implementer management ■ Measurement and verification ■ Regulatory compliance ■ Customer liaison

As of 2014, some program implementation tasks will shift to PG&E when the Demand Response Management Systems (DRMS) software is deployed. The software, which is offered by a number of vendors, has the ability to manage some enrollment and installation data.

5.6.1 Participant Acquisition and Enrollment

Due to the maintenance mode of the program, the primary marketing goal is to replace the approximately 12,000 to 15,000 customers who leave the program annually through attrition. PG&E is primarily responsible for marketing activities, although it draws support from affiliate vendors as needed.

Primary marketing efforts generally deployed during the spring and summer months include:
- Marketing campaigns are focused in spring/summer
- Direct mail (acquisition letter with basic information about the program)
- Telemarketing efforts
- Affiliates (PG&E vendors who leverage various PG&E programs)
- Radio advertising
- Digital media advertising

While both single- and multifamily homes can participate, marketing efforts have focused on single-family housing due to higher load shed opportunities and lower turn-over rates.

Customers enroll in the program by:
1. Returning a business reply card included in an acquisition letter
2. Enrolling online:
   http://www.pge.com/en/myhome/saveenergymoney/plans/smartac/index.page

3. Calling the SmartAC program toll-free line: 1-866-908-4916[14]
4. Through an authorized affiliate – HVAC contractors

Upon enrollment, Goodcents receives customer data and then generates a work order, executes the scheduling and installation processes with a target of completion for device installation within 30 days.

5.7 Engagement with the Program

This section describes participant engagement with various elements of the program, their awareness of program details, and their behavior during and after AC Cycling events.

Opinion Dynamics fielded a survey with active SmartAC program participants in February 2014 to examine participant experience with program processes, their general awareness of AC Cycling events, and their behavior during and after events. Given that this study started in late 2013, Opinion Dynamics fielded the survey several months after participants experienced their last SmartAC event on September 2013. While the survey instrument was specific about event times, some recollection bias may exist simply based on the delay between the participants' experience with the SmartAC program and when they were asked about it.

We completed 328 interviews with residential participants who have at least one active load control device, including 190 interviews with SmartAC-only and 138 interviews with dually enrolled participants. Sample sizes were established to yield a 90% confidence with a ±10% precision in survey results for PG&E SmartAC participants at the program level. The sample proportionally represents both the number of SmartAC Only participants and those dually enrolled in the SmartRate program and ensures adequate representation by the control technology option (programmable thermostat or load switch - at the behest of PG&E, we treated direct load control and adaptive load control customers in one cohort.), climate zone (coastal, midrange, and inland). Appendix A provides a detailed sampling plan.

Table 13 shows the completed surveys for active participants based on technology type, program design option, and climate zone.

Table 13. PG&E SmartAC Program Participant Survey Completes

Program Technology/ Choice	Coastal	Midrange	Inland	Total	% of Total
Load Switches - SmartAC-Only	17	65	65	**147**	45%
Load Switches - Dually Enrolled	10	46	46	**102**	31%
Thermostat – SmartAC-Only	3	20	20	**43**	13%
Thermostat - Dually Enrolled	3	18	15	**36**	11%
TOTAL	**33**	**149**	**146**	**328**	100%
% of Total	10%	45%	45%	100%	

5.7.1 Participant Satisfaction

Participants rate their satisfaction with the program overall 8.0 on a 0 to 10 scale. Participants are most satisfied with components such as their control technology (7.9), followed by the number of events (7.7) and their incentive levels (7.6). Generally, participants rate the expected length of 3 to 4

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[14] http://www.pge.com/en/myhome/saveenergymoney/plans/smartac/index.page.

hours per event the lowest (7.2), However shorter event times are only recommended by 4% of the participants. Some highlights include:

- Compared to SmartAC-only, dually enrolled participants give higher satisfaction scores for all program features.

- PCT participants express higher satisfaction than load switch participants in the two categories that distinguish the segments.

  - PCT participant satisfaction with their control device averages 8.5, compared to 7.8 for load switch participants.

  - PCT participants reported higher satisfaction with their one-time incentive payment (even though they did not receive a monetary incentive, but rather simply the technology free of charge) of 8.1 than load switch participants, who received between $25 to $50 (depending on year of enrollment) and gave a score of 7.6.

Table 14. Participant Satisfaction across SmartAC-Only and Dually Enrolled Participants

Program Components	All Mean	SmartAC-Only (n=190)					Dually Enrolled (n=138)				
		0-3 Score	4-6 Score	7-10 Score	Don't Know	Mean	0-3 Score	4-6 Score	7-10 Score	Don't Know	Mean
Program overall	8.0	4%	18%	73%	5%	7.9	1%	11%	85%	4%	8.5*
Control technology	7.9	5%	16%	65%	14%	7.8	2%	11%	74%	13%	8.3*
Number of events	7.7	4%	20%	53%	23%	7.4	2%	10%	81%	7%	8.5*
Incentive levels	7.6	5%	20%	70%	11%	7.4	4%	14%	79%	2%	8.2*
PG&E	7.5	7%	29%	52%	3%	7.3	3%	17%	79%	3%	8.1*
Expected length of 3-4 hours	7.2	7%	23%	62%	12%	6.9	2%	9%	85%	2%	8.0*

Note: (*) The difference is statistically significant at the 90% confidence level.

When asked about drivers of their satisfaction score, one-quarter noted that the program and its technology work (23%). SmartAC-only noted that the program did not adversely affect them, whereas dually enrolled participants reported that the program was a good idea.

Where participants gave low overall program ratings (scores of 0-3), they reported dissatisfaction with the program and referred to problems with program technology or processes (e.g., "equipment is inferior," "it doesn't work when needed," "I don't feel it is working"). Another three noted a lack of communication and understanding of the program (i.e., "it's confusing," "because I never hear from you," "because nobody has explained it").

Table 15. Drivers of Program Satisfaction Scores (multiple responses)

Drivers of Satisfaction Score	SmartAC-Only (n=190)	Dually Enrolled (n=138)	Weighted Total (n=328)
POSITIVE REASONS			
Program/technology works/no complaints	22%	26%	23%
Wasn't much affected/inconvenienced	13%*	5%	11%
I like the program/it's a good idea	9%	16%*	11%
Environmental benefits	10%	8%	9%
Low effort/it's easy	4%	7%	5%
SDG&E managed expectations well	3%	7%	4%

Drivers of Satisfaction Score	SmartAC-Only (n=190)	Dually Enrolled (n=138)	Weighted Total (n=328)
Monetary savings/noticed reductions in energy bill	1%	6%*	2%
NEUTRAL REASONS			
No strong feeling either way	5%	9%	6%
Don't know much about it	10%*	3%	8%
Rates should be more affordable	2%	2%	2%
NEGATIVE REASONS			
Not satisfied with program	4%	7%	5%
Poor communication/information	2%	3%	2%
Events are too long	1%	2%	1%
OTHER/DON'T KNOW			
Other	2%	3%	2%
Don't know/refused	21%	17%	20%

Note: The difference is statistically significant at the 90% confidence level.

The majority (77%) reported that they are somewhat or very likely to recommend the program to others (Table 16). There are differences by dually enrolled or SmartAC-only participants:

■ The number who are "very likely" to recommend the program is higher among dually enrolled participants at 49%, in comparison to 38% among SmartAC-only participants.

■ Only a small percentage of the dually enrolled participants (8%) report being very unlikely to recommend the program to others. SmartAC-only participants are much more likely to say this than dually enrolled participants.

■ When asked to explain their rating, almost one-third (27%) of SmartAC-only participants indicated that a lack of knowledge is why they would not recommend the program.

Table 16. Likelihood of Recommending the SmartAC Program

Would you recommend the program to others?	SmartAC-Only (n=190)	Dually Enrolled (n=138)	Weighted Total (n=328)
Very likely	38%	49%*	41%
Somewhat likely	36%	36%	36%
Neither likely nor unlikely	9%	6%	8%
Somewhat unlikely	5%	5%	5%
Very unlikely	10%*	2%	8%
Don't know	2%	1%	2%

Notes: (*) The difference is statistically significant at the 90% confidence level.

5.7.2. Program Awareness

The participant survey revealed that about three-quarters (73%) of program participants first heard about the SmartAC program through direct mail. The top three ways of learning about the program are direct mail, bill inserts, and telemarketing efforts. There were not significant differences between how SmartAC-only and dually enrolled participants heard of the program, although a larger number of SmartAC-only participants could not recall how they first learned about the program. Three times as

many SmartAC-only participants (15%) do not remember how they first learned about the program, as opposed to 5% of dually enrolled participants.

Table 17. How Participants First Heard about the SmartAC Program (multiple responses)

Outreach Method	Weighted Percent (n=328)
MAIL	**73%**
Direct mail	44%
Bill insert	25%
Postcard	4%
Brochure/flyer	2%
Program letter sent to me upon moving into the house	1%
Email	1%
PHONE	**12%**
Utility called me/soliciting	11%
Called utility directly	1%
OTHER	**5%**
Installer/contractor/"when they hooked up AC"	2%
PG&E/utility (general/other/unspecified)	2%
From a friend/word-of-mouth	1%
Professional experience/contact	1%
PG&E's website	1%
Don't know	**12%**

5.7.3   Motivation to Enroll in the Program

More than one-third (38%) of active program participants indicated expected bill reductions as their key motivation to participate in the SmartAC program. Although bill savings were significantly more important for dually enrolled participants (51%), it was still named by one-third (33%) of SmartAC-only participants, who only received a one-time incentive payment upon enrollment. Almost one-third (29%) of all participants indicated emission reductions and environmental benefits as motivation to participate in the program, and 10% stated they participated to prevent system outages.

Table 18. Motivation to Participate in the SmartAC Program (multiple responses)

Driver for Participation	Weighted Percent (n=328)
Expected reduction in energy bill	38%
Save the environment/reduce emissions/be a good citizen	29%
Incentive payment	14%
Prevent blackouts	10%
Save energy	7%
Liked the idea/seemed like a good program	7%
It was offered/recommended	3%
Getting a new thermostat	2%
Not using AC much anyway/not an inconvenience	2%
Required/no choice	1%
Don't know	6%

5.7.4   Awareness of Program Design Features

This section highlights participants' reported awareness of various program design features.

Knowledge of the Maximum Number of Event Days

SmartAC program participants' overall knowledge about the maximum number of possible event days is relatively low, with only 16% of participants reporting that they know the number of possible events per season. As shown in Figure 3, dually enrolled participants (25%) exhibit a higher awareness compared to SmartAC-only participants (13%).

Figure 3. Awareness of the Maximum Number of AC Cycling Events per Season
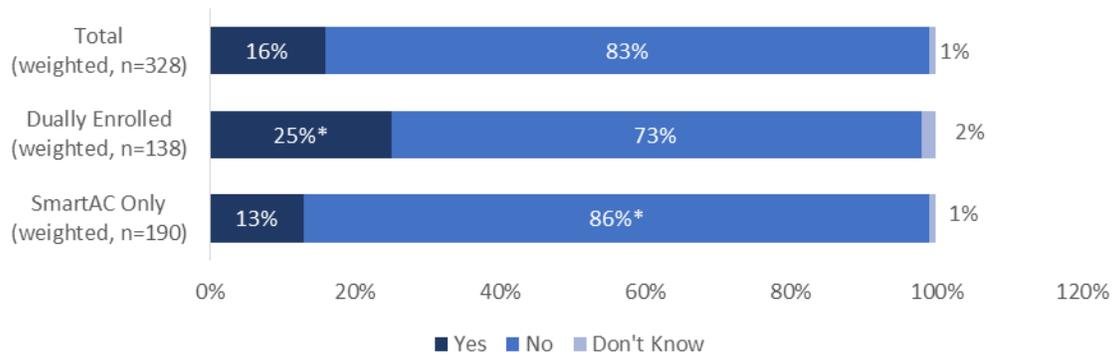
Note: (*) The difference is statistically significant at the 90% confidence level.

Among SmartAC-only participants, it appears that inland residents are more knowledgeable about the maximum possible event days. However, the group of coastal SmartAC-only respondents is small (n=20), and findings should therefore be interpreted with caution.

Figure 4. Awareness of Maximum Possible Number of Events among SmartAC-Only Participants
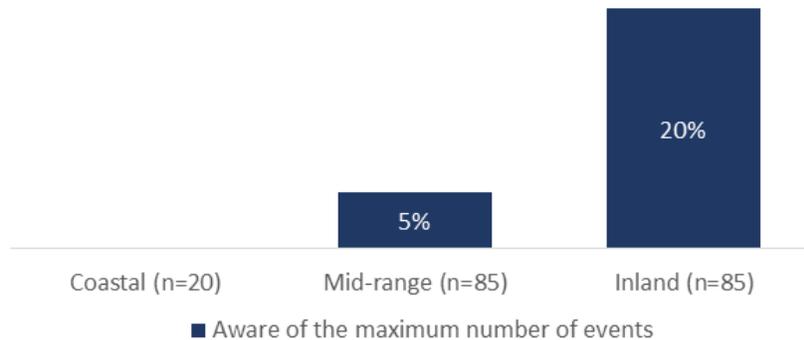
Knowledge of Event Start/End Time and Duration

In general, participants are unaware of expected event start and end times, as well as duration.

In order to examine program participants' knowledge about the timing and duration of AC Cycling events, we asked respondents to estimate the length, start time, and end time of a typical event. For PY2013, actual event start/end/duration times were highly inconsistent (see Table 10 above), so it cannot be expected that participants would necessarily understand and recollect events.

SmartAC-only participants believe that events are two hours in length or less. When dually enrolled participants report awareness, the start/end/duration times are closely aligned to those of the SmartRate program's events.

Table 19 shows participants' estimations of the duration of a typical AC Cycling event.

- SmartAC Only:
    - More than one-third of SmartAC-only participants (36%) believe that the typical AC Cycling event lasts less than 2 hours, which is in-line with only the duration of the 1.5-hour systemwide test event. All other events were longer in duration.
    - Only a small percentage (8%) suggested a longer duration.
    - More than half (56%) could not estimate event duration at all.

- Dually enrolled:
    - About 44% of dually enrolled participants were unable to estimate event duration.
    - Almost one-third estimated the typical event length between 3 and 5 hours—, which corresponds with the timeframe of SmartDays that lasted five hours in the summer of 2013. This may be because participants have the perception that the SmartRate and SmartAC programs overlap, and they are more aware of SmartRate program design features due to the notification and the inherent risk provided by the price signal.

Table 19. Participants' Estimated Length of a Typical AC Cycling Event

Estimated Event Duration	SmartAC-Only (n=190)	Dually Enrolled (n=138)	Weighted Total (n=328)
2 hours or less	36%*	17%	32%
2-3 hours	5%	2%	4%
3-5 hours	1%	29%*	8%
5-10 hours	1%	6%	2%
More than 10 hours	1%	2%	1%
Don't know	56%*	44%	53%

*The difference is statistically significant at the 90% confidence level.

In general, irrespective of whether the customer is a SmartAC-only or dually enrolled participant, their understanding of start and end times closely aligns with features of the SmartRate program. That is, on average all SmartAC program participants believe the program is called roughly between 2 p.m. and 7 p.m., whereas the SmartAC-only program participants exhibit vast variability in time and duration of events.

Table 20. Average Estimated Start Time, End Time, and Duration of a Typical AC Cycling Event

Understanding of Event Duration and Start/End Times	SmartAC-Only (n=190)	Dually Enrolled (n=138)	Total (n=328)
Average start time	2:35 p.m.	1:52 p.m.	2:11 p.m.
Average end time	6:39 p.m.	6:40 p.m.	6:40 p.m.

There were some outliers in the data. Approximately 20 participants believe that the duration of events is 20 hours or longer. One-third (36%) of SmartAC-only participants estimate the length of a typical AC Cycling event to be 2 hours or less, which corresponds with the timeframe of the systemwide test event.

5.7.5 Event Recollection

Although most people report to be home typically, and most participants experienced at least one AC Cycling event, just above one-quarter (27%) of participants recalled a PY2013 event. However, the test event occurred throughout the day in 1.5-hour segments among rotating groups, outside of normally expected event windows.

Exposure to AC Cycling Events

To contextualize participants' event recollection, we further cross-referenced the survey respondents with event participation data from the program database.

The vast majority (69%) of the program participants only experienced the system test day on July 1, a test triggered to rotating participant groups for 1.5 hours throughout the day (from 9 a.m. through 8 p.m.) to most program participants. Just over one-quarter (26%) of the respondents underwent two events (the systemwide test event and one sub-Lap event), while only 2% experienced three days of AC Cycling.

Table 21. Survey Respondents' Exposure to AC Cycling Events as per the Program Database

Number of Events	Exposed per Tracking Data (n=328)
0	3%
1	69%
2	26%
3	2%

Summer Occupancy Patterns

We establish occupancy patterns during events to assess whether participants were likely to have experienced one of the events we subsequently ask about during the interview.

About half (46%) of the participants noted that their schedule during afternoon weekdays is not consistent. However, 83% said that they are likely to be home in the afternoon (defined as 2 p.m. to 5 p.m.), and almost all participants are home between 5 p.m. and 7 p.m. Therefore, most are likely to experience an event if called within the summer afternoon periods.

Table 22. Participants' Summer Household Occupancy Patterns (multiple questions)

Occupancy Patterns	Weighted Percent (n=328)
No consistent schedule	46%
Home in afternoon	83%
Home in early evening (5 p.m. - 7 p.m.)	98%
Not home during afternoon and early evening (2 p.m. - 7 p.m.)	12%

How Participants Learn of SmartAC Program AC Cycling Events

We asked all survey respondents to report how they would know that an event is ongoing, given that participants do not receive notification of AC Cycling events.

- SmartAC-only participants most commonly notice events through changes in their AC units (16%), such as noise levels or the fan blowing warm air, and 10% state that they see their device blinking.

- One-quarter of active SmartAC-only participants (25%) report they have no means of knowing when an event is in progress, or say they "don't know" (29%) how they would learn about an event.

For dually enrolled participants, event notification from PG&E (for SmartDays only) is the predominant way of learning about AC Cycling events (64%), with 40% of participants receiving notifications by phone, 20% by email, and 4% via text messages. We specifically asked about the SmartAC program, but the dually enrolled participants tend to confuse both programs and provide SmartRate program design features when asked about the SmartAC program.

Table 23. How Participants Learn about AC Cycling Events (multiple responses)

How do you know whether an AC Cycling event is ongoing?	SmartAC-Only (n=190)	Dually Enrolled (n=138)	Weighted Total (n=328)
TECHNOLOGY	30%	10%	25%
Notice changes in AC unit (blows warm air, fan starts/turns off, sound)	16%*	5%	13%
AC Cycling device is blinking	10%	5%	9%
Lose the ability to control my AC	4%	0%	3%
NOTIFICATION (dually enrolled only)	5%	49%	17%
Phone notification	4%	40%*	13%
Email notification	2%	20%*	7%
Text notification	1%	4%	1%
TEMPERATURE CHANGES	9%	8%	9%
The temperature goes up	7%	5%	7%
It is a hot day, so assume events are called	2%	5%	3%
OTHER	4%	2%	3%
Friends/family/neighbors	1%	1%	1%
Program/IOU website	1%	0%	1%
Other	2%	1%	1%
DON'T KNOW / NO WAY OF KNOWING	54%	32%	49%
Don't know	29%	21%	27%
I have no way of knowing an event is taking place	25%*	11%	22%

Note: (*) The difference between customer segments is statistically significant at the 90% confidence level.

Event Recollection

Although the majority of participants experienced at least the July 1 test event, slightly less than one-third of all program participants (27%) noticed an AC Cycling event as it was happening. Event awareness tends to be higher among dually enrolled participants, those with programmable

thermostats, those living in inland areas, and participants who have experienced at least two sub-Lap events. Some highlights include:

- Among dually enrolled participants, 35% noticed at least one AC Cycling event, and 14% correctly recalled the number of 2013 event days.

- In comparison, only 25% of SmartAC-only participants stated remembering an event in PY2013, and only 7% remember the number of days their AC unit cycled.

Table 24. Event Awareness and Response

Awareness and Response	SmartAC-Only (n=190)	Dually Enrolled (n=138)	Weighted Total (n=328)
Noticed event	25%	35%*	27%
Recalled number of events	7%	14%*	9%
Experienced change in comfort	11%	18%	13%
Engaged in other energy-saving activities	17%	30%*	20%
Cooled down the house after the event	9%	11%	6%

Note: (*) The difference is statistically significant at the 90% confidence level.

Inland participants are also more likely to report noticing an AC Cycling event.

Figure 5. Event Recall across Climate Zones
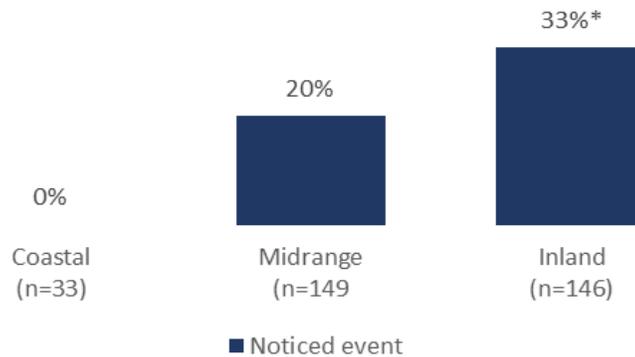
Note: (*) The difference is statistically significant at the 90% confidence level.

Control technology appears to be associated with event awareness, as 41% of participants using PCTs noticed an event, compared to only 25% of load switch participants. This is somewhat expected, as PCTs blink during AC Cycling events.

Figure 6. Event Recall among Load Switch and PCT Users
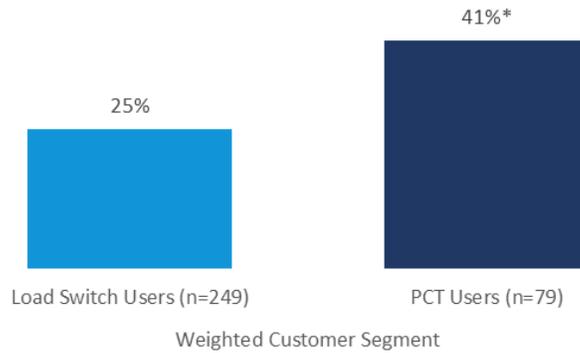
Note: (*) The difference is statistically significant at the 90% confidence level.

5.7.6   Participant Behavior during Events

Opinion Dynamics examined participants' comfort levels and behaviors during AC Cycling events for several reasons: (1) to understand if participants feel inconvenienced during events; (2) to assess whether they engage in behavior that may lead to snapback effects; and (3) to determine whether participants can provide more load during events upon receiving notification.

Reported Change in Comfort Levels

Overall, almost half (47%) of the participants who noticed an AC Cycling event said they experienced a change in comfort levels during the cycling period. Although not statistically significant, Figure 7 below shows that dually enrolled participants report experiencing slightly higher changes in comfort levels (52%) than SmartAC-only participants (45%). (As will be shown later, they are also more likely to completely turn off their AC unit, which may lead to this increased discomfort level.)

About half (52%) of inland participants noted a change in comfort levels, whereas only 38% of the midrange climate zone participants did so. Among the three respondents in coastal areas who noticed the AC Cycling event at all, only one reported a change in comfort levels.

Figure 7. Change in Comfort Levels for SmartAC-only and Dually Enrolled Customers
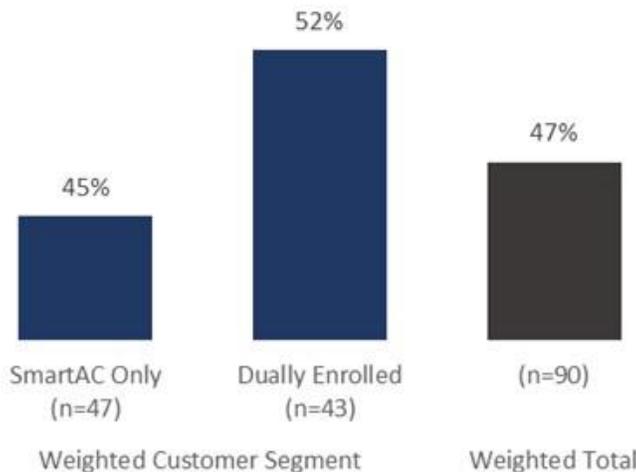
Additional Energy Savings during Events

Three out of four participants (75%) who recalled an AC Cycling event undertook additional energy-saving activities during event periods, besides simply letting their AC unit cycle (or turning it off).

Figure 8 below shows that dually enrolled participants engaged in energy-saving activities more frequently than SmartAC-only participants, because of both more-frequent notification and the price risk of not reducing energy during SmartDays.

Further, a higher proportion of PCT participants (88%) report reducing energy consumption compared to load switch participants (71%). PCTs blink during events, thus providing a more direct link with actual ongoing events than those who only have an "out of sight" load switch, perhaps prompting participants to want to reduce overall load consumption.

Figure 8. Participants Who Report Engaging in Additional Energy-Saving Activities during Events
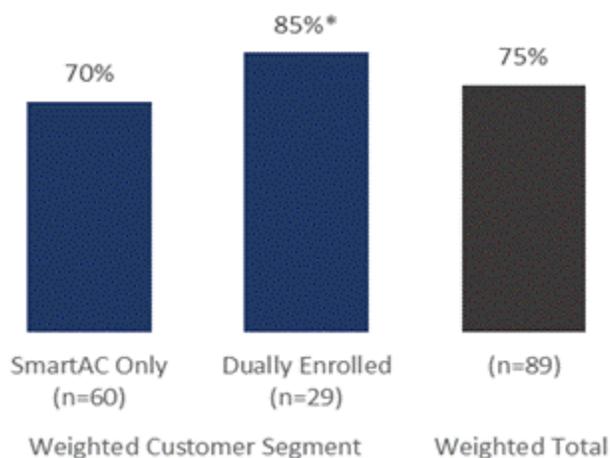
Note: (*) Statistically significant at p<0.10.

Table 25 lists energy-saving activities undertaken by participants during event periods. Shifting time of appliance usage, such as postponing the use of clothes washers (25%) and dishwashers (23%), is most frequently noted, followed by "turning off lights" (21%) and "unplugging appliances" (20%). In addition to reducing energy use during event times, 20% of participants said they closed curtains to keep the house cool.

Table 25. Additional Energy-Saving Activities during AC Cycling Events (multiple response)

Behavioral Activities around DR Events	Weighted Total Percent (n=72)
REDUCE ENERGY USE	65%
Run clothes washer earlier or later in the day	25%
Run dishwasher earlier or later in the day	22%
Turn off lights	21%
Unplug appliances	20%
Change settings (lower or increase) in thermostat	5%
Don't watch TV	5%
Turn off HVAC unit	4%
Use as little energy as possible (general)	3%

Behavioral Activities around DR Events	Weighted Total Percent (n=72)
Line dry clothes	2%
Don't cook/bake	3%
KEEP THE HOUSE COOL	**31%**
Close down curtains to keep house cool	20%
Use the fan instead of the AC unit	12%
Close windows/doors	3%
Open windows at night	1%
OTHER / DON'T KNOW	**3%**
Other	1%
Don't know	2%

Dually enrolled participants could theoretically rely on the SmartAC program's AC Cycling events to reduce their energy consumption. However, AC Cycling events did not fully overlap with SmartDays, the events called by the SmartRate program. SmartDays events occur between 2 p.m. and 7 p.m., whereas AC Cycling events varied considerably. SmartDays occurred more frequently than AC Cycling events in PY2013. Some dually enrolled participants report that rather than letting their unit cycle upon receiving notification of a SmartDay, they were more likely to turn off their AC unit altogether (43%) or lower the thermostat temperature setting (4%). However, more than one-third of SmartRate participants (37%) rely on PG&E to auto-cycle their AC during SmartDays, which may lead them to inadvertently consume more energy than they intend to, or believe that PG&E is helping them reduce overall load, when technically that is not the case.

This may be a strategic response to the fact that SmartRate program event days in PY2013 exceeded SmartAC program event days (although participants may not be aware of this), and thus exerted more control over their energy consumption, especially as they were exposed to a price signal.

Figure 9. "Upon notification of a SmartDay, do you let your AC unit cycle or turn off the HVAC unit?" (n=110)
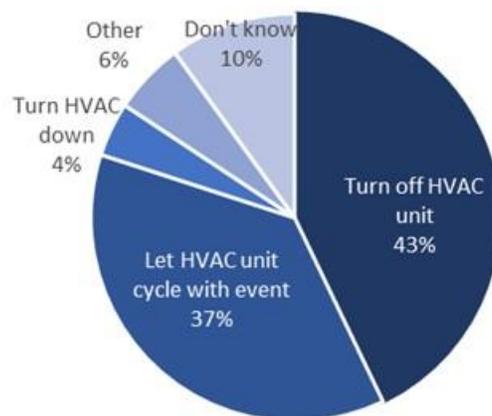
5.7.7   Overriding Events

We asked participants who recalled an AC Cycling event (n=90) whether they overrode their participation in the event. Only four respondents reported to have overridden participation in selected AC Cycling events (4% of those who recalled the event, 0.1% of the total surveyed participants).

5.7.8   Snapback Effects

Opinion Dynamics examined participants' reported behaviors during and after AC Cycling events that could lead to snapback or snapback effects. Overall, a minority of participants reported that they would not engage in behaviors that would lead to snapback effects, such as lowering their AC unit after an event. Differences exist among cohorts, as SmartAC-only, inland, and PCT participants were more likely to state that they would turn down their thermostat after a perceived event. In addition, only a minority noted that they would have pre-cooled the house had they been aware of an upcoming AC Cycling event.

Turning Down Thermostats

The data showed the following trends:

■ Changing temperature settings after an event – overall participant population:

  ■ One-third of the participants who recalled a 2013 AC Cycling event (35%, n=90) reported that they would lower their thermostat temperature setting to cool down the house faster after AC Cycling events (see Table 26 below), even though they did not necessarily know whether an event was in progress. About 22% said they would do so after all events and 13% said they did so only after some events.

  ■ Of those who say they recalled the event (n=90), about 58% said that they did not change the temperature settings of their air conditioning unit to cool down the house after an event occurred.

■ Dually enrolled vs. SmartAC-only participants: Among those who recalled an AC Cycling event, one-quarter (28%) of SmartAC-only participants cool down their house after some events, whereas only 11% of dually enrolled participants do so. This could be because the price signal for SmartDays continues through 7 p.m., and participants are not fully aware of when an event ends. Again, this may well be because participants confuse the SmartRate (where they receive notifications) with the SmartAC program (where they do not).

■ Load switch vs. PCT users: More load switch (26%) than thermostat participants (9%) lower their AC unit thermostat after some of the events.

■ Climate zones: While differences across climate zones are not significant, there is a slight trend toward more-frequent adjustment of AC temperature settings in inland areas (21%) in comparison to midrange climate zones (12%) or coastal areas (0%),

Table 26. "Have you ever changed the temperature settings of your AC unit after an event?"

Lowering thermostats after AC Cycling events	SmartAC-Only Weighted (n=47)	Dually Enrolled Weighted (n=43)	Weighted Total (n=90)
Yes, after some events	28%*	11%	22%
Yes, after all events	9%	20%	13%
No	56%	63%	58%

Lowering thermostats after AC Cycling events	SmartAC-Only Weighted (n=47)	Dually Enrolled Weighted (n=43)	Weighted Total (n=90)
Don't Know	7%	6%	7%

Notes: Question asked of 90 participants who recalled an AC Cycling event.
(*) The difference between cohorts is statistically significant at the 90% confidence level.

Pre-Cooling the Premise

Had they been aware of an upcoming event, more than two-thirds of all participants (69%) stated that they would not pre-cool their house. About 15% would do so after some events, and 11% did so after all events. As shown in Table 27, no differences existed between cohorts.

Table 27. "Would you pre-cool your house had you known about the event?"

Would you pre-cool house?	SmartAC-Only (n=190)	Dually Enrolled (n=138)	Weighted Total (n=328)
Yes, for some events	16%	13%	15%
Yes, for all events	10%	15%	11%
No	68%	69%	69%
Don't Know	6%	3%	5%

5.8   Program Communication

PG&E maintains communications with enrolled participants through efforts such as:

■ A spring newsletter reminding participants about the upcoming demand response event season, and providing tips about lowering energy usage

■ An end-of-season postcard to select groups of participants

While PG&E mails these materials to most participants, a small percentage (estimated at around 10,000) did not receive internal communications in PY2013 so they could serve as a control group for testing the effectiveness of marketing materials.

The PG&E SmartAC program offers a toll-free dedicated customer service hotline as well as program-specific communications through its website. While program participants are familiar with PG&E's website (75%) or PG&E's toll-free line (62%), barely half of all participants reported awareness of program-specific information tools, such as the informative sticker on the control device (45%) and the SmartAC program's toll-free line (41%). Participants become aware of existing customer support through a welcome kit provided upon installation of a device, a sticker on the control device, and an annual spring newsletter.

The recollection of program marketing efforts is significantly higher among dually enrolled than SmartAC-only participants. More than two-thirds of dually enrolled participants remember receiving the spring newsletter (72%) and end-of-season postcard (68%). Approximately half of the SmartAC-only participants recall the spring newsletter (53%) and end-of-season postcard (45%).

Table 28. Recollection of Key Marketing Activities

Marketing Activity	Weighted Customer Segment		Weighted Total (n=328)
	SmartAC-Only (n=190)	Dually Enrolled (n=138)	
Recalls spring newsletter	53%	72%*	58%
Recalls end-of-season postcard	45%	68%*	51%
Would want more frequent information	26%*	15%	23%

Note: (*) Differences between customer segments are statistically significant at the 90% confidence level.

While more than one-quarter (26%) of SmartAC-only participants stated that they would want frequent communication about the program, the share is significantly lower among dually enrolled participants (15%) who received some information through notification of SmartDays events.

Mailings are the preferred way of receiving program information (indicated by 45% of participants) and almost one-third (31%) of the participants favor email. There is also an age component where preference for email is particularly high among participants between 35 and 54 years old (50% stated they prefer to receive information via email).

Table 29. Preferred Way to Receive Program Information

Communication Method	Weighted Percent (n=323)*
MAIL	84%
Direct mail/newsletter	45%
Email	31%
Bill insert	9%
PHONE	7%
Phone call	6%
Text message	1%
OTHER	4%
Website	3%
Social media messages	1%
Personal contact	1%
Don't know/refused	4%

Note: (*) Excludes four participants who did not want information.

5.9 Customer Support

While three-quarters of participants are aware of the PG&E's website, there were significant differences in awareness levels for PG&E's utility-wide and SmartAC program-specific toll-free phone lines.

■ Almost two-thirds (60%) of dually enrolled participants are aware of the SmartAC program line, whereas only one-third (34%) of SmartAC-only participants are.

■ Awareness of the toll-free line is also higher among PCT participants (58%) compared to load switch participants (38%).

Table 30. Awareness of Customer Support Tools

Customer Support Tool Options	Participant Segment		Total (weighted, n=328)
	SmartAC-Only (weighted, n=190)	Dually Enrolled (weighted, n=138)	
PG&E's website	76%	75%	75%
PG&E's toll-free line	58%	74%*	62%
Sticker on the control device	44%	48%	45%
SmartAC program toll-free line	34%	60%*	41%

Note: (*) The difference is statistically significant to SmartAC-only participants at the 90% confidence level.

5.10   Reasons for Leaving PG&E's SmartAC Program

In general, lapsed customers were most likely to mention that they left the program because of issues with the program technology or feeling uncomfortable during events. Based on self-reported data, lapsed customers recalled events at a higher rate than active participants did, but our data did not show any major differences in occupancy patterns during likely event periods. The program data notes that 14% of program participants had load switches, yet 60% of lapsed customers had PCTs (although we note that our sample sizes by technology were small).

The tracking data notes three categories that lead to customers leaving the SmartAC program:

1. The customer moved (about 57,000 since program inception)

2. The customer changed to a medical rate and was no longer eligible to participate (about 9,500 since inception)

3. The customer chose to remove the control device for "other" reasons (13,000 customers since program inception)

Since inception, the program has lost 79,924 customers due to device deactivation or removal. The large majority of these (84%) were for reasons that cannot be controlled by the program (deactivation due to moving or medical rate). Of those who chose to leave for other reasons, almost two-thirds (62%) of the approximately 13,000 customers who left the program did so after 2011. Prior to 2011, the program called events infrequently, and mostly for emergency reasons. More AC Cycling events have occurred each year since 2011 than in previous years. Figure 10 shows the number of customers who left the program per year.

Figure 10. Year of Leaving the Program for Reasons Other than Moving or Changing to Medical Rate (n=12,983)
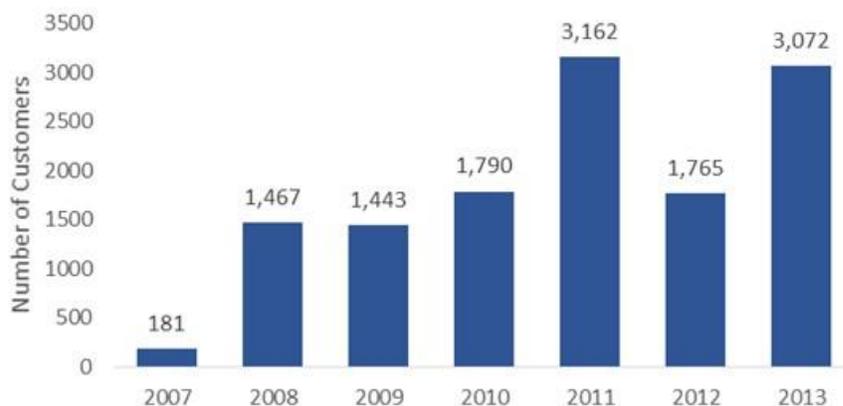
In order to understand the reasons behind the customers' decision to leave the program—other than moving or adopting a medical baseline tariff —we conducted a survey with 68 lapsed customers who were classified as "removed" in the program-tracking data. We created sample cohorts where we completed surveys with 48 SmartAC-only lapsed customers and 20 dually enrolled lapsed customers. We weighted aggregate results to ensure that they statistically represent the lapsed customer population. We also established the sample to reduce recollection bias (i.e., we included only participants who opted-out of the program since 2012).

5.10.1 Lapsed Customer Event Recollection

We established whether lapsed customers would have experienced AC Cycling events by examining their typical premise occupancy schedule, with the hypothesis that customers who were likely at home during events would have more consistently experienced them. Summer occupancy patterns between lapsed customers are consistent with those of enrolled participants. A majority of lapsed customers (84%) noted that they are likely to be home in the afternoon (2 p.m. to 5 p.m.), and almost all participants (94%) are home between 5 p.m. and 7 p.m. However, half of the lapsed customers (51%) did not have a consistent summer afternoon schedule, which would indicate that while they were home some of the time, their schedule might not have been consistent enough to ensure that they experienced an event. Residential lapsed customers who were typically home between 2 p.m. and 7 p.m. recalled events more often than those with inconsistent schedules (71% vs 37%).

Table 31. Summer Afternoon Occupancy Patterns

Occupancy	Weighted Percent (n=68)
No consistent schedule	51%
Home in afternoon	84%
Home in early evening (5 p.m. - 7 p.m.)	94%
Not home during afternoon and early evening (2 p.m. - 7 p.m.)	13%

Note: Rounded percentages.

Table 32 shows that just over half of the lapsed customers (52%) recalled experiencing AC Cycling events prior to leaving the program. This is higher than active participants' recollection of events.

It is important to note that while the program does not notify participants about AC Cycling events, dually enrolled participants receive SmartDays event notifications from the SmartRate program. There was no statistically significant difference in the recall between the SmartAC-only and dually enrolled lapsed customers.

Table 32. Event Recall

Recall	Weighted Percent (n=68)
Recalled events between May and October	52%
Did not recall events between May and October	48%
Total	**100%**

Note: Rounded percentages.

5.10.2   Reasons for Leaving the Program

The most frequently stated reasons for leaving the program were technology issues (30%), including the perception that the load switch was incompatible or adversely impacted the HVAC unit (17%), and event issues (23%), including feeling hot or uncomfortable (19%). About 10% of respondents seemed surprised that they were no longer program participants.

The survey sample frame excluded specific categories among lapsed customers, namely customers who moved or switched to a medical tariff. While these customers theoretically were not in the sample frame, 9% of respondents noted that they moved, and another 4% noted that they were in the medical baseline tariff, perhaps indicating that the classifications in the tracking data may not be fully accurate.

A few (8%) left the program because they did not see program impacts, perhaps because they did not notice events or did not see a reduction in consumption on their bill. This is highly likely the situation, because the majority of events were sub-Lap.

Table 33. Reasons for Leaving SmartAC Program (multiple response)

Reasons for Leaving SmartAC Program	Weighted Percent (n=68)
Technology Issues	**30%**
Device adversely impacted/not compatible with AC/contractor removed device	17%
HVAC unit was not working/upgraded/replaced	11%
Added solar to my home	4%
My control device broke	4%
AC Cycling Event Issues	**23%**
Felt uncomfortable/hot during event days	19%
Duration of events too long	4%
Life Events	**16%**
Moved	9%
On a medical baseline tariff	4%
Needed control for baby	2%
Program Design Issues	**15%**
Did not need it/did not see program impacts	8%
Did not like that utility was controlling HVAC unit/"big brother" effect	4%
Program staff was not helpful/responsive	2%

Reasons for Leaving SmartAC Program	Weighted Percent (n=68)
My energy bill increased/thought bill would increase	3%
Customer Classification Issues	**14%**
Did not know I was no longer a participant/did not opt-out	10%
Not original decision-maker	4%
Other	**11%**
Something (generally) was not working	3%
It did not work as described	<1%
Didn't like it	<1%
Don't know	6%

Notes: (1) Rounded percentages.
(2) Category totals in bold are not always the sum of the reasons they include due to rounding and avoiding double counting of customers who may have stated multiple reasons within the category.

5.10.3 Lapsed Customer Control Technology

PCT lapsed customers represented a much larger percentage of the lapsed customer population than the program database would indicate (14% of active participants have thermostats). This may indicate that PCT customers are more likely to opt-out of the program, perhaps because of increased awareness of events (due to the blinking light on the device) or some issues related to the technology.

Reasons given by PCT users for leaving the program included:
- The technology caused problems AC unit /contractor removed control device (26%)
- On a medical tariff/other discounts/medical reason (e.g., surgery, have a disability) (13%)
- My HVAC was not working/upgraded/replaced (13%)

Table 34. Technology Used to Cycle (n=67)

Technology	Weighted Percent (n=67)
Load switch	23%
Thermostat	60%
Do not recall	17%
Total	100%

Note: Rounded percentages.

5.10.4 Dually Enrolled Lapsed Customers

More than half of the dually enrolled customers (11 of 20, see Figure 11 below) were unsure about whether they left the SmartRate program, or how the higher peak electricity prices associated with it affected their decision to leave the SmartAC program. However, nearly half (9 of 20) stated they would have stayed in the SmartAC program had they not also been exposed to the SmartRate program's prices. Peak price affected the small number of dually enrolled customers who also reported leaving the SmartRate program (4 of 20). Most of these customers (3 of 4) stated that they would have stayed in the SmartAC program if they had not been exposed to the higher SmartRate prices.

Figure 11. Lapsed Dually Enrolled Customers - SmartRate Program Participation Effect and Outcome (n=20)
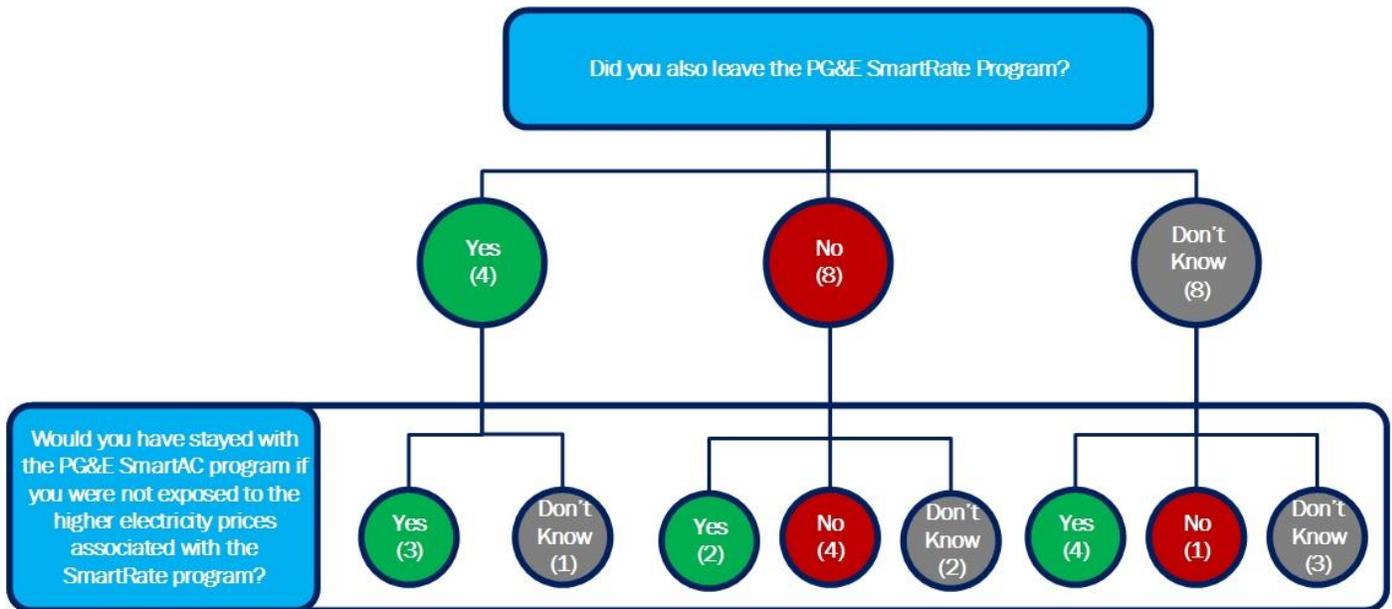
5.11   Recommendations for Program Improvements

In general, the majority of active participants and lapsed customers noted that they did not have suggestions for improvements to the SmartAC program. Those who did mostly requested additional and more frequent information about the program and events. For the most part, customers did not suggest changes in the incentive structure or the addition of other cycling options. Table 35 shows that most participants state that no changes to existing incentive levels are needed (59%). Only 15% of participants would find additional incentives more appealing, and 10% of the participants would like to see annual rate discounts or bill credits.

Table 35. Desired Changes on Program Incentive Levels

Desired Changes in Incentive Levels	SmartAC-Only (n=217)	Dually Enrolled (n=78)	Weighed Total (n=295)
No changes	59%	62%	59%
Higher incentives	17%	12%	15%
Annual rate discounts /bill credits	10%	10%	10%
Don't know	16%	17%	16%

Note: Omits those who responded off-topic and mentioned other program improvements.

Similarly, the majority of customers (82%) report that they do not desire changes to the 50% duty cycle choice. A small share of customers (7%) would prefer a lower duty cycle, where they most commonly suggested a 25% duty cycle option. Only a minority of customers (2%) suggested a higher duty cycle option.

Table 36. "Would you prefer a different cycling strategy than the current 50% duty cycle?"

Change in Duty Cycle Options	SmartAC-Only (n=190)	Dually Enrolled (n=138)	Weighed Total (n=328)
No changes to existing cycle	81%	86%	82%
Lower than 50%	8%	2%	7%
Higher than existing cycle	2%	2%	2%
Don't know	9%	8%	9%

For program improvements, some participants mentioned higher incentives (15%), followed by more information or education (9%). About 11% of SmartAC-only participants requested more information or education, compared to 4% of dually enrolled participants.

Table 37. Participants' Suggestions for Program Improvement (multiple responses)

Suggested Program Improvements	SmartAC-Only (n=190)	Dually Enrolled (n=138)	Weighted Total (n=328)
Higher incentive (regular bill discount/bonus)	16%	14%	15%
More information/education	11%*	4%	9%
Better event notification	3%	1%	3%
Change cycling options offer percentage	2%	4%	2%
Fewer events	2%	1%	2%
Develop program phone app	2%	0%	1%
Other	6%	5%	7%
No improvements needed	45%	54%	47%
Don't know/refused	17%	20%	18%

Note: (*) The difference statistically significant at the 90% confidence level.

We also asked lapsed customers for suggestions on how the SmartAC program can better explain program options and designs. Customers frequently expanded their answers to include suggestions for program improvement generally. However, most lapsed customers (68%) did not provide any kind of suggestion at all. In general, these customers provided the same reasons for leaving the program as those who provided suggestions.

Table 38 below highlights suggestions from the nearly one-third of lapsed customers who made suggestions. The most frequent were ensuring that the equipment worked (8%), and ensuring that the program does what is stated (6%). A few lapsed customers (6%) suggested that providing general explanations would be an improvement. There was no significant differences in suggestions between the SmartAC-only and dually enrolled lapsed customers.

Table 38. Suggestions for Improvement from Lapsed Customers (multiple response)

Suggestions for ...	Weighted Percent (n=68)
Improving the Program	**23%**
Improve equipment/ensure the program works	8%
The program should do what it says it does	6%
Increase financial benefits/savings	4%
Shorten duration/was uncomfortable	4%
Ensure that contractors are well trained	2%
Provide the option to opt-out in certain circumstances	<1%

Suggestions for …	Weighted Percent (n=68)
Do not notify customers for every DR event (although others asked for notification)	<1%
Improving the Explanation of Program Design and Options	**10%**
Provide general explanation, as none was given	8%
Provide estimates of energy savings related to participation in DR events	2%
No Improvements Suggested	**68%**

Notes: (1) Rounded percentages.
(2) Category totals are not a sum. They may be due to rounding and avoiding double counting of customers.

5.12   Program Data Tracking Recommendations

Issues with the SmartAC program database are minimal, and it is a best practice that the program track active participant and lapsed customer status, specifically classifying whether they leave the program because they have moved or signed up for the medical baseline tariff. It would be an enhancement if the program could track why participants leave the program for the population that is currently classified as "removed." This can provide insight on trends for participants leaving the program, which may help the program to reduce the level of exodus.

Because participants can have multiple control devices, the tracking data establishes customer records at the device level. For each device record, PG&E records the control device data, customer contact information, and program enrollment and participation data. Each device record has a status with the ability to track selected reasons for leaving the program:
- Installed – designates actively enrolled participants/devices
- Various installation status (pending, complete, assigned, reschedule, scheduled)
- Deactivated moved – denotes customers who moved (devices stay on premises)
- Deactivated medical – denotes customers who are in the medical tariff, thus not eligible to participate in the program
- Lapsed (Removed or Cancel) – customers who left the program for reasons other than moving or going on a medical tariff

We clarified some data inconsistencies with PG&E as we were data cleaning the records to create a sample for the surveys. We highlight them below, with a recommendation on how to address these records.
- **Data discrepancies in SmartRate flag:** Event participation data revealed that 901 devices currently marked without a SmartRate flag indeed participated in 2013 SmartRate events. This may be related to recent program changes, but should be reviewed for accuracy.
- **Duplicate records:** Data examination revealed a small number of duplicate records (653) in terms of device ID and serial number. These records should be reviewed and eliminated.
- **Missing data:** In the preparation of the sample, we detected 40,226 device records (across 37,586 customers) without valid phone numbers. To improve future evaluation work or customer support more broadly, it is recommended to obtain phone numbers if possible.
- **Data dictionary:** For future evaluations, it would be beneficial to receive a data dictionary for the following field: Current Status.

6.   SCE Summer Discount Plan Program Process Evaluation

This chapter provides the detailed process evaluation findings and recommendations for the Southern California Edison (SCE) Summer Discount Plan (SDP) program. In this chapter, we address the following research objectives:

- Document program description and processes
- Describe PY2013 SDP events
- Report on overall program participant satisfaction
- Discuss awareness of the program and events, including notification of program events and participant communications
- Describe participant reactions to events and engagement with the program, including action during events and snapback effects
- Assess reasons as to why lapsed customers left the program
- Recommend program improvements

Note that this chapter provides details of all SCE SDP program-specific findings. The highlights of this chapter are also included in the integrated section of the report (see Chapter 0). This detailed chapter is intended for the SCE staff running the program.

6.1   Program Description

The SDP program began in 1983 as an emergency response program. In 2012, the program transitioned to add economic dispatch as an event trigger. This transition stemmed from a 2010 California Public Utilities Commission (CPUC) decision to make the program more responsive to peak loads, especially as capacity reduced in the SCE service territory due to the retirement of the SONGS nuclear power plant.

Prior to adding economic dispatch, the program sent out a letter to its participants explaining that SDP events would likely be called more frequently with the new economic dispatch mechanism. The communication also detailed new features of the program, including the option to install an override switch so customers could override an event (not previously offered). According to SCE, less than 1% of existing residential participants opted to have the override switch installed. Moreover, less than 1% of existing residential participants left the program despite more frequent events.

The program initially targeted a total of 300,000 participants to allow a load curtailment of 200MW, as mandated by California Independent Systems Operator (CAISO). The current number of active residential SDP program participants is 296,280 households with 301,594 devices. In addition, the program also targeted nonresidential customers. The current number of commercial participants is 8,503 with 10,639 active devices, which is just above the target level of 10,000 devices for the program.

The SDP program delivered an average of 171 MW of demand response (DR) per event in 2013. The events ranged from 60 MW to 290 MW in aggregate for the residential sector. The four nonresidential events delivered between 30 MW to 60 MW of demand response.[15]

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[15] Navigant, May 2014, Impact Evaluation of SCE's 2013 Summer Discount Plan Program.

Table 39. SCE Summer Discount Plan Program Active Participants

Participant Type	Cycling Option	Enrolled Participants	% of Participants	Enrolled Control Devices	% of Enrolled Devices
Residential	100%	268,424	88%	273,022	87%
	50%	27,856	9%	28,572	9%
	Sub-Total	296,280	97%	301,594	97%
Commercial	100%	6,034	2%	7,309	
	50%	1,775	1%	2,417	1%
	30%	694	0%	913	0%
	Sub-Total	8,503	3%	10,639	3%
TOTAL		**304,783**	**100%**	**312,233**	**100%**

Notes: Device counts based on service account ID in the program-tracking database, less seven devices with invalid duty cycle option. Customer counts based on customer account ID. All counts before removing duplicate phone numbers.

Some residential customers are dually enrolled in other programs. Often, SDP program participants also enroll in the Save Power Days (SPD) program. SPD is a voluntary program with opt-in notification that calls up 12 events per year in which customers receive a request to reduce energy consumption between 2 p.m. and 6 p.m. Historically, all SCE customers with smart meters automatically defaulted in the SPD program. Beginning in 2013, only those who sign up for opt-in notification of events are eligible to receive SPD bill credits.

6.2 Program Design Features

Table 40 highlights the program design as of 2013 for the SDP program.

Table 40. SCE Summer Discount Plan Program Design Characteristics

Category	Description – SCE Summer Discount Plan Program
Program inception year	1985
Program period	June 1 to October 1
Technologies offered	■ For PY2013, a Corporate Systems Engineering load switch is the primary technology option ■ A pilot to install programmable thermostats with about 1,300 thermostats is currently in testing ■ Load switches for new customers and/or customers who have their previous switch replaced have event override capability (primarily offered to residential customers).
Event period	■ Varies ■ Most events started around 3 p.m. and 4 p.m.
Event duration	■ Noted as 2 to 6 hours ■ Average duration for residential events was 2 hours ■ Average duration for nonresidential events was 1 hour
Event limitations	Events can be called for a maximum of 6 hours and an annual limit of 100 hours
Exclusions	No events called on weekends and holidays
Duty cycle options	Residential participants: 100%, 50% (standard option); lower incentive payments given if participants have the ability to opt-out of events through override switches (override option) Nonresidential participants: 100%, 50%, 30%; typically nonresidential participants do not override events, given that they have rooftop-mounted AC units

Category	Description – SCE Summer Discount Plan Program
Changing duty cycle options	Yes, at any time. Payment thresholds occur by September 1 of every year; participants who have a step-down (lower than before) duty cycle change get the lower incentive payment. Participants cannot step up their duty cycle after September 1 (or if they do, they are notified that their incentive payment will still be calculated on the lower duty cycle option).
Incentive payments	Incentive payments vary by duty cycle and customer segment. They are offered as a calculated incentive payment based on tonnage during the each operating month of the program summer season. **Residential Participants:** About 90% of residential participants selected the 100% duty cycle option. About 1% have the override feature installed. ■ 100% duty cycle 　■ Standard: $0.36/calculated AC ton per day 　■ Override option: $0.18/calculated AC ton per day ■ 50% duty cycle 　■ Standard: $0.18/calculated AC ton per day 　■ Override option: $0.09/calculated AC ton per day **Nonresidential Participants:** Approximately 80% of commercial participants are on a 100% duty cycle, 15% on a 50% duty cycle, and less than 5% on 30% duty cycle. Differences in sector and firm size often drive which duty cycle is selected. ■ 100% duty cycle: $12.69/calculated AC ton per month ■ 50% duty cycle: $4.44/calculated AC ton per month ■ 30% duty cycle: $0.89/calculated AC ton per month
Emergency triggers	■ CAISO State 1 emergency forecast ■ CAISO State 2 emergency ■ SCE declaration of a Category 1, 2, or 3 Storm Alert ■ Program testing ■ SCE discretion, provided that it follows program design rules (in terms of duration, maximum hours per year, and other related factors)
Economic/other triggers	High wholesale energy prices, as designated by the SCE Integrated Operation Group
Notification of events	■ There are no pre-event notifications for residential participants. However, a light on residential devices flashes during an event. ■ SCE is currently developing a smartphone app to notify residential participants, with the objective of decreasing customer calls to the Call Center during an event.[16] ■ Commercial participants can sign up for event notification through email and text message. Approximately 25% of commercial participants have signed up for notification, and 4,800 alerts went out as of September 2013.
Overriding events	■ All new participants in the program have devices with an override switch installed (they still have to actively sign up for the override option, which lowers incentive payments). ■ Commercial participants do not have the option to override an event because many have roof-mounted AC units. ■ Except for those with override-enable load switches, participants cannot override SDP events. If they call the SCE support line to override an event, they are given choices to either leave the program, or alternatively change their duty cycle options (for those who qualify).
Leaving program	Yes, at any time. Once a customer leaves, they cannot enroll for 12 months.

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[16] The SDP program is weighing the advantages of rolling out such an app, with the potential downside that participants might turn up their ACs before an event.

Category	Description – SCE Summer Discount Plan Program
Enrollment options/ customer support	■ Enrollment online, Call Center, or hard copy application form ■ Summer Discount Plan Program Hotline: 1-800-497-2813 ■ SCE General Customer Support: 1-800-655-4555
Program third-party vendors/implementers /aggregators	Program uses two contractors who serve distinct geographic areas. Both focus primarily on device installation, maintenance/service calls, and managing the customer service center. ■ GoodCents (SCE's northern service area, company in Rancho Cucamonga) ■ NRG Power Solutions (serves SCE's southern service area, based in Santa Ana)
Technology failure rates	Estimated rate of 15% of the 263 logger devices that were installed to support the impact evaluation in 2011

6.3 Program Design Changes

The program generally has been implemented according to its design. Major updates to technologies and other program design options have been limited by long-term service agreements with technology providers. However, the program underwent some changes, highlighted in Table 41.

Table 41. Major Recent Program Design Changes

Category	Description	Timing
Duty cycle options	Eliminated 100% and 67% duty cycle options for nonresidential participants	Since 2012
Programmable thermostat	Programmable thermostat offered as a test pilot	Since 2013
Economic triggers	Added economic dispatch (high wholesale localized energy prices) for calling SDP events	Since 2012

6.4 PY2013 Summer Discount Plan Program Events

This section documents the timing and trigger of PY2013 SDP events.

6.4.1 Event Characteristics

In 2013, the SDP program called 12 events for residential participants (11 within the summer months (June through September), one in late fall) and four events for nonresidential participants. Residential events were mostly sub-Lap events called for system testing or economic dispatch purposes (except for two systemwide test events). Nonresidential events were mostly test events called for all nonresidential participants. On average, residential participants experienced only seven to eight events throughout the summer, as most events were sub-Lap. With the exception of the late fall event, all residential SDP events coincided with other SCE demand response programs. The majority of events (58%) were 2-hour events, and 25% were 1-hour events. Only two events lasted for three or more hours. The tables below show their date, start times, and end times.

Table 42. Residential SDP Events in 2013

No	Event Dates	Start Time	End Time	Duration (hours)	Estimated MW	Trigger (Economic/ Reliability/ M&E)	Load Switches	PCT	Want-Offs during Event and Hour before	Daily Want-Offs	San Dimas Temp	Other DR Events
1	28-Jun	4:00 PM	6:00 PM	2	92	Economic	93,425	1	124	151	95	CBP, AMP, DBP
2	2-Jul	4:00 PM	6:00 PM	2	127	Economic	198,181	7	73	95	86	SPD, DBP. CBP
3	19-Jul	4:00 PM	5:00 PM	1	74	Economic	100,707	7	6	38	89	CBP
4	22-Aug	3:00 PM	5:00 PM	2	144	Economic	154,731	142	21	36	97	CBP
5	28-Aug	3:00 PM	5:00 PM	2	191	Economic	211,199	224	55	86	96	SPD, DBP,CBP, SAI
6	29-Aug	2:00 PM	5:00 PM	3	206	Economic	202,941	157	137	192	101	CBP, AMP/DRC Test
7	4-Sep	3:00 PM	5:00 PM	2	150	Economic	150,558	87	73	130	101	CBP, AMP, SAI
8	5-Sep	4:00 PM	5:00 PM	1	164	Economic	155,115	147	19	122	100	CBP, SPD
9	6-Sep	2:00 PM	6:00 PM	4	326	Economic	307,641	245	336	407	100	CBP, DRC, SAI
10	9-Sep	3:00 PM	5:00 PM	2	87	Economic	150,294	96	94	228	85	CBP, DRC, DBP, SPD
11	30-Sep	7:00 PM	8:00 PM	1	47	Economic	308,699	306	2	26	69	SAI
12	13-Nov	5:00 AM	7:00 PM	2	220	Economic	307,937		0	16	76	None

Table 43. Nonresidential SDP Events in 2013

No	Event Dates	Start Time	End Time	Duration (hours)	Estimated MW	Trigger (Economic, Reliability, M&E)	Groups	Participants	Wants-Off during Event and Hour before	Want-Offs	San Dimas Temp	Other DR Events
1	2-Jul	3:00 PM	4:00 PM	1	48	Economic	All	10,409	1	5	86	SPD, DBP, CBP
2	22-Aug	4:00 PM	5:00 PM	1	75	Economic	All	10,580	0	0	97	CBP
3	29-Aug	4:00 PM	5:00 PM	1	84	Economic	All	10,617	1	1	101	CBP, AMP/DRC Test
4	9-Sep	3:00 PM	4:00 PM	1	46	Economic	All	10,646	3	3	85	CBP, DRC, DBP, SPD

6.4.2   System Peaks vs. DR Event Timing

SCE did not provide systemwide peak data. However, given that all events were sub-Lap events for test or economic dispatch (except for a couple of systemwide events later in the season/year); events were not necessarily meant to meet system peaks. Most events exhibited characteristics of peak days such as high temperature days (with the exception of the late September and winter events). Given a relatively high capacity in the SCE system due to low natural gas prices (as well as gas futures), SCE has not needed to call systemwide events. Therefore, there is not sufficient data to establish whether events meet system peaks, although events appear to occur on days and times likely to experience high-energy demand.

6.5   Technology and Expected Failure Rates

The SDP program primarily uses a Corporate Engineering Systems direct load control device that it has used since program inception. Recently, the program began offering load switches that have override capabilities to all new customers as well as existing participants who actively requested this option. In addition, SCE started a program in October 2013 to replace 43,000 of the older residential switches with the new override switches if the AC unit is easily accessible.

The load impact report from 2011 estimated a failure rate of about 15% based on metered load data. In early 2012, the estimated failure rate of control devices was about 10%. Given that the devices only communicate one way, they are hard to test; however, the load curtailments from impact evaluations have shown that they work well in aggregate. If participants call in about a suspected failed device, SCE will send its contractors out to test the device. If the device has actually failed, SCE will replace the switch. If the device was manufactured prior to 2003, they will replace it with an override-ready switch.

6.6   Program Implementation

This section describes program processes.

SCE engages two contractors, GoodCents Solutions and NRG Systems, to primarily manage installation and maintenance of load control switches. The device is a Corporate Engineering System direct load switch, and the company is available to service the devices as needed.

The primary responsibilities of GoodCents and NRG are to:
- Schedule the installation of control devices
- Perform device testing prior to installation
- Install the device at the participant's premise
- Conduct service calls to the participant premises upon request
- Monitor the operational capability of the system by doing planned testing (and replacement if necessary) of a random sample of devices annually
- Manage the Call Center operations

SCE is primarily responsible for program design and implementation, including marketing, customer enrollment, and vendor management.
- Program design planning
- Program marketing
- Implementer management

Table 44 shows the service area where NRG and GoodCents operate.

Table 44. Distribution of NRG Power and GoodCents Solutions District Areas

District	District Name	Assigned To	District	District Name	Assigned To
22	Montebello	NRG Power	47	Whittier*	NRG Power
26	Covina	NRG Power	48	Fullerton	NRG Power
27	Monrovia	NRG Power	49	Santa Barbara	NRG Power
29	Santa Ana	NRG Power	50	Big Creek	GoodCents Solutions
30	Foothill	GoodCents Solutions	51	San Joaquin	GoodCents Solutions
31	Redlands	GoodCents Solutions	52	Tehachapi	GoodCents Solutions
32	Compton	NRG Power	53	Kernville	GoodCents Solutions
33	Huntington Beach	NRG Power	59	Valencia	NRG Power
34	Ontario	GoodCents Solutions	72	Barstow	GoodCents Solutions
35	Thousand Oaks	NRG Power	73	Victorville	GoodCents Solutions
36	Antelope Valley	GoodCents Solutions	77	Menifee	GoodCents Solutions
39	Ventura	NRG Power	79	Palm Springs	GoodCents Solutions
40	Arrowhead	GoodCents Solutions	84	29 Palms/Yucca	GoodCents Solutions
42	Santa Monica	NRG Power	85	Bishop/Mammoth	GoodCents Solutions
43	Saddleback	NRG Power	86	Ridgecrest	GoodCents Solutions
44	South Bay	NRG Power	87	Blythe	GoodCents Solutions
46	Long Beach	NRG Power	88	Wildomar	GoodCents Solutions

6.6.1   Participant Acquisition and Enrollment

As a mature program, the SDP program's marketing efforts focus primarily on replacing lapsed customers who have left the program through attrition (moving, going on medical baselines, or actively leaving the program).

Direct mail is the primary marketing method for both residential and small nonresidential customers. SCE account representatives target large nonresidential customers. Nonresidential customers have a portfolio of SCE-sponsored DR programs available, but they can select up to two programs in most cases. Account representatives often work closely with their customers to recommend the most appropriate programs. According to some limited interviews with account representatives, other DR programs likely yield more load and pay higher incentives to customers, and therefore tend to be offered first. As a result, the prevalence of large nonresidential participants in the SDP program is limited to 3% of the participant population.

While there is a diverse representation of business segments in the SDP program, schools are the most prevalent (by tonnage) because they are good candidates for a cycling program, given that their afternoon occupancy drops significantly. However, this may suggest that some of these participants may be program "free riders."

Residential customers can enroll in the program through response cards included in direct mail campaigns, SCE's website, by phone, or through the service center. For large nonresidential customers, the account representatives typically fill out an application form.

Once a customer enrolls, SCE generates a work order that it sends to the implementation contractor, who will then schedule the device installation. Once the device is installed, the customer becomes an active participant on their next meter read date.

SCE has a processing center to process applications and approve work orders for the program. In the summer, SDP program staff train approximately 30 employees to handle customer support.

6.7 Participant Program Engagement

This section describes participants' satisfaction with the SDP program, their motivation to enroll, their engagement with various elements of the program, their awareness levels of program design features, their recollection of SDP events, and their behavior during or after SDP events.

Opinion Dynamics fielded a survey with SDP program active participants in April 2014 to examine their experience with program processes, their general awareness of SDP events, and their behavior during and after events. Given the timing of this study, we fielded this survey several months after participants experienced their last SDP event in September 2013. While the survey instrument was specific about event times, some recollection bias may exist, simply based on the delay between the participant experience with SDP events and the time in which they responded to a survey about it.

We completed 138 interviews with residential and 126 interviews with nonresidential participants with at least one active load switch. We further segmented the sample cells to ensure adequate representation of duty cycle choices (100% and 50% for residential participants; 100%, 50%, and 30% for nonresidential participants). We also segmented participants in three climate zones (coastal, midrange, and inland). (See Appendix B for climate zone allocations and for the survey sampling plan.) We segmented nonresidential participants into small nonresidential (service plan codes GS1 and GS2) and large nonresidential (service plan codes GS3 & TOU) participants.

Opinion Dynamics established sample sizes to yield a 90% confidence with a ±10% precision in survey results at the program level. We weighted the aggregate results of total participants, duty cycle, climate zone and size to ensure that they statistically represent the selected strata in the program population.

Table 45. Residential Completes with Active SDP Program Participants

Program Technology/Choice	Coastal	Midrange	Inland	Total	% of Total
50% duty cycle	17	20	10	47	34%
100% duty cycle	20	50	21	91	66%
TOTAL	37	70	31	138	100%
% of Total	27%	51%	22%	100%	

Table 46. Nonresidential Completes with Active SDP Program Participants

Program Technology/Choice	Small	Large	Total	% of Total
30% duty cycle	6	20	26	21%
50% duty cycle	10	30	40	32%
100% duty cycle	20	40	60	48%
TOTAL	36	90	126	100%
% of Total	29%	71%	100%	

6.7.1 Participant Satisfaction

Participants rated their satisfaction with the program overall at 8.5 (residential) and 8.2 (nonresidential). Both residential and nonresidential participants give the lowest average satisfaction score (7.5) for the expected event length. For residential participants, satisfaction is highest with the program technology (mean of 9.2). While satisfaction for the duty cycle options is high at the program level (9.0), 100% duty cycle participants rate their duty cycle option significantly higher (9.1) than 50% duty cycle participants rate theirs (8.4). Coastal participants give a higher overall satisfaction score,

are more satisfied with incentive levels, and rate satisfaction with the expected length events higher than midrange participants do.

Table 47. Residential Participant Satisfaction Ratings (weighted total, n=138)

Program Design Components	0-3 Score	4-6 Score	7-10 Score	Don't Know	Mean
The program overall	3%	11%	86%	1%	8.5
Program technology	0%	6%	82%	12%	9.2
The duty cycle option	1%	9%	85%	5%	9.0
The number of events called	3%	9%	78%	10%	8.5
SCE	3%	12%	84%	1%	8.4
Incentive levels	7%	12%	80%	1%	7.9
Expected length of 3-4 hours	7%	28%	62%	3%	7.5

Nonresidential participants rate their overall satisfaction with the program at 8.2. Average scores for other program design features range from 7.5 to 8.6 (

Table 48). There are notable differences in average satisfaction ratings for Good Value (50%) participants who gave lower satisfaction scores:

- Average satisfaction with SCE is significantly lower for Good Value (50%) participants (7.6).
- Average satisfaction with program technology is significantly lower (7.5 compared to 8.5 for Maximum savings (30%) and 8.8 for Maximum Savings (100%) participants.
- Average satisfaction with the number of events called is significantly lower on the Good Value (50%) of 7.6 than Maximum Savings (100%) (mean of 8.6) and the Maximum Comfort (30%) (8.1, not statistically significant)
- Average satisfaction with the expected length of events is lower (6.6 compared to 7.7 for both other duty cycle options)

Table 48. Nonresidential Participant Satisfaction Ratings (weighted total, n=126)

Program Design Components	0-3 Score	4-6 Score	7-10 Score	Don't Know	Mean
The program overall	4%	9%	83%	4%	8.2
Duty cycle option	4%	6%	84%	6%	8.6
Program technology	4%	6%	79%	10%	8.5
The number of events called	3%	8%	84%	5%	8.4
SCE	4%	12%	80%	4%	8.1
Incentive levels	3%	17%	74%	6%	7.7
Expected length of 3-4 hours	9%	16%	69%	7%	7.5

Residential and nonresidential participants' positive satisfaction ratings are mostly driven by expected monetary savings, functioning program processes and technology, and little inconveniences (Table 50) Participants with lower satisfaction ratings commonly note that they are dissatisfied with the lack of apparent bill savings, poor communication, or lack of information about the program.

Residential participants report two notable differences depending on their climate. Coastal participants were more likely to state that program and technology work than midrange participants (44% versus 23%). This is also consistent with more midrange (11.3%) than coastal (0.5%) or inland (0.7%) participants noting that they are not satisfied with the program.

Table 49. Drivers of Satisfaction Ratings (multiple responses)

Drivers of Satisfaction Ratings	Residential Weighted Total (n=138)	Nonresidential Weighted Total (n=126)
POSITIVE REASONS		
Monetary incentives/savings	26%	18%
Program/technology works/no complaints	24%	26%
Wasn't much affected/inconvenienced	14%	9%
I like the program/it's a good idea	12%	4%
SCE managed expectations/explained the program well	6%	2%
Environmental benefits	5%	3%
Low effort/it's easy	3%	5%
NEUTRAL REASONS		
No strong feeling either way	9%	6%
Don't know much about it	0%	3%
NEGATIVE REASONS		
Not satisfied with program	9%	6%
No bill savings	6%	0%
Poor communication/information	5%	2%
Incentive is too low	2%	0%
Not enough information	0%	2%
Events are too long	1%	1%
OTHER / DON'T KNOW		
Other	3%	7%
Don't know/refused	3%	16%

Both participant segments note that they are likely to recommend the program to others (Figure 12).

Figure 12. Participants' Likelihood of Recommending the SDP Program to Others
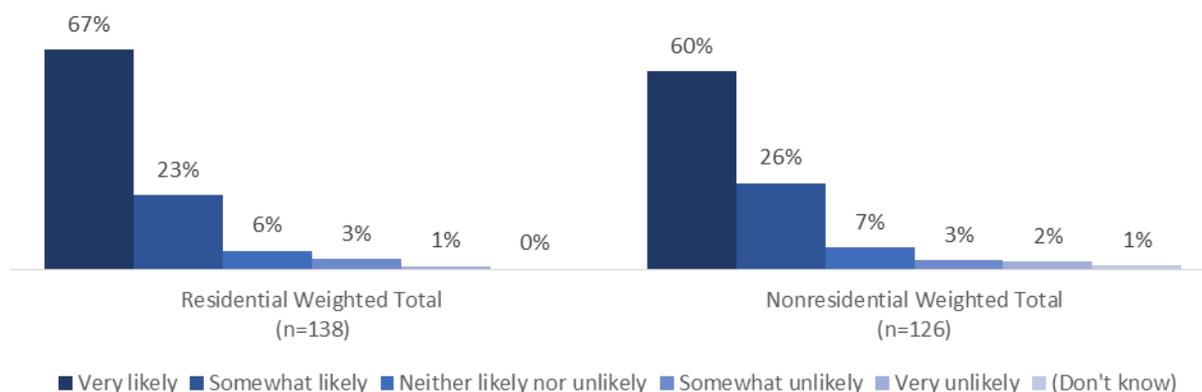
Most participants stated that they are "very likely" or "somewhat likely" to stay enrolled in the program (see Figure 13 below). Only six of 138 residential and two of 126 nonresidential participants note they are not likely to stay with the program.

Figure 13. Participants' Likelihood of Staying Enrolled in the SDP Program

■ Very likely ■ Somewhat likely ■ Neither likely nor unlikely ■ Somewhat unlikely ■ Very unlikely ■ Don't know / Refused
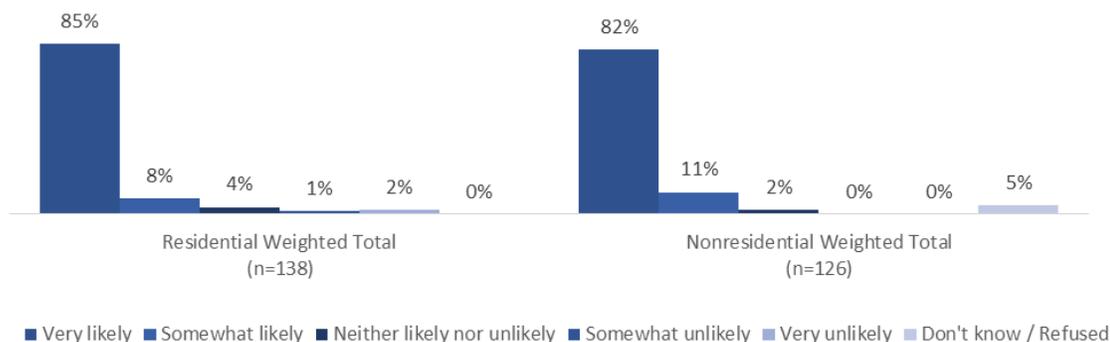
6.7.2   Program Awareness

Bill inserts and direct mail were the most common ways by which participants first heard about the program. For nonresidential participants, a call from the utility was the next most frequently cited approach. About 12% of residential participants noted that they learned about the program through a friend, highlighting the importance of social networks among this population.

Notable differences between participants are as follows:

■   More coastal (39%) than midrange participants (19%) heard of the program through direct mail.

■   About one third (30.5%) of nonresidential Maximum Comfort (30%), compared to 7.3% of Good Value (50%) noted receiving a notification from SCE.

■   More (19%) nonresidential Good Value (50%) than Maximum Savings (100%) participants (5.9%) said they received information on the program through a bill insert.

Table 50. How Participants First Heard about the SDP Program (multiple responses)

How participants first heard about the program	Residential Weighted Total (n=138)	Nonresidential Weighted Total (n=126)
MAIL		
Bill insert	42%	9%
Direct mail	21%	43%
Program letter sent to me upon moving into the house	2%	0%
Postcard	1%	4%
Brochure/flyer	1%	0%
Email	1%	3%
PHONE		
Utility called me/soliciting	9%	17%
Called utility directly	3%	1%
OTHER		
From a friend/word-of-mouth	12%	6%
SDG&E's website	9%	1%
Facility already involved	0%	3%
SCE representative	0%	3%

How participants first heard about the program	Residential Weighted Total (n=138)	Nonresidential Weighted Total (n=126)
Senior management	0%	3%
SDP program website	1%	0%
SDG&E/utility (general/other/unspecified)	1%	1%
Other	2%	1%
Don't know	6%	12%

6.7.3   Motivation to Enroll in the Program

Most of the participants from both segments reported that expected bill reductions or incentive payments were their main motivation to participate in the program.

Table 51. Main Motivation to Participate in the SDP Program

Motivation	Residential Weighted Total (n=138)	Nonresidential Weighted Total (n=126)
Expected reduction in energy bill	68%	58%
Incentive payment	20%	28%
Prevent blackouts	4%	2%
Save the environment/reduce emissions/be a good citizen	2%	9%
It was recommended/offered	1%	1%
Installed with the house when we moved in	1%	0%
Senior management	0%	1%
Other	1%	0%
Don't know	3%	1%

6.8   Awareness of Program Design Features

This section focuses on the participants' understanding of program design features such as event triggers, frequency of events and duty cycle options. While participants seem knowledgeable about the program rationale and explain that they understood their options upon enrollment, their awareness levels of how much cycling to expect and the availability of different duty cycle options is low.

Knowledge of Event Triggers

The SDP program was historically an emergency dispatch program. In 2012, the program added economic dispatch as a SDP event trigger. To notify residential customers of this change, SCE sent a letter to program participants explaining SDP events would likely occur more frequently. In this letter, SCE further highlighted the opportunity to request an override-enabled switch, which would residential enable participants to opt-out of SDP events.

About one-quarter (23%) of residential participants noted, they are aware the program now includes economic event triggers where events can occur more frequently. For the most part, however, participants cite non-economic event triggers when asked why SDP program events occur. For example, half (51%) of all residential participants name avoiding power outages as the primary event trigger. Nonresidential participants most commonly name energy savings (38%), high demand on the grid (26%), and avoiding power outages (23%).

Table 52. Event Triggers ("Why do you think SCE calls SDP events?") (multiple responses)

Event Trigger	Residential Weighted Total (n=138)	Nonresidential Weighted Total (n=126)
Avoid rotating outages/keep the lights on	51%	23%
Save energy/electricity	15%	38%
High demand on grid/limited grid capacity	12%	26%
Reduce emissions	8%	4%
High energy prices	7%	2%
Hot weather	1%	3%
Other	4%	1%
Don't know	10%	13%

Knowledge of Event Frequency, Start/End Time, and Duration

Overall awareness of program-specific design features—such as the maximum number of events, typical event start/end times, and event duration— is low. The SDP program only communicates with participants during special circumstances (such as the communication on higher expected event frequency). As such, the majority of residential (74%) and nonresidential (79%) participants state that they are unaware of the maximum number of event days that could occur.

Figure 14. Participants' Awareness of the Maximum Possible Number of Events per Season
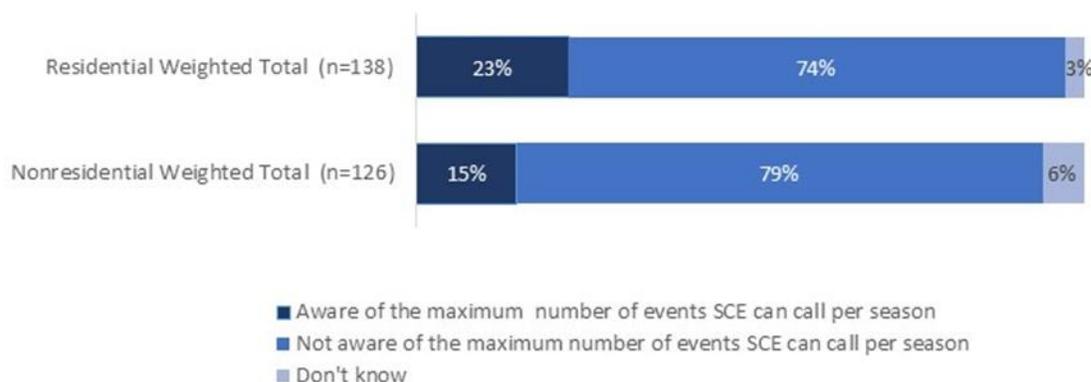
Almost half (48%) of nonresidential participants are unable to estimate the number of event days. Among those who gave estimates, one-third (32%) believe that five or fewer events are called, whereas almost one-fifth (19%) overestimated the number of events called during a typical summer.

Table 53. Participants' Estimated Event Days during a Typical Summer

Estimated Number of Events	Residential Weighted Total (n=138)	Nonresidential Weighted Total (n=126)
5 or less	41%	32%
6 to 10	21%	11%
11 to 20	6%	4%
More than 20	3%	4%
Don't know/refused	29%	48%

Most residential participants estimate the length of a typical SDP event to be 1 to 2.5 hours (37%) or 3 to 5 hours (33%), whereas nonresidential participants' estimates are most commonly under 3 hour (Table 54).

Table 54. Estimated Length of a Typical SDP Event

Estimated Event Duration	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=126)
Less than 1 hour	11%	24%
1-2.5 hours	37%	28%
3-5 hours	33%	11%
6-10 hours	5%	3%
More than 10 hours	0%	0%
Don't know	13%	34%

Table 55 summarizes participants' estimated start and end times of typical SDP events. In PY2013, start and end times for events varied, but most events occurred in the mid to late afternoon periods.

Table 55. Estimated Start and End Time of a Typical SDP Event

Estimated Timing and Duration of a Typical Event	Residential		Nonresidential	
	Time	Don't Know (n=138)	Time	Don't Know (n=126)
Average start time	2 p.m.	10%	12:30 p.m.	30%
Average end time	5:15 p.m.	6%	4:45 p.m.	31%

Awareness of Duty Cycle Options

A participant's duty cycle selection affects the expected load drop from that participant. To maximize program utilization, customers with high load shed potential should thus be enticed to enroll in the highest duty cycle option. However, to attract customers who are not willing or able to subscribe to the 100% duty cycle option upon enrollment, the SDP program offers two duty cycle options for residential participants and three duty cycle options for nonresidential participants:

■ Residential: Maximum Savings (100%) and Maximum Comfort (50%) duty cycle

■ Nonresidential: Maximum Savings (100%), Good Value (50%), and Maximum Comfort (30%) duty cycle

The majority of participants note that they clearly understood the duty cycle options during enrollment. More than two-thirds (69%) of residential participants reported that duty cycle options were clearly explained upon enrollment. However, 50% duty cycle participants are more likely to report that they clearly understood the program duty cycle options (89%), compared to two-thirds (67%) of 100% duty cycle participants.

Figure 15. Residential Participants' Reporting of Clearly Understanding Duty Cycle Options
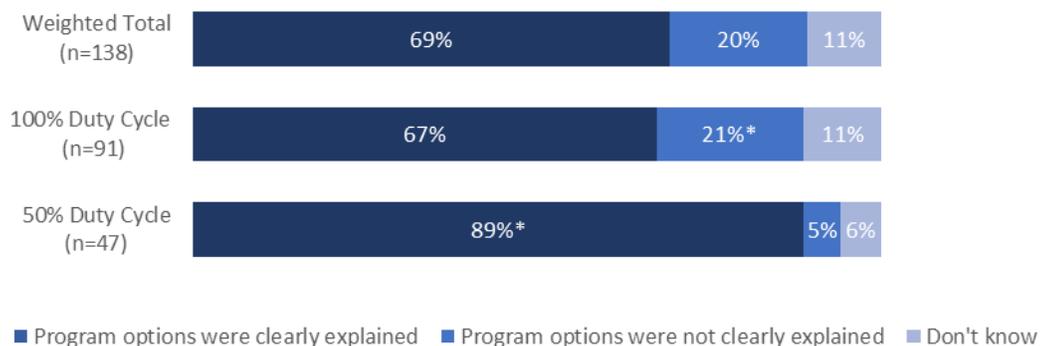
The understanding of duty cycle options is similarly high among nonresidential participants. About two-thirds (62%) report that the duty cycle options were clearly explained at enrollment. There are no significant differences between duty cycle options.

Figure 16. Nonresidential Participants' Reporting of Clearly Understanding Duty Cycle Options
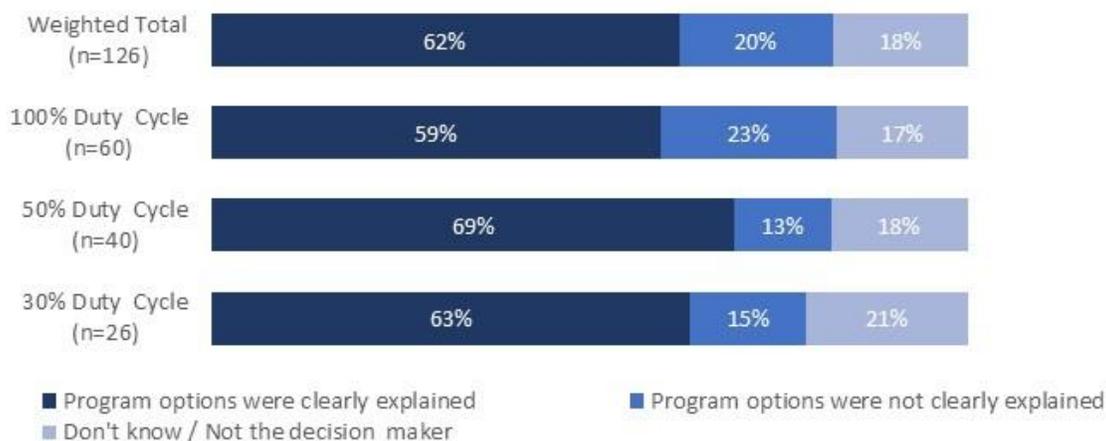
Although two-thirds of the participants indicated that duty cycle options were explained clearly upon enrollment, only half of all residential (50%) and nonresidential (48%) participants said that they were aware of other duty cycle options. Lower current awareness levels might be related to the program's limited interaction with participants (Table 56).

Table 56. Participants' Awareness of Different Duty Cycle Options

Awareness	RESIDENTIAL			NONRESIDENTIAL			
	50% Duty Cycle (n=47)	100% Duty Cycle (n=91)	Weighted Total (n=138)	30% Duty Cycle (n=26)	50% Duty Cycle (n=40)	100% Duty Cycle (n=60)	Weighted Total (n=126)
Aware of multiple duty cycle options	42%	51%	50%	43%	43%	50%	48%
Not aware of multiple duty cycle options	58%	49%	50%	57%	57%	50%	51%

Changing Duty Cycle Options

SDP participants have the option of changing their duty cycle selection any time. Duty cycle adjustments are rare, as the majority of residential (87%) and nonresidential (93%) participants report they have never changing their duty cycle option. Change patterns of duty cycle options are as follows:

- Residential: Eight of 138 (7%) had previously changed their cycling option. There is not a clear pattern on direction of duty option change.

- Small nonresidential: None changed their duty cycle option.

- Large nonresidential: Seven of 126 changed their duty cycle option to lower duty cycle options. Only one increased their selection to Maximum Savings (100%).

6.8.1   Event Notification

Historically, SCE has not offered event notification to program participants. In 2013, the program gave nonresidential participants the option to sign up for opt-in notifications via email or text message. Almost one-third (31%) of the nonresidential participant population indicated that they have taken up this offer. Take-up could further be increased with higher awareness of event notification; nearly two-thirds (61%) of those aware of this feature (52% of participants) have signed up to receive email or text alerts.

Figure 17. Awareness and Sign-Up for Opt-In Event Notification (Nonresidential Only)
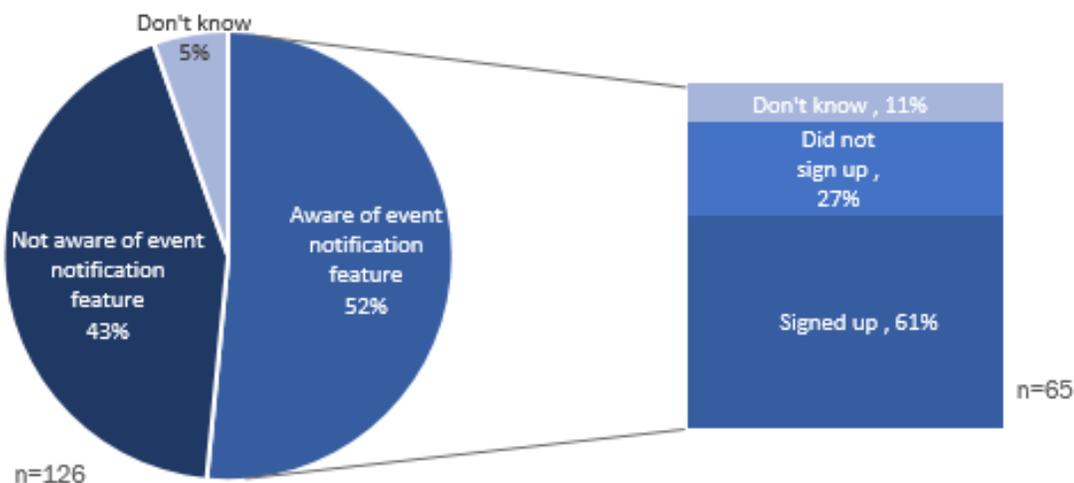
6.8.2   Summer Occupancy Patterns

Before examining event recollection, we first established whether participants were likely to be at their premise (home or business) during possible event days. The majority of residential participants (80%) report that at least one household member is typically home during summer afternoons (see Figure 18 below). Thus, most program households are likely to experience SDP events.

Figure 18. Percent of Residential Participants Generally Home during Summer Afternoons
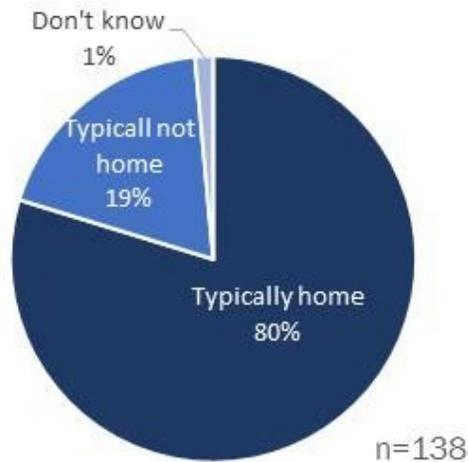
The share of those typically home during likely event periods is particularly high among inland residential participants (Figure 19).

Figure 19. Climate Zones of Residential Participants Home during Event Hours
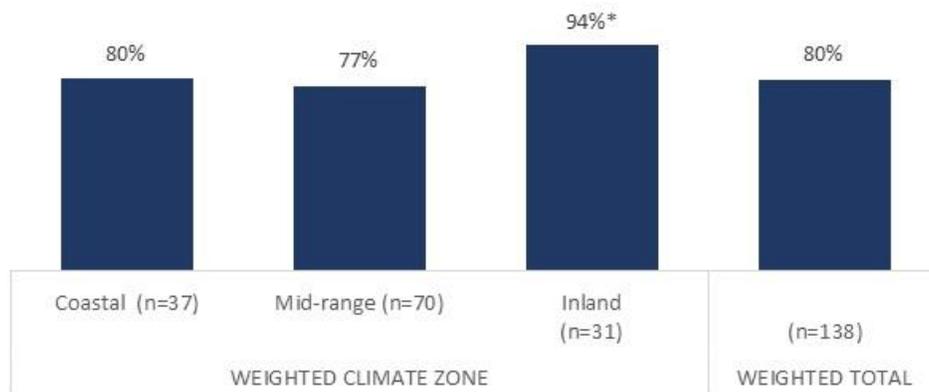
(*) The difference is statistically significant at the 90% confidence level.

Possible event exposure is similarly high in the nonresidential sector. The majority of nonresidential participants (82%) typically operate their facilities between 11 a.m. and 7 p.m., thus are also likely to experience SDP events.

Table 57. Nonresidential Participants' Business Hours (mutually exclusive categories)

Operating Hours	Weighted Total (n=126)
Open between 11 a.m. and 4 p.m.	3%
Open between 11 a.m. and 6 p.m.	13%
Open between 11 a.m. and 7 p.m.	82%
Open between 11 a.m. and evening/night	1%

6.8.3   Event Recollection

While the number of SDP events varies over time, in PY2013 residential participants experienced an average of seven to eight SDP events each (there were 12 residential events in total), whereas nonresidential participants participated in four events. Although most participants are present at their premises during likely event times, only one-third (39%) of residential participants noticed SDP events in 2013, in comparison to half (48%) of nonresidential participants.

How Participants Learn of SDP Events

In the absence of event notification, residential participants most commonly notice SDP events through changes in their AC unit (34%) or the flashing light on the control device (23%). Only 10% of residential participants report that they have no way of knowing whether an event is in progress. However, while the blinking device is equally important to 50% and 100% duty cycle participants (22% and 23%, respectively), a significantly larger share of participants on 100% cycling (36%) than 50% cycling (16%) cite changes in the AC unit as their main way to learn about the program.

As described above, the program offers opt-in event notification to nonresidential participants. As a result, event alerts are the most common way to learn about the program among this group (21%). Other ways to learn about ongoing events include changes in comfort (18%) and noticing changes in the AC unit (16%). Notable differences among nonresidential participant segments include:

- About 21% of Maximum Savings (100%) compared to 7% of Good Value (50%) participants believe events take place any time they feel uncomfortable/hot.

- More small Maximum Comfort (30%) than all large nonresidential participants (13%) notice changes in their AC unit.

- The share of participants who state they have no way of knowing if an event is called is significantly higher among Good value (50%) and Maximum Savings (100%) participants (21% and 8%, respectively).

Table 58. How Participants Learn about SDP Events (multiple responses)

SDP Event Identifiers	Residential Weighted Total (n=138)	Nonresidential Weighted Total (n=126)
TEMPERATURE		
Felt hot, uncomfortable (and assumed an event was called)	19%	18%
My customers felt hot, uncomfortable, complained	0%	6%
My employees felt hot, uncomfortable, complained	0%	4%
It is a hot day, so I assume events are called	4%	4%
The temperature goes up	3%	0%
TECHNOLOGY		
Notice changes in my AC (blows warm air, fan starts, it turns off, sound)	34%	16%
AC Cycling device is blinking	23%	5%
Lose the ability to control my AC	6%	1%
NOTIFICATION		
Receive notification from the utility	5%[a]	21%
OTHER		
Program/IOU website	2%	1%
Friends/family/neighbors	0%	0%

SDP Event Identifiers	Residential Weighted Total (n=138)	Nonresidential Weighted Total (n=126)
Other	3%	5%
DON'T KNOW / NO WAY OF KNOWING		
Don't know	8%	11%
I have no way of knowing an event is taking place	10%	20%

Notes: (a) Residential participants do not receive event notification. However, some participants have both residential and nonresidential accounts. In addition, participants may consider that a Power Save Day notification may have applied to the SDP program.

Event Recollection

When asked directly whether they recalled any SDP events during the summer of 2013, half (49%) of all residential participants stated that they noticed their AC cycling. Figure 20 below shows that recollection among Maximum Savings (100%) participants is higher than among Maximum Comfort (50%) participants. While more than 51% of Maximum Savings (100%) participants noticed a 2013 event, only one-third (27%) of Maximum Comfort (50%) participants did so.

Among those residential participants who did not notice SDP events in 2013 (77 respondents), almost one-third (28%) said that they would not have noticed the event because they typically do not use their AC unit. This may indicate potential free riders within the program.

Figure 20. Residential Participants' Recollection of 2013 SDP Events
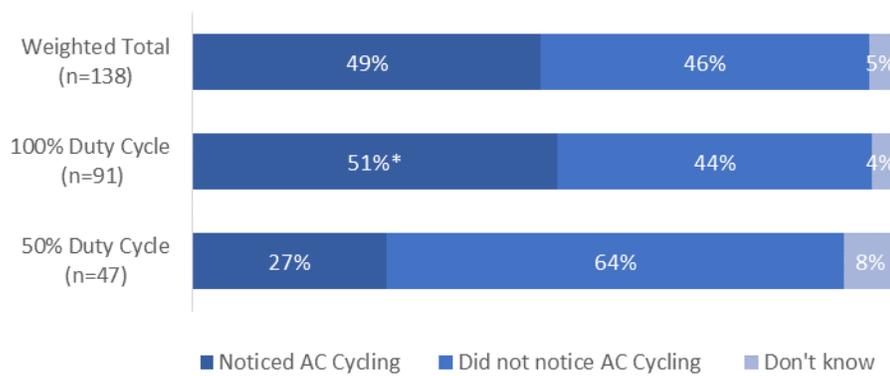
Event recollection levels are similar in the nonresidential participant segment, where almost half (48%) recalled a 2013 SDP event. Figure 21 shows that more large nonresidential (53%) than small nonresidential participants (26%) noticed an event.

Figure 21. Nonresidential Participants' Recollection of a 2013 SDP Event
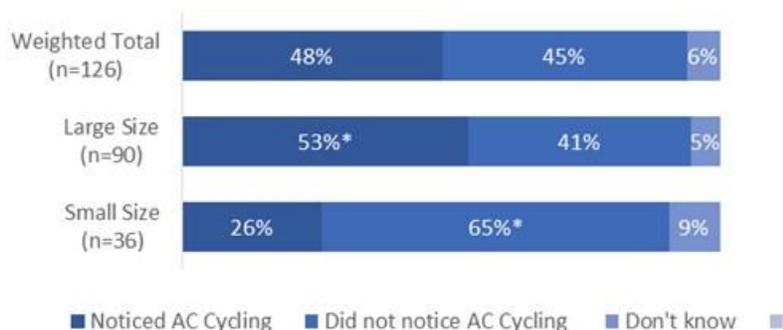
Those unaware of SDP events (62 of 126 respondents) most commonly reported that they do not mind a change in temperature (51%), their customers did not complain about comfort (48%), or the premise was closed (29%). Only 2% of nonresidential participants noted that they would not have noticed an event as the AC unit is regularly turned off to conserve energy, indicating potentially low levels of "free-riding" in the nonresidential participant segment.

6.8.4 Participant Behavior during Events

We examine participants' comfort and behaviors during SDP events to understand if certain customer segments feel more inconvenienced than others, and to help understand the drivers of additional energy savings.

Residential and nonresidential participants' responses to SDP events differ substantially.

Three-quarters of those (39%) residential participants who noticed a 2013 SDP event reported experiencing a change in comfort. While only a small number of Maximum Comfort (50%) participants recalled an event (n=11), it appears that a larger share of Maximum Savings (100%) participants (75%) reported experiencing a change in comfort (Figure 22).

Figure 22. Residential Participants' Change of Comfort during SDP Events
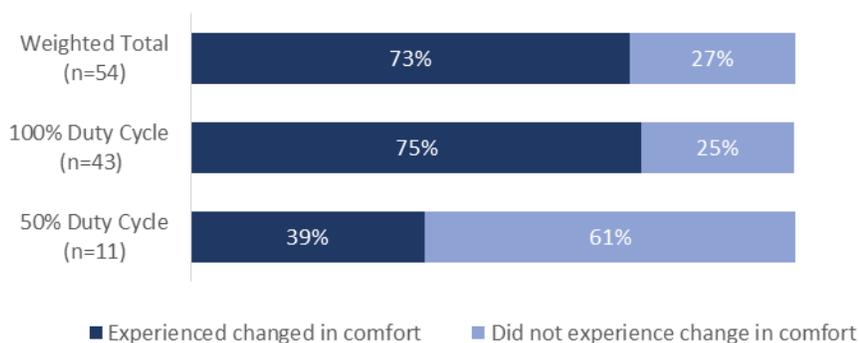
For the most part, nonresidential participants either do not notice or do not experience discomfort during events (possibly, because the four nonresidential events were only one hour long). Only a small share of nonresidential participants who recalled 2013 events (14%, 8 of 54) reported that an event adversely affected business operations. Nevertheless, behaviors that may lead to additional energy savings are fewer in the nonresidential sector (only reported by 25% of participants).

Figure 23. Effects of Event Participation on Businesses (n=54)
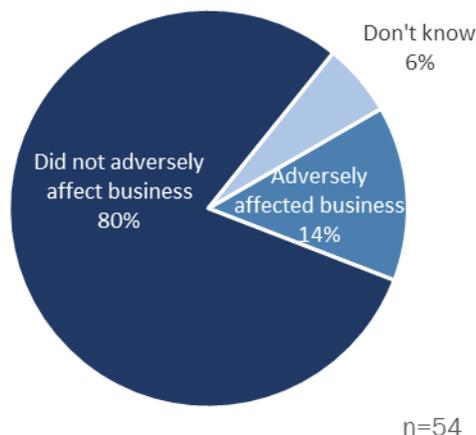
Additional Energy Savings during Events

Among those who recalled a SDP event, 80% of residential and 25% of nonresidential participants state they undertake additional energy-saving actions during events. Notable differences between customer segments exist:

■ Residential: Although discomfort related to events appears to be high for residential participants, the majority (80%) report that they engage in additional energy-saving actions, predominantly by turning off lights or postponing the use of the dishwasher and/or clothes washer. Additional energy savings appear to be more common among coastal (85%) and midrange (88%) than inland participants (35%).

■ Large nonresidential: More than twice as many (54% vs. 22%) Maximum Savings (100%) than Maximum Comfort (30%) participants report engaging in additional energy-saving activities.

Table 59. Additional Energy-Saving Behaviors during Events

Event Behavior	Residential				Nonresidential
	Coastal (n=11)	Midrange (n=33)	Inland (n=10)	Weighted Total (n=54)	Weighted Total (n=54)
Undertake additional energy savings	85%	88%	35%	80%	25%
Do not undertake additional energy savings	15%	12%	55%	18%	22%
Don't know	0%	0%	11%	2%	4%

Table 60 lists additional energy-saving activities participants undertake during events.

■ Residential: most commonly turn off lights (40%), postpone usage of their clothes washer (38%) or dishwasher (31%), and unplug appliances (26%)

■ Nonresidential: most commonly turn off lights (55%), unplug appliances (15%), and keep the facility cool by closing curtains (12%) or using the fan instead of the AC (12%)

Table 60. Types of Energy-Saving Activities during Events (multiple responses)

Energy-Saving Activity	Residential Weighted Total (n=41)	Nonresidential Weighted Total (n=24)
REDUCE ENERGY USE		
Turn off lights	40%	55%
Run clothes washer earlier or later in the day	38%	0%
Run dishwasher earlier or later in the day	31%	9%
Unplug appliances	26%	15%
Don't cook/bake	7%	6%
Turn off HVAC unit	7%	9%
Change settings (lower or increase) in thermostat	5%	10%
Line dry clothes	1%	0%
Use as little energy as possible (general)	0%	2%
KEEP THE HOUSE COOL		
Close down curtains to keep house/facility cool	14%	12%
Use the fan instead of the AC unit	8%	12%
Open windows	4%	2%
Close windows/doors	4%	0%
OTHER/DON'T KNOW		
Leave the house	7%	0%
Other	11%	2%
Don't know	0%	1%

6.8.5   Overriding Events

According to SCE's estimates, less than 1% of the program population has the override-enabled load switch, leaving the majority of participants without the technical capabilities to override an SDP event. Opinion Dynamics asked participants whether they would accept a lower incentive payment in exchange for the option to override events, which SCE already offers to new customers. For the most part, we found that the majority of residential and a sizable number of nonresidential participants do not have a strong interest in overriding an event when the tradeoff is a lower incentive payment (62% of residential and 41% of nonresidential participants). Only 16% of residential and 37% of nonresidential would like this option.

Figure 24. Desire to Override Event Participation in Exchange for Lower Incentive
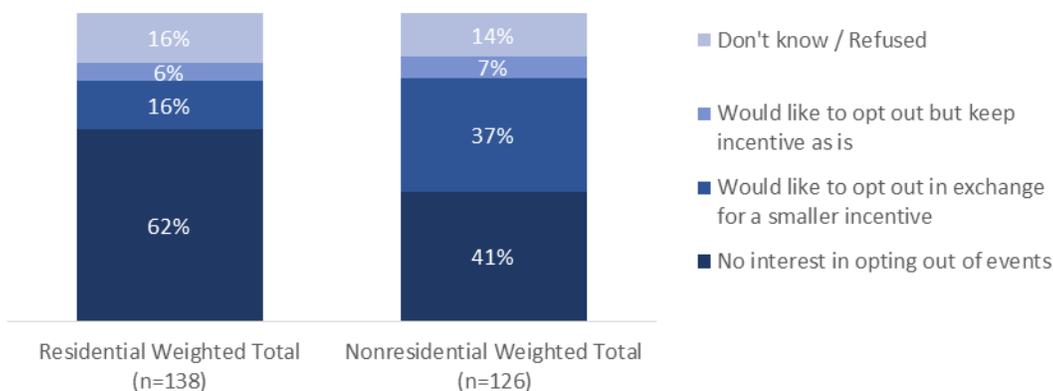
6.8.6 Snapback Effects

Snapback effects can occur in the aftermath of induced low-usage periods, such as when energy demand spikes in an effort to cool down a premise after SDP events. Opinion Dynamics examined participant-reported behaviors during and after events that may lead to snapback effects. In general, one-fifth of nonresidential participants who recalled SDP events (or 11% of the entire nonresidential participant segment) reported engaging in activities that lead to snapback, such as lowering their thermostat after an event.

Table 61. "Have you ever changed the temperature settings of your AC unit after a SDP event?"

Lower thermostat in the aftermath of a SDP event	Weighted Total (n=54)
Yes, after all events	16%
Yes, after some events	6%
No	74%
Don't know	4%

About 30% noted that they would either always or sometimes pre-cool the facility had they been aware of an upcoming event.

Table 62. "Would you pre-cool your facility if you were aware that an event would take place?"

Would Pre-Cool facility	(n=126)
Yes, before all events	22%
Yes, before some events	8%
No	68%
Don't know	3%

6.8.7 Program Communication

With the exception of special circumstances (such as when the program changed its program design to include economic dispatch), participants do not receive frequent information about the SDP

program. Almost half of all residential (40%) and nonresidential (47%) participants state that they would like to receive more frequent information about the program.

For nonresidential participants, the interest in more frequent communication is highest among half of large Good Value (50%) and Maximum Savings (100%).

Table 63. Participants' Desire for More Frequent Program Communication

■ Want more frequent information   ■ Do not want more frequent communication   ■ Don't know
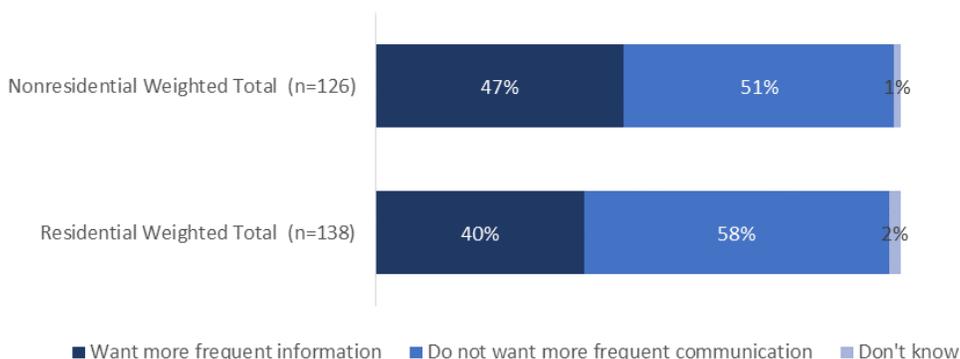
Email is the preferred way to receive program information for both residential (45%) and nonresidential (63%) participants. Although Maximum Comfort (50%) participated noted, they prefer direct mail.

Table 64. Preferred Way to Receive Program Information

Preferred Way to Receive Program Information	Residential Weighted Total (n=138)	Nonresidential Weighted Total (n=126)
MAIL		
Email	45%	63%
Direct mail/newsletter	16%	26%
Bill insert	32%	1%
PHONE		
Phone call	6%	1%
Text message	0%	2%
OTHER		
Website	0%	0%
Personal contact	0%	1%
Don't know/refused	1%	4%

6.8.8   Customer Support

The program provides customer support through SCE's website and Call Center operations. The majority of residential (86%) and nonresidential (82%) participants are familiar with SCE's website, and a sizable number (61% and 64%, respectively) are aware of the utility's toll-free hotline. Awareness of the SDP-specific phone lines is lowest, at 41% for both residential and nonresidential participants.

More nonresidential Good Value (50%) participants are aware of SCE's website (96%) than are Maximum Savings (100%) (78%) and Good Value (30%) (79%) participants.

Figure 25. Participants' Awareness of Customer Support Tools
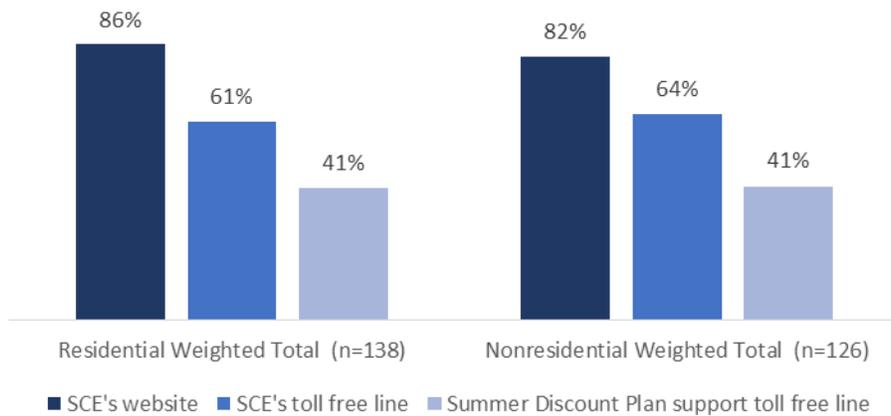
6.8.9   Support of Remote Cycling

When asked whether participants preferred SCE to cycle their AC unit remotely, or would rather have the ability to initiate cycling themselves upon event notification or other utility intervention, the majority of residential (87%) and nonresidential (88%) participants state that they like the convenience of remote cycling.

Figure 26. Support of Remote Cycling among Residential Participants
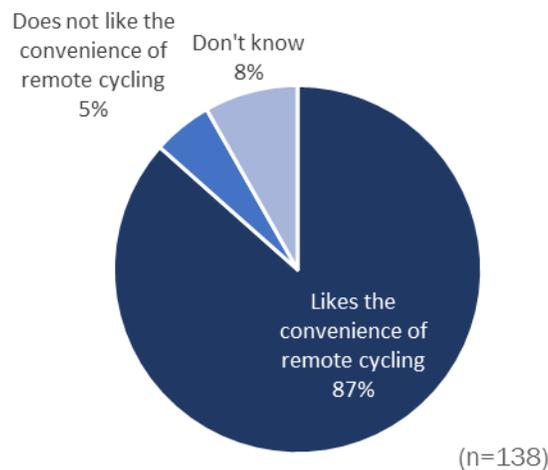
Figure 27. Support of Remote Cycling among Nonresidential Participants

(n=126)
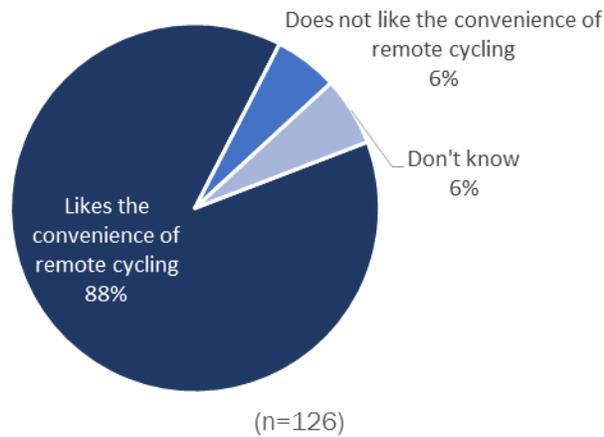
6.8.10   Reasons for Leaving the SDP Program

SCE's program-tracking data designates customers who have left the program with the following flags:

1.   Account termination date

2.   Program status (Removed or Out of Service)

Program records do not indicate the reasons why participants may have left the program. Since program inception, the tracking data notes that 55,423 residential customers and 1,122 nonresidential customers have left the program. We have fielded a lapsed customer survey to 110 customers who left the program: 70 residential, 30 small nonresidential and 10 large nonresidential.

6.8.11   Lapsed Customer Event Recollection

Lapsed customers recalled the events at a higher rate than did active participants, despite no apparent difference occupancy patterns. Table 65 shows that just over half of the customers reported experiencing SDP events (52% residential; 55% nonresidential). There were no significant differences in event recall for the residential or nonresidential participants (i.e., by climate zone or size).

Table 65. Event Recall

Customer Segment	Recalled Events	Did Not Recall Events or Don't Know
Residential (n=71)	52%	48%
Nonresidential (n=40)	55%	45%

Note: Rounded percentages.

6.8.12   Reasons for Leaving the Program

Customers who had previously enrolled in the SDP program most commonly explained they left the program because of life events (moving, family additions, etc.). Only one-tenth stated that comfort levels (12%) or technology problems (10%) were the reasons for leaving the program.

Table 66 shows that residential customers noted multiple reasons for leaving the SDP program:

- Nearly two-thirds (65%) cited life events (i.e., moving, illnesses, and new babies and pets)
- Several customers (10%) noted technology issues
- Only about one in eight (12%) noted their discomfort during an SDP event
- About 7% of respondents did not realize they were no longer program participants

Table 66. Reasons Residential Customers Left the Program (multiple response)

Reasons for Leaving the Program	Weighted Percent (n=71)
Life Events	**65%**
Moved	50%
On a medical baseline tariff/illness	12%
New baby	2%
New pet	1%
SDP Event Issues	**12%**
Felt uncomfortable/hot during event days	12%
Technology Issues	**10%**
Load switch adversely impacted/not compatible with HVAC/ contractor removed my control device	5%
My HVAC unit was not working/upgraded/replaced	3%
Added solar to my home	2%
Switched to an evaporator	1%
Customer Classification Issues	**8%**
Did not know I was no longer a participant/did not opt-out	7%
No longer qualified for the program	1%
Program Design Issues	**7%**
Did not like that utility was controlling HVAC unit/"big brother"	2%
Did not like not being notified/not knowing when events happen	2%
Program staff was not helpful/responsive	2%
Incentive payments were not enough	2%
My energy bill increased/thought bill would increase	1%
Don't know	**6%**

Note: Category totals in bold are not always the sum of the reasons they include due to rounding and avoiding double counting of customers with multiple responses.

Table 67 shows the reasons nonresidential lapsed customers left the SDP program.
- The most frequently stated reason among these customers was a change in operations (54%), which was primarily moving premises (51%).
- Nearly one in six customers (15%) did not realize they were no longer program participants.
- About one in eight (13%) reported discomfort or interference with their business practices.

Table 67. Reasons Nonresidential Customers Left the Program (multiple response)

Reasons for Leaving the Program	Weighted Percent (n=40)
Change in Operations	**54%**
Moved/no longer on premise	51%
Closed account	2%
Customer Classification Issues	**15%**
Did not know I was no longer a participant/did not opt-out	15%
AC Cycling Event Issues	**13%**
Felt uncomfortable/hot during event days	8%
Adversely affecting my business processes (e.g., manufacturing products, storing products, etc.)	5%
Technology Issues	**4%**
My HVAC unit was not working/upgraded/replaced	3%
Added solar	1%
Program Design Issues	**4%**
My energy bill increased/thought my bill would increase	3%
Incentive payments were not enough	1%
Other	**6%**
Not original decision-maker	6%
Don't know	**5%**

Note: Category totals in bold are not the sum of the reasons due to rounding and multiple responses

6.8.13   Duty Cycle Changes among Lapsed Customers

As with the active participant population, the majorities of both residential (87%) and nonresidential lapsed customers (80%) did not change incentive and cycling options after first signing up for the program. The few residential and nonresidential customers who did change provided various reasons for doing so.

Table 68. Change in SDP Program Options

Change in SDP Program Options	Residential (n=71)	Nonresidential (n=40)
Did not change incentive/cycling options after sign-up	87%	80%
Changed incentive/cycling options because customer…	6%	3%
Did not know of changed incentive and cycling options	7%	17%
Total	**100%**	**100%**

Note: Rounded percentages.

6.9   Suggestions for Program Improvement

The majority of residential (66%) and nonresidential (76%) participants did not have program improvement suggestions.

We also asked lapsed participants about changes they would have liked to see in the program that may have led them to consider not leaving. While suggestions for overall program improvements vary, both residential and nonresidential lapsed customers name the provision of event notification most frequently.

Table 69. Lapsed Customers' Suggestions for Improvement (multiple response)

Suggestions	Residential (n=71)	Nonresidential (n=40)
Improving the Explanation of Program Design and Options	**17%**	**13%**
General Information and Updates	**11%**	**13%**
Provide better information/updates on personal energy bill and savings	6%	3%
Provide better information on effects/how the program functions	3%	-
Provide more information/periodic updates	3%	6%
Provide event information/notification on event days and times		2%
Better explain cycling options/provide examples/cheat sheet		1%
Methods for Information	**5%**	**3%**
Provide information through a letter/bill inserts/flyer	3%	3%
Provide information through service reps/more personal contact	2%	-
Provide information through website/smartphone app/online	2%	-
Providing Immediate Information	**6%**	**-**
Provide information through a phone call or text/more direct phone communication	4%	-
Provide a digital monitor/meter	2%	-
Improving the Program	**10%**	**2%**
Improve control technology equipment	3%	-
Allow customers to cycle their own AC by themselves	2%	-
Increase knowledge of onsite subcontractors	2%	-
Improve the response of customer service to control technology issues	2%	-
Improve customer service in general	2%	-
Do not enroll customers who live in hot locations and depend on their AC	1%	-
Decrease bill	1%	-
Help pay for the unit	-	2%
Did not have a suggestion/don't know	**74%**	**85%**

Notes: (a) Rounded percentages.
(b) Category totals in bold are not the sum of the reasons due to rounding and multiple responses

6.10 Tracking Database

Issues with the SDP program-tracking data were minimal. Our main recommendation to improve data management is the inclusion of "Reasons for leaving the program," and the provision of additional customer phone numbers where a common contact (such as a property manager) manages multiple participant premises, as both would improve targeting for future evaluations.

The SDP program database's unique records focus on the device level. Each device record has program participation data (device ID, "active" or "inactive" customer status, enrollment date, opt-out date, duty cycle option, event bank number), customer characteristics (SCE rate plan code, residential or nonresidential rate type, NAICS code where applicable), and customer contact information (name, address, phone number).

While preparing the survey sample, some minor issues became apparent:

1. **Missing "opt-out reason":** While the SDP program database captures the program participation status and opt-out date, it does not currently record reasons for why lapsed customers leave the program. To better understand why customers leave the program, and to be able to reduce exodus, SCE should consider establishing high-level categories for reasons why customers leave (e.g., moving, illness/medical baseline, life event, technology, discomfort, etc.). This would further enable potential re-enrolling of customers who left the program for "fixable" reasons.

2. **Missing duty cycle data for lapsed customers:** The duty cycle option on lapsed customers' devices is set to "0." We recommend that SCE also track the last duty cycle option before they left the program, to determine whether participants in particular duty cycle cohorts are more likely to leave the program, thus enabling the development of interventions to maintain these participants in the program.

3. **Residential devices linked to nonresidential participants:** A number of devices are installed in residential homes and flagged with Rate Type "domestic" (278). However, these premises appear to be managed by a larger entity (i.e., property managers). Where this is the case, SCE should consider capturing phone numbers of residents, when possible, for the purpose of future studies or direct contact with the resident of the premise.

4. **Devices without customer account numbers:** ID numbers for 8,640 devices could not be matched to the customer account numbers provided by SCE separately from the program-tracking data.

5. **Discrepancies between status code and non-participation date:** We found a small number of devices that were recorded with an inactive status date but did not have a non-participation date (186), or were coded as active but had a duty cycle selection of "0" (70). As per discussions with SCE, these devices were considered inactive. Consider reviewing and updating these records.

7. SDG&E Summer Saver Program Process Evaluation

This chapter provides the detailed process evaluation findings and recommendations for the San Diego Gas & Electric (SDG&E) Summer Saver program. In this chapter, we address the following research objectives:

- Document program description and design features
- Describe PY2013 Summer Saver events
- Document program implementation, including contractor responsibilities and participant acquisition and enrollment
- Report on overall program satisfaction
- Discuss awareness of the program and events, including notification of program events and customer communications
- Describe participants' reactions to events and engagement with the program, including action during events and snapback effects
- Assess reasons for why lapsed customers left the program
- Recommend program improvements

Note that this chapter provides details of all SDG&E Summer Saver program-specific findings. These are also summarized in the integrated section of the report. This detailed chapter is intended for the SDG&E staff running the program.

7.1 Program Description

SDG&E's Summer Saver program commenced in 2005 as a demand response (DR) program to curtail energy consumption during local and statewide emergencies or at times of peak demand.

SDG&E installs one-way communicating load switches with the ability to temporarily disengage air conditioning units when demand response events are in progress. SDG&E, through its program aggregator, Comverge, installs a load control switch. Participant customers receive an annual bill credit on their SDG&E bill at the end of the event season for program enrollment based on AC tonnage and cycling options. While participants do not get lower tariffs as a result of participating in this program, the load switch device does qualify as an enabling technology, and therefore can yield a higher bill credit for Peak Time Rebate, should the participant reduce below their target. Participants who leave the program are not eligible for the annual bill credit and do not receive partial bill credits.

The Summer Saver program can occur up to 120 hours during the event season, May 1 through October 31, with a 40 hour/month and three event/week maximum. Historically, the program has not offered notifications for Summer Saver events, although opt-in notifications are now available. Although no capacity load shed is specifically mandated, SDG&E has established a capacity target of 42 MW to 100 MW. The Summer Saver program is available to residential and small commercial customers whose usage does not exceed 100kW per month within a 12-month cycle. Some exceptions are in place for schools that exceed the 100 kW threshold.

Table 70 shows the active enrollment of participating customers in the event as of December 2013 by duty cycle selection. The program had 23,085 residential and 4,620 nonresidential program participants.

Table 70. Summer Saver Program Enrollment as of December 2013

Customer Type	Cycling Option	Active Participants	% of Participants	Enrolled Control Devices	% of Enrolled Devices
Residential	100%	11,302	41%	3,929	36%
	50%	11,783	43%	13,787	35%
	Subtotal	23,085	83%	27,716	71%
Commercial	50%	3,201	12%	7,511	19%
	30%	1,419	5%	3,839	10%
	Subtotal	4,620	17%	11,350	29%
TOTAL		27,705	100%	39,066	100%

Note: Participants based on unique account number.

Some participants are dually enrolled in other programs offered by SDG&E. For nonresidential customers, other demand response programs include the Base Interruptible, Capacity Bidding, Critical Peak Pricing, Technology Incentives, and Permanent Load Shifting programs. Residential participants with smart meters were defaulted to the Reduce Your Use (RYU) Days, a voluntary program where customers who reduce energy consumption on specific days according to a calculated baseline receive bill credit rewards for the amount of energy reduced (this program is currently available as an opt-in option only).

7.2   Program Design Features

Table 71 highlights the PY2013 program design for the SDG&E Summer Saver program.

Table 71. SDG&E Summer Saver Program Design Characteristics

Category	Description – SDG&E Summer Saver Program
Program inception year	2005
Program period	May 1 through October 31
Technologies offered	Direct load switch with one-way paging communication
Eligible customers	Residential customers and commercial facilities with average monthly peak demand up to 100 kW over a 12-month period (some exceptions made for schools)
Event period	Anytime between 12 p.m. and 8 p.m. on weekdays
Event duration	From 2 to 4 hours
Event limitations	■ Not to exceed 40 hours/month, 120 hours, or 15 days per year, 3 events/week ■ Holidays and weekends excluded
Exclusions	No events called on weekends (beginning in 2013) or holidays
Duty cycle options	■ Residential: 100% and 50% ■ Nonresidential: 50% and 30%
Duty cycle option change allowed?	■ Yes, at any time ■ Customers who enroll between September 1 and October 31 must enroll at the 50% cycling option ■ Customers who want to select the 100% cycling option must do so before Sept, 1st

Category	Description – SDG&E Summer Saver Program

Incentive payments	■ One-time bill credit issued in December
	■ Residential incentives:
	  ■ 100% duty cycle: $38/ton, up to $152 annual bill credit/per enrolled AC unit
	  ■ 50% duty cycle: $11.50/ton, up to $46 annual bill credit/per enrolled AC unit
	■ Nonresidential options:
	  ■ 50% duty cycle: $15/ton
	  ■ 30% duty cycle: $9/ton

Emergency triggers	■ CAISO Stage 1 emergency ■ CAISO Stage 2 emergency ■ Local emergencies ■ Forecasted peak load of more than 3,800 MW in the SDG&E service territory ■ SDG&E discretion
Economic dispatch	No economic triggers are in place
Events notification	■ Via phone, opt-in only
Event override	■ Not available
Opt-out of program?	Customer may opt-out of the program anytime. However, customers who opt-out during a program year do not receive partial compensation (that is, they forfeit their incentive payment for the year). No waiting period exists for re-enrollment.
Enrollment options/ customer Support	■ Comverge-managed Call Center: 1-800-850-1705 ■ Open from 8 a.m. to 6 p.m. PST, Mon-Fri
Program implementers aggregators	■ Comverge has been the program's aggregator since the program's inception in 2005, and the contract is valid through 2016

The program has been generally implemented according to its design.

7.3   Program Design Changes

SDG&E implements the program through an aggregator, Comverge. The contract with Comverge is in place through at least 2016, which in some ways limits SDG&E's ability to change the program significantly. However, the program underwent some design changes over time.

Table 72. Major Program Design Changes since Inception

Category	Description	Timing
Weekend Option	Program had a weekend option for DR AC Cycling events with a $10 bonus.	Eliminated in 2013
Event Notifications	SDG&E introduced opt-in event notification. About 1,100 participants signed up as of early 2014.	Introduced in 2013
Duty Cycle Options	■ Limited the incentive choices toward the end of each program year to minimize free ridership and "program hopping." As of September 1 of each program year, newly enrolled customers must start at the lower duty cycle option. Customers who seek to change their cycling option can transition to a lower duty cycle.	Introduced in 2013
Duty Cycle Options	■ Removed nonresidential 100% duty cycle option ■ Introduced nonresidential 30% duty cycle option	Introduced in 2011

7.4   PY2013 Summer Saver Events

This section describes PY2013 Summer Saver events.

7.4.1   Event Characteristics

For PY2013, the Summer Saver program called six system wide events within a two-week period in August and September. Three of the six events occurred on consecutive days in late August, and the remaining three events took place the following week. All events were 4 hours in duration.

The program infrastructure allows for targeting of events to particular substations or circuits if necessary. The program did call one test event that occurred with 600 customers on one circuit.

Table 73. SDG&E Summer Saver Program DR events

Event Date	Day of Week	Reported MW Available	Reported MW Results	Activation Start Time	Activation End Time	Duration (Hours)
8/28/2013	Wednesday	11.4	12.9	3:00 PM	7:00 PM	4
8/29/2013	Thursday	13.5	11.5	2:00 PM	6:00 PM	4
8/30/2013	Friday	14.6	20.1	1:00 PM	5:00 PM	4
9/3/2013	Tuesday	12.7	14.3	1:00 PM	5:00 PM	4
9/5/2013	Thursday	13.6	15.3	1:00 PM	5:00 PM	4
9/6/2013	Friday	14.2	21.0	1:00 PM	5:00 PM	4

7.4.2   System Peaks vs. DR Event Timing

The SDG&E Summer Saver events generally coincided with the system peaks.

Figure 28. DR Events Timing Compared to System Peak
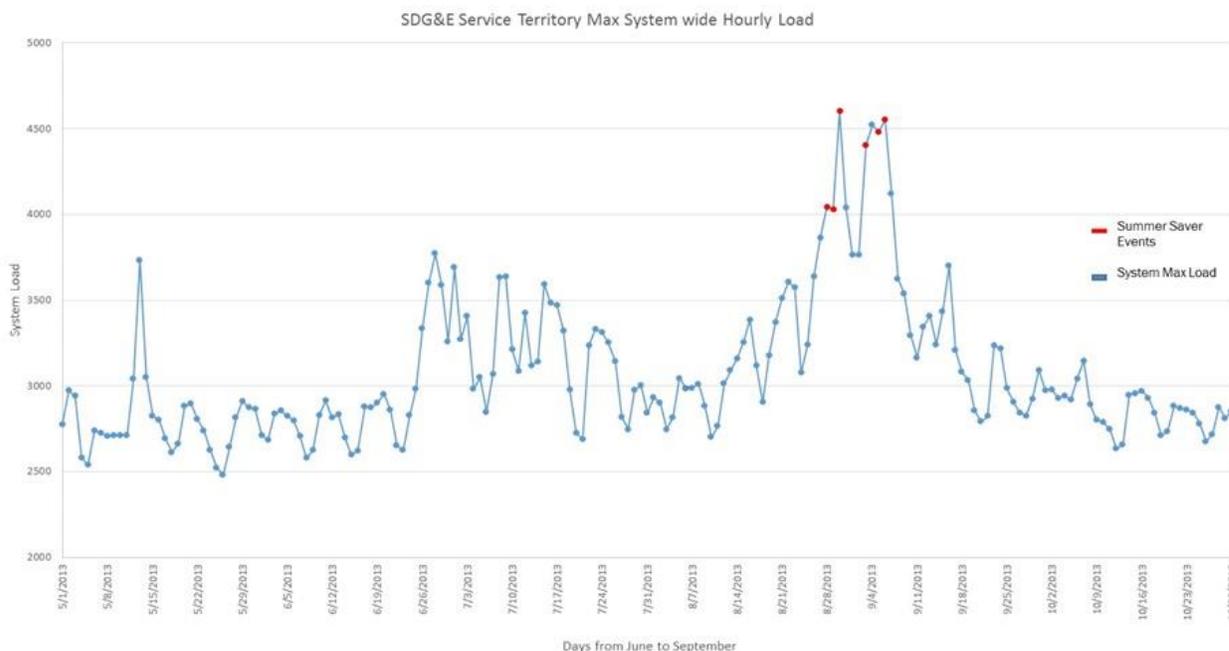
Figure 29 shows event durations against the system peak mapping.

Figure 29. System Peak vs. Event Period
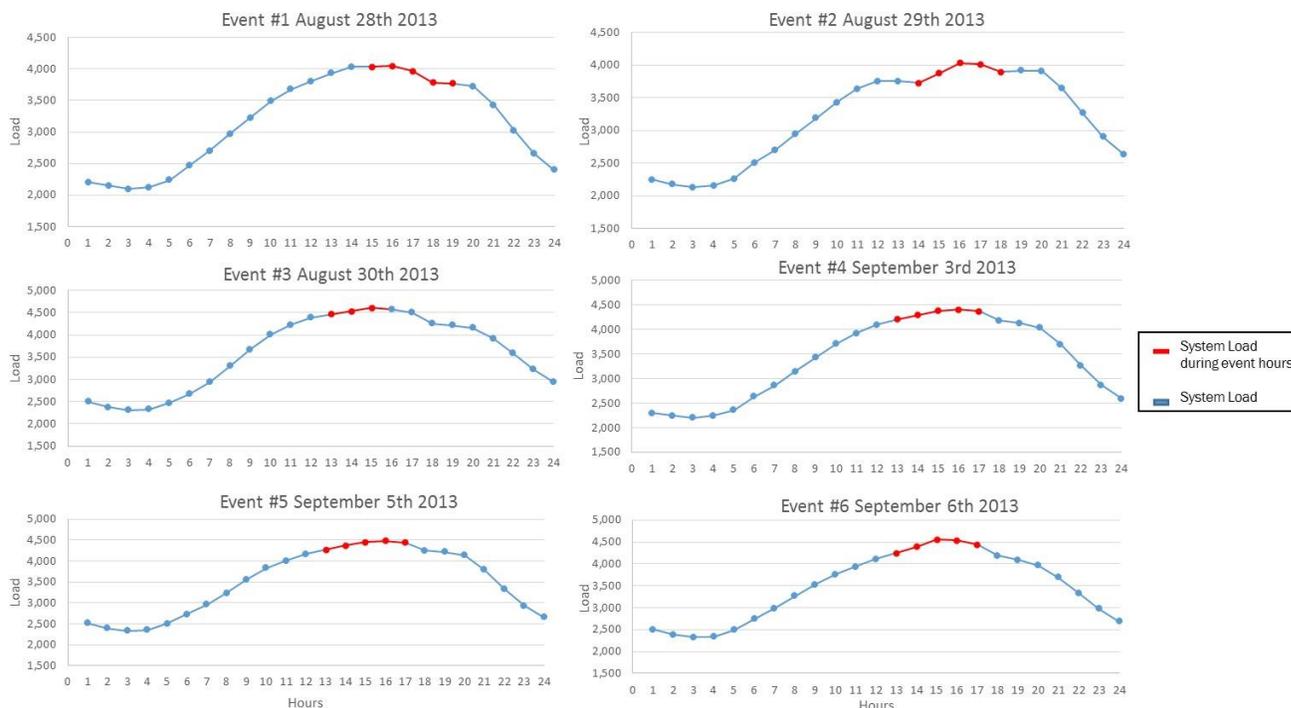
7.5   Program Technology and Expected Failure Rates

Comverge provides the direct load control switch used to cycle AC units. The load switch is generally installed outdoors or adjacent to the customer's AC unit, and is activated remotely through a paging signal. When DR events are in progress, the load switch receives a radio signal, which turns the device on and off according to the selected duty cycle. All load switches are one-way communicating devices.

Load switches generate load reduction by directly controlling the operation of the AC compressor. An AC compressor has two modes: on or off. The amount of cooling provided is determined by how much the compressor runs. Duty cycle, expressed in percentage terms, indicates the run-time of an AC unit during a period of time. A 50% duty cycle would indicate that the unit is running a total of 30 minutes in an hour. A 100% duty cycle essentially shuts off the AC unit from running during the event period.

Given the one-way communicating nature of the load control devices, it is challenging to determine exact failure rates and to determine whether a device is still operational. The SDG&E Summer Saver program staff reports an expected 7% failure rate on the load switch devices, some of which were installed a decade ago. Comverge receives payment based on a verified load shed capacity, and thus has an incentive to optimize the measureable load available through the program participants. Until recently, Comverge randomly inspected up to 20% of its installed load switches to identify and replace failed ones. Recently, with the deployment of smart meters, analysis of this data enables pinpointing participants whose loads did not drop after one or more Summer Saver event. This serves as an indicator of a potential device failure, and this premise then receives an inspection of its load switches. Comverge reports that review of smart meter data indicated that about 1% of customers did not have an observable load drop. (That does not necessarily equate to failure rates, as some previously failed

devices have been replaced, given the implementer sweep of deployed switches to test for operational use, and other participants may not have been using their AC units). If used more widely, leveraging smart meter data will reduce costs of randomly inspecting load switches by reducing the number of switches inspected.

7.6   Program Implementation

Comverge has the primary responsibility to implement the program in its entirety. As an aggregator, Comverge positions the program as a Virtual Peaking Capacity (VPC) plant (i.e., the utilities contract to receive a capacity in the form of load drop). In the process, SDG&E outsources all of the program processes. Comverge then receives a capacity payment for the kW that it can measurably deliver when Summer Saver events occur.

Table 74. SDG&E Summer Saver Program Primary Responsibilities

Aggregator Primary Responsibilities	SDG&E Primary Responsibilities
■ Marketing ■ Customer recruitment ■ Device testing and installation ■ Device maintenance/service calls ■ Customer service ■ Deliver program capacity during events	■ Program design changes ■ Review and approval of program marketing materials ■ Summer Saver event triggers (along with CAISO) ■ Vendor/Invoice management ■ Issuing bill credits to participants at year end

7.6.1   Participant Acquisition and Enrollment

As a mature program, Comverge's current marketing strategy is aimed at replacing customers who leave the program through attrition (moves or opting-out) to maintain a target range of load that can be shed during Summer Saver events. Prospective customers are identified using data analytics available through SDG&E's smart meter deployment, where customers are typically targeted based on a threshold amount of energy consumption, indicating they may have a central AC unit and are likely to use it during Summer Saver event days. Current marketing campaigns focus on new enrollments (Enrollment Outbound), re-enrolling those who previously left the program (Enrollments Win-Backs), and reconnecting disconnected customers and replacing failed switches (Reconnects).

The current primary marketing method is direct mail; however, past marketing efforts also included telemarketing and door-to-door canvassing. On its website, SDG&E highlights annual bill credits, maintaining electricity reliability, greenhouse gas reductions, and natural resource conservation as benefits for Summer Saver program participation.[17]

Marketing costs are included in the capacity charge paid to Comverge to achieve load shed for the program. Costs per enrolled customers vary depending on the marketing approach used. Rough costs, depending on approach, range from $35 per enrolled customer for outbound calling to $69 per enrolled customer for direct mail.

Once customers decide to enroll in the program, they have three options:
■ Mail: submitting a postage-paid reply card
■ Online: through the program's website: (www.summersaverprogram.com)
■ Phone: SDG&E Summer Saver program customer service representative

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[17] http://www.sdge.com/rebates-finder/sdge%E2%80%99s-summer-saver-program

When participants leave the program due to moving, the program maintains the premise as an active participant. Given the cost of removing switches (rolling a truck, technician time) and the fact that deactivated switches do not adversely impact the AC operation and are out of sight (as AC units are typically outside or on the roof), the device remain in place as otherwise stranded assets. The program mails the new premise occupants a letter notifying them that their home is already a Summer Saver program participant. Thus, they are automatically enrolled in the program, but give them information about what to do should they desire to opt-out.

In premises that stay vacant, Comverge regularly reviews customer lists to determine whether a premise that opted-out has become vacant or changed occupants. In these events, Comverge reaches out to these customers via direct marketing or soliciting phone call to gauge whether these new customers would want to enroll in the program.

7.7 Participant Program Engagement

This section describes participant engagement with various elements of the program, their awareness levels of program details, and their behavior during/after Summer Saver events.

Opinion Dynamics fielded a survey to the Summer Saver program's participants in February 2014 to examine their experience with program processes, general awareness of DR events, and behavior during and after events. Given the timing of this study, Opinion Dynamics fielded this survey several months after participants experienced their last Summer Saver event (September 2013). While the survey was specific about event times, some recollection bias may exist, simply based on the delay between the participant experience with the DR program and the time when they were asked about it.

Opinion Dynamics completed 198 surveys with residential and 90 surveys with nonresidential participants. We further segmented sample cells to ensure adequate representation of duty cycle choices (100% and 50% for residential, 50% and 30% for nonresidential) and climate zone (coastal and inland)—see Appendix C for the sampling plan for the survey and climate zone allocations.

Opinion Dynamics established sample sizes to yield a 90% confidence with a ±10% precision in survey results at the program level. We weighted the aggregate results of total participants, duty cycle and climate zone to ensure that they proportionally represent the selected strata in the program population. Table 75 highlights the completed active participant surveys based on customer segment, duty cycle, and climate zone.

Table 75. SDG&E Summer Saver Program Participant Survey Completes

Program Technology/ Choice	Coastal	Inland	Total	% of Total
Residential				
100% Duty Cycle	20	73	93	32%
50% Duty Cycle	20	85	105	36%
Residential Subtotal	**40**	**158**	**198**	**68%**
Nonresidential				
50% Duty Cycle	20	25	45	16%
30% Duty Cycle	20	25	45	16%
Nonresidential Subtotal	**45**	**45**	**90**	**32%**
TOTAL – All Completes	**85**	**203**	**288**	**100%**

7.7.1   Participant Satisfaction

Residential program participants gave the program overall a mean satisfaction score of 8.3 which is slightly above the mean rating for participants' satisfaction with SDG&E (8.0). Satisfaction scores for specific program design features range from 7.5 for satisfaction with incentive levels and duration of event, to 8.3 for satisfaction with duty cycle options. Notable differences include:

■ 100% duty cycle rate program satisfaction higher (8.9) than 50% duty cycle participants (7.6)

■ 100% duty cycle also were more satisfied with their duty cycle option (9.2) compared to 50% duty cycle participants (7.5)

Table 76. Residential Participant Satisfaction across Duty Cycle Options

On a scale from 0 to 10, how satisfied are you with…	Weighted Total Mean (n=198)	50% Duty Cycle (n=105)					100% Duty Cycle (n=93)				
		0-3 Score	4-6 Score	7-10 Score	Don't Know	Mean	0-3 Score	4-6 Score	7-10 Score	Don't Know	Mean
The program overall	8.3	8%	15%	76%	1%	7.6	1%	5%	94%	0%	8.9*
The duty cycle option	8.3	7%	21%	65%	8%	7.5	1%	5%	87%	7%	9.2*
Program technology	8.2	7%	19%	59%	15%	7.6	1%	7%	78%	15%	8.9*
SDG&E	8.0	10%	13%	76%	1%	7.5	4%	8%	86%	2%	8.5*
Number of events	7.9	9%	15%	65%	10%	7.5	1%	15%	78%	6%	8.5*
Expected length of 3-4 hours	7.5	13%	22%	60%	6%	6.8	2%	17%	78%	4%	8.1*
Incentive levels	7.5	11%	22%	59%	8%	6.8	4%	13%	76%	7%	8.1*

Note: *The difference is statistically significant at the 90% confidence level.

Respondents most commonly reported positive satisfaction because the program/technology worked well (28%) and due to the level of incentives or bill savings (15%). Bill savings were especially important to 100% duty cycle participants (25%, compared to 5% for 50% duty cycle participants).

Participants with lower satisfaction ratings most commonly reported that the program/technology does not work for them (7%), that communication about the program is poor (4%), and that their bill remained high (4%).

Table 77. Drivers of Satisfaction Ratings from Residential Customers (multiple responses)

Drivers of Satisfaction Score	50% Duty Cycle (n=105)	100% Duty Cycle (n=93)	Weighted Total (n=198)
POSITIVE REASONS			
Program/technology works/no complaints	23%	33%	28%
Monetary incentives/bill savings	5%	25%*	15%
Wasn't much affected/inconvenienced	14%	10%	12%
Environmental benefits	7%	12%	9%
I like the program/it's a good idea	6%	6%	6%
SDG&E managed expectations well	4%	4%	4%
Low effort/it's easy	5%	2%	4%
NEUTRAL REASONS			
No strong feeling either way	8%	5%	6%
Don't know much about it	3%	1%	2%
NEGATIVE REASONS			

Drivers of Satisfaction Score	50% Duty Cycle (n=105)	100% Duty Cycle (n=93)	Weighted Total (n=198)
Program/technology does not work	9%	5%	7%
Poor communication/information	7%	2%	4%
No bill savings/bill still high	7%*	1%	4%
Events are too long	1%	0%	1%
OTHER / DON'T KNOW			
Other	6%	10%	8%
Don't know/refused	14%	15%	11%

Satisfaction among nonresidential participants is slightly lower, with an overall score of 7.3. For specific program features, mean satisfaction scores range from 6.6 for event duration to 7.7 for the technology.

Table 78. Nonresidential Participant Satisfaction (n=90)

On a scale from 0 to 10, how satisfied are you with…	0-3 Score	4-6 Score	7-10 Score	Don't Know	Mean
The program overall	7%	28%	65%	2%	**7.3**
Program technology	2%	22%	59%	17%	**7.7**
Number of events	3%	30%	59%	8%	**7.3**
The duty cycle option	3%	33%	57%	7%	**7.2**
SDG&E	7%	34%	55%	4%	**7.0**
Incentive levels	8%	34%	51%	7%	**6.8**
Expected length of 3-4 hours	11%	35%	50%	5%	**6.6**

Nonresidential participants most commonly explain high satisfaction ratings with working program processes or technology (16%), or they did not feel adversely affected or inconvenienced (10%). Participants' main drivers of dissatisfaction include insufficient information about the program/events (9%), poor communication (7%), or negative impacts on employee comfort (7%).

Table 79. Nonresidential Customers Drivers of Satisfaction Scores (multiple responses)

Drivers of Satisfaction	Weighted Total (n=90)
POSITIVE REASONS	
Program/technology works/no complaints	16%
Wasn't much affected/inconvenienced	10%
Monetary incentives/savings	8%
Low effort/it's easy	7%
Environmental/community benefits	6%
I like the program/it's a good idea	3%
SDG&E managed expectations well	1%
NEUTRAL REASONS	
No strong feeling either way	1%
Don't know much about it	0%
NEGATIVE REASONS	
Not enough information	9%
Not satisfied with effects on facility and employee comfort	7%

Drivers of Satisfaction	Weighted Total (n=90)
Poor communication/information	7%
Problems with technical support/service	5%
Not satisfied with program	5%
Does not work for our business model	2%
No bill savings	0%
Events are too long	0%
OTHER/DON'T KNOW	
Other	14%
Don't know/refused	12%

The majority of residential participants are either "very likely" (54%) or "somewhat likely" (30%) to recommend the Summer Saver program to others. Figure 30 shows that the share of participants who would "very likely" recommend the program is highest among 100% duty cycle participants.

Figure 30. Residential Participants' Likelihood of Recommending the Program to Others
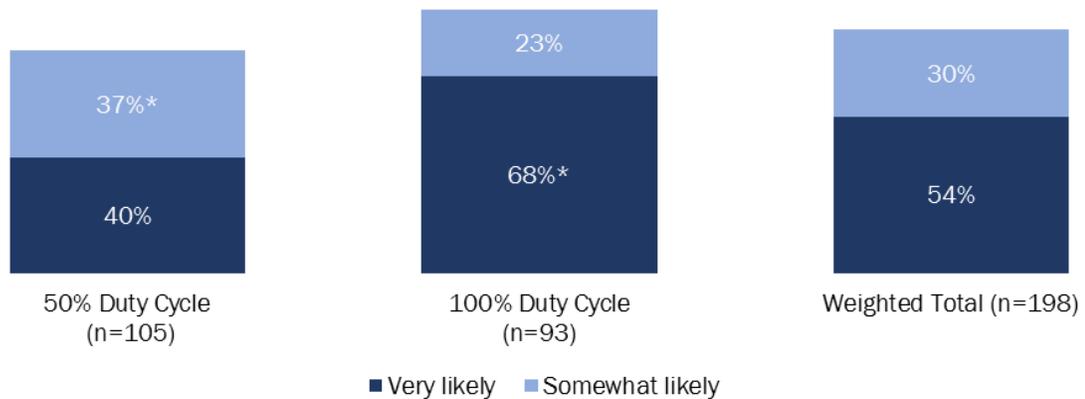
(*) Note: The difference is statistically significant at the 90% confidence level.

In comparison, slightly fewer nonresidential participants state they are "very likely" (41%) or "somewhat likely" (39%) to recommend the Summer Saver program to others (Figure 31).

Figure 31. Nonresidential Customers' Likelihood of Recommending the Program to Others
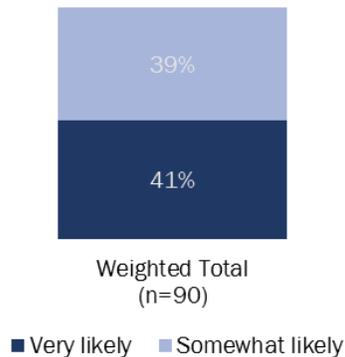
The majority of residential (78%) and nonresidential (67%) participants indicate that they will "very likely" stay enrolled in the program. More residential 100% duty cycle participants (85%) state so than 50% duty cycle participants (71%).

Table 80. Participants' Likelihood of Staying Enrolled in the Program

Likelihood of Staying Enrolled	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
Very likely	78%	67%
Somewhat likely	13%	16%
Neither likely nor unlikely	4%	1%
Somewhat unlikely	1%	8%
Very unlikely	3%	5%
Don't know	2%	2%

7.7.2   Program Awareness

Direct mail was the most effective method of reaching residential participants, with more than 67% noting that as how they first heard about the program, followed by outbound calling at 9%. The reverse occurred for nonresidential participants, where less than one-third (27%) learned about the program through direct mail, and 41% learned through telemarketing activities. Notably, almost one-third of nonresidential participants learned about the program through friends or utility information.

Table 81. How Participants Learned about the Summer Saver Program (multiple responses)

How Participants First Heard about the Program	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
MAIL	**67%**	**27%**
Bill insert	36%	17%
Direct mail	27%	6%
Postcard	4%	1%
Brochure/flyer	2%	0%
Program letter sent to me upon moving into the house	2%	1%
Email	4%	2%
PHONE	**9%**	**41%**

How Participants First Heard about the Program	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
Utility called me/soliciting	7%	32%
Called utility directly	2%	10%
OTHER	**12%**	**27%**
From a friend/word-of-mouth	6%	9%
Utility representative	0%	8%
SDG&E/utility (general/other/unspecified)	2%	4%
SDG&E's website	2%	3%
TV/radio/mass media advertising	2%	0%
Senior management/colleague	0%	1%
Contractor/"when they hooked up the AC"	0%	1%
Don't know	**12%**	**6%**

7.7.3 Motivation to Enroll in the Program

More than two-thirds of residential participants state that bill savings (55%) or the incentive payment (20%) were the primary motivators for program participation. Next, participants most commonly cited emission reductions or environmental benefits (11%).

Among 100% duty cycle, primary drivers were: role of incentive payments (26%). This was also true for inland participants (20%). Among 50% duty cycle, primary drivers were environmental benefits (20%)

Table 82. Residential Participants' Motivation to Enroll in the Summer Saver Program

Motivation to Participate	Weighted Total (n=198)
Expected reduction in energy bill	55%
Incentive payment	20%
Save the environment/reduce emissions	11%
Prevent blackouts	7%
Save energy	4%
Not using AC much anyway	2%
Getting a new thermostat	1%
Other	2%
Don't know	3%

Only 35% of nonresidential participants say incentive payments are the main driver for participation. Environmental benefits play a larger role for almost one-quarter (23%), which may be in line with corporate goals or green targets, followed by expected bill reductions (21%).

Interestingly, there seem to be different motivations to participate among nonresidential cohorts. While group sizes are small, trends in the data show that almost half of the coastal 50% duty cycle participants report expected bill savings.

Table 83. Nonresidential Participants' Motivation to Enroll in the Program (multiple responses)

Nonresidential Participants' Motivation	Weighted Total (n=90)
Incentive payment	35%
Save the environment/reduce emissions/be a good citizen	23%
Expected reduction in energy bill	21%
Prevent blackouts	5%
Save energy	4%
Getting a new thermostat	1%
It was recommended/offered to us	1%
Other	2%
Don't know	8%

7.7.4   Awareness of Program Design Features

While participants seem knowledgeable about why SDG&E calls events (Table 84), their knowledge of event-specific program components is low.

Knowledge of Event Triggers

Almost two-thirds of all residential participants (65%) and over half (54%) of the nonresidential participants indicated avoiding power outages as the dominant reasons why events occur.

Table 84. Event Triggers (Why do you think SDG&E calls Summer Saver events in the summer?)

Customers' Understanding of Triggers for DR Events	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
To avoid rotating outages/keep the lights on	65%	54%
To reduce emissions	13%	5%
High demand on grid/to reduce demand on grid/limited capacity	8%	5%
High energy prices	8%	9%
Save energy/electricity	6%	17%
Save money	1%	0%
Natural disaster emergencies(wildfires, high winds, earthquakes)	1%	1%
Hot weather	0%	1%
Other	1%	2%
Don't know	7%	7%

Knowledge of Event Frequency, Start/End Times, and Duration

Awareness of program-specific features is also low. About 42% of residential and 53% of nonresidential participants cannot estimate the number of event days during a typical summer. Still, a sizable portion of residential (16%) and nonresidential (23%) participants overestimate the number of event days (gave estimates of 11 or higher, see Table 85 below). Over-estimates suggest that participants may perceive the Summer Saver program as more demanding than it is in reality, or that they potentially confuse Summer Saver events with other SDG&E demand response programs.

Table 85. Participants' Estimated Event Days during a Typical Summer

Estimated Number of Events	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
5 or less	21%	12%
6 to 10	22%	12%
11 to 20	12%	14%
More than 20	4%	9%
Don't know/refused	42%	53%

In PY2013, the SDG&E Summer Saver programs were 4 hours in duration. About one-third of residential (34%) and 15% of nonresidential responses were within this time allocation. That is, residential participants tend to better estimate the average event duration of 4 hours, whereas nonresidential participants believe events are 2 hours in duration or less.

Table 86. Participants' Estimated Length of a Typical Summer Saver Event

Estimated Event Duration	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
Less than 1 hour	5%	15%
1-2.5 hours	25%	23%
3-5 hours (actual PY2013 event duration)	34%	15%
6-10 hours	11%	9%
More than 10 hours	0%	1%
Don't know	25%	37%

Knowledge of Event Start and End Times

Residential participants estimate an average start time of approximately 1 p.m. (which corresponds to four of six events in 2013). Nonresidential participants estimate an earlier average start time of 12:15 p.m.

Table 87. Average Estimated Start and End Times of a Typical Summer Saver event

Estimated Time/Duration of a Typical Event	Residential		Nonresidential	
	Time	Don't Know	Time	Don't Know
Average start time	1.00 p.m.	19%	12:15 p.m.	22%
Average end time	6.00 p.m.	19%	4:45 p.m.	26%

Awareness of Duty Cycle Options

In general, awareness of multiple duty cycle options is low. Slightly more than one-third (39%) of residential and 11% of nonresidential customers of the program's multiple duty cycle options.

About half (48%) of residential 100% duty cycle participants are more aware of multiple choices, compared to less than one-third (31%) of 50% duty cycle participants. This may represent an untapped potential for additional load shed from already-enrolled customers, and underscores a need for more clarity and information regarding duty cycle options.

Table 88. Participants' Awareness of Different Duty Cycle Options

Awareness of Different Duty Cycle Options	RESIDENTIAL			NONRESIDENTIAL		
	50% Duty Cycle (n=105)	100% Duty Cycle (n=93)	Weighted Total (n=198)	30% Duty Cycle (n=45)	50% Duty Cycle (n=45)	Weighted Total (n=90)
Aware of different duty cycle options	31%	48%*	39%	13%	10%	11%
Not aware of different duty cycle options	69%*	52%	61%	87%	91%	89%

Note: *The difference is statistically significant between duty cycles at the 90% confidence level.

Although awareness of multiple duty cycle options is low, slightly more than half of residential participants (54%) state that the duty cycle options were clearly explained upon enrollment. This may suggest that participants refer to the concept of cycling more broadly or the impacts of their own duty cycle selection but that different duty cycle options were a decision made upon enrollment and have since been forgotten.

However, one-third noted not clearly understanding program options. This lack of clarity may have led residential participants to select a perceived-as-less-risky 50% duty cycle option. In other words, residential participants who reported lack of clarity in program options were more likely to select the 50% duty cycle option.

Figure 32. Residential Participants Reporting that Duty Cycle Options Were Clearly Explained
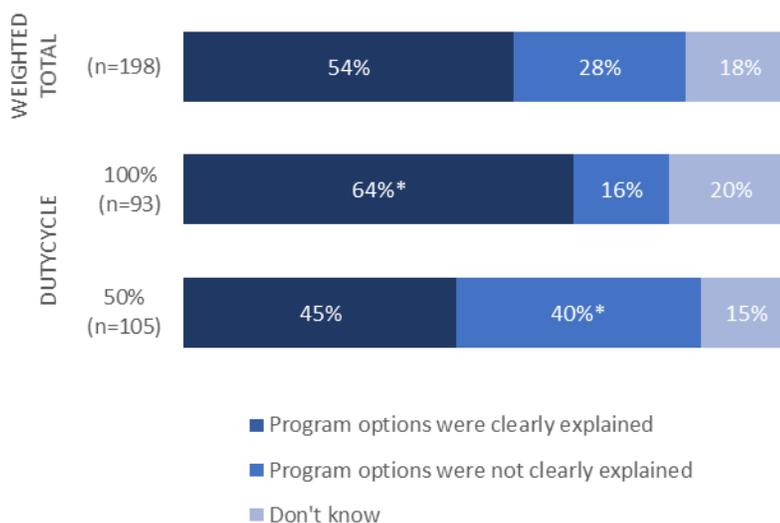
Note: (*) The difference is statistically different at the 90% level.

The reverse trend is true for nonresidential participants. While fewer nonresidential participants reported that duty cycle options were clearly explained (28%) upon enrollment, participants with the lower 30% duty cycle report a slightly higher level of awareness of multiple program options.

Figure 33. Nonresidential Participants Reporting that Duty Cycle Options Were Clearly Explained
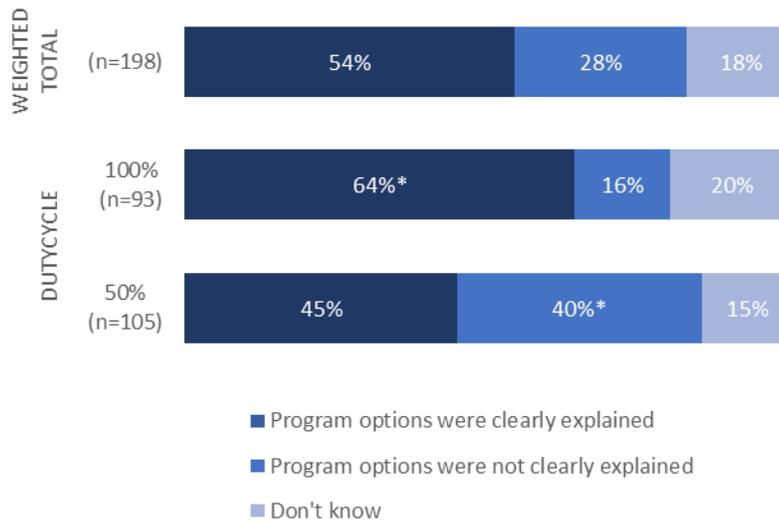
Note: (*) The difference is statistically different at the 90% level.

Changing Duty Cycle Options

SDG&E Summer Saver program participants have the option to change their duty cycle selection at any time. However, only about 7% of respondents exercised this option.

The share of residential participants who had changed duty cycles is almost even between the 50% duty cycle participants (8%) and the 100% duty cycle participants (7%). This indicates no strong change from one duty cycle option to another.

Similarly, few (6%) nonresidential participants indicated that they have previously changed their duty cycle option (4% of 30% duty cycle participants; 7% of 50% duty cycle participants).

Table 89. Percentage Participants who Changed their Duty Cycle Option

Participants	Weighted Total
Residential Participants	**(n=198)**
Yes	7%
No	88%
Don't Know	5%
Nonresidential Participants	**(n=90)**
Yes	6%
No	93%
Don't Know	1%

7.7.5   Event Notification

Historically, SDG&E did not notify participants of Summer Saver events other than announcing events on its website (about 3% indicated they have checked SDG&E's website for ongoing events although 21% of residential and 17% of nonresidential participants are aware of this website feature). As noted above, only a minority has previously gone online to check if an event is in progress.

In early 2013, the program offered an opt-in event notification option. SDG&E reports that as of early 2014, only a minority of the Summer Saver program participants (~1,100 customers, approximately 4% of the active participant population) had signed up for opt-in notification.

Only a small share of all participants are aware of the notification option (15% and 18% of residential and nonresidential participants, respectively). About 9% of residential survey respondents reported that they signed up to receive event notification, whereas only 2% of nonresidential participants did so. This overestimate could be a result of incorrect self-reporting by survey respondents, selection bias, or respondents confusing Summer Saver program notifications with other SDG&E alerts, such as those for the Reduce Your Use program.

Table 90. Awareness and Take-Up of Event Notification Features

Notification Features	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
Aware of event notification feature	15%	18%
Signed up for event notification	9%	2%
Aware of Summer Saver program website	22%	17%
Checked website for ongoing events	3%	3%

Awareness tends to lead to higher opt-in rates. Almost 59% of residential participants who are aware of the opt-in feature reported having already signed up (Figure 34). This suggests that low opt-in rates about notification may be related to low awareness levels of the opt-in notification option.

Among nonresidential participants, the conversion is slightly lower, where of the 16 respondents who were aware of event notification, only two (14%) had signed up.

Figure 34. Residential Participant Awareness and Sign-Up for Event Notification
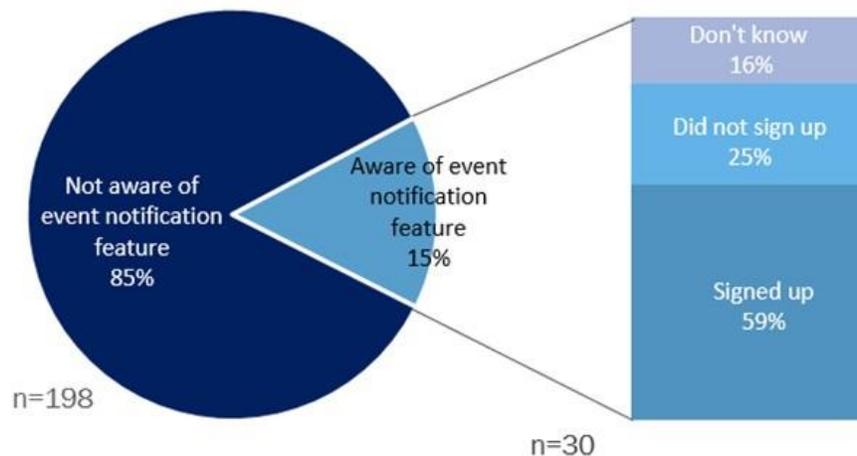
Figure 35. Nonresidential Participant Awareness and Sign-Up for Event Notification
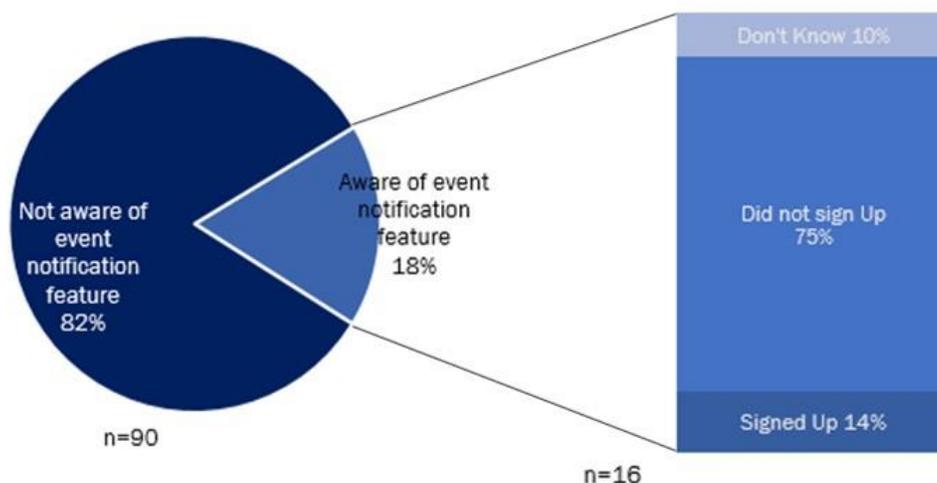
7.7.6 Event Recollection

Occupancy Patterns

Before examining event recollection, we first established whether participants are likely to be at home/business during likely event days.

- The majority of residential participants (82%) report that at least one household member is typically home during summer afternoons. Therefore, most program households are likely to experience events.

- Most nonresidential premises (86%) are typically open for business through 7 p.m. More inland (92%) than coastal (75%) participants reported operating during this timeframe.

How Participants Learn of Events

As call notification is "opt-in" and few participants have signed up to date (Table 90), participants are most likely to learn of Summer Saver events through changes in temperature and comfort (39% residential, 46% nonresidential), followed by changes in the AC unit (21% residential, 13% nonresidential). Notable differences between residential customer segments include:

- A significantly larger share of 100% duty cycle participants assume the program automatically triggers event days on all hot days (14%, compared to 5% of 50% duty cycle participants).

- Almost one-fifth (18%) of inland participants reported noticing an event through changes in their AC unit, in comparison to only 7% of coastal participants. This is not surprising, given that coastal residents tend to use their AC units less frequently.

Table 91. How Participants Learn about Summer Saver events (multiple responses)

Ways Active Participants Learn of Ongoing Events	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
TEMPERATURE/COMFORT	39%	46%
I felt hot, uncomfortable	29%	33%

Ways Active Participants Learn of Ongoing Events	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
My customers or employees felt hot, uncomfortable	0%	9%
It is a hot day, so I assume events are called	9%	3%
The temperature goes up	1%	2%
HVAC UNIT	**21%**	**13%**
I notice changes in my AC (blows warm air, fan starts, it turns off, sound)	15%	11%
AC Cycling device is blinking	5%	3%
I lose the ability to control my AC	1%	0%
NOTIFICATION	**6%**	**10%**
I receive notification from the utility via email *	5%	7%
I receive notification from the utility via SMS/text	1%	2%
I receive notification from the utility via phone	0%	1%
OTHER	**6%**	**1%**
Friends/family/neighbors	1%	0%
Program/IOU website	1%	0%
Other	4%	1%
DON'T KNOW / NO WAY OF KNOWING	**34%**	**31%**
Don't know	15%	11%
I have no way of knowing an event is taking place	19%	20%

*Note: The program does not offer email notification. Respondents who stated email notification may be confusing the Summer Saver program with other alerts. Omitting the 7% suggests that 3% of participants have signed up for notification, which is comparable to the 2% from Table 98.

Event Recollection

In PY2013, program participants experienced six system-wide Summer Saver events. Although most participants indicated that someone is likely present at the venue during possible event times, event recollection is relatively low. Only half of the residential (50%) and nonresidential (54%) participants noticed an event in the summer of 2013.

Table 92. Participants' Recollection of 2013 Summer Saver Events

Noticed a PY2013 Summer Saver Event	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
Yes	50%	54%
No	45%	38%
Don't know	5%	8%

7.7.7   Consecutive Event Days

SDG&E called Summer Saver events in three consecutive days, followed by two consecutive days of events. All PY2013 events occurred within a two-week period. SDG&E wanted to assess participants' reactions to multiple consecutive event days, specifically whether they were more likely to experience discomfort and therefore leave the program due to experiencing events over consecutive event days.

In general, awareness of events was low. While half (50%) of residential participants noticed an event, only one-fifth (21%) recalled experiencing events on consecutive days. Interestingly, a larger share of

coastal (27%) than inland respondents (19%) recalled the consecutive cycling, though the difference is not statistically significant.

Nonresidential participants show similar low recollection patterns. One-fifth (22%) of nonresidential participants recalled the three consecutive event days, compared to 54% who recalled any 2013 event.

Table 93. Recollection of Consecutive Event Days in August 2013

Participant Recollection	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
Noticed Summer Saver event	50%	54%
Noticed consecutive Summer Saver events	21%	22%
Undertook different steps on consecutive event days	12%	11%

Approximately half of the residential (59%) and nonresidential (49%) participants who recalled the consecutive events indicated they took additional steps to cool their premises during these event days.

Table 94. Energy-Saving Behaviors during Consecutive Event Days

Measures Taken during Consecutive Event Days	Residential Frequencies (out of 24)	Nonresidential Frequencies (out of 10)
Turned on AC unit earlier in the day to pre-cool the house	6	2
Used fans	6	3
Left the house/facility	4	2
Lowered temperature settings of AC after event	4	0
Opened windows	3	0
Changed behavior (not active, pool)	2	0
Turned off electric appliances	2	0
Postponed certain energy-consuming tasks	1	0
Kept doors shut	0	1
Other	0	2
Don't know	4	0

Participants were further asked if consecutive event days may increase their likelihood to leave the program. The vast majority stated they are unlikely to leave the program due to consecutive cycling. Figure 36 shows the percentage of residential participants who said they would likely leave the program after two or three consecutive event days. Notably, more 50% duty cycle participants leave the program after two and three consecutive days of cycling.

Figure 36. Residential Participants' Likelihood of Leaving Program after Consecutive Event Days
(Percentage of participants who rated 7-10, where 0 is "very unlikely" and 10 is "very likely")
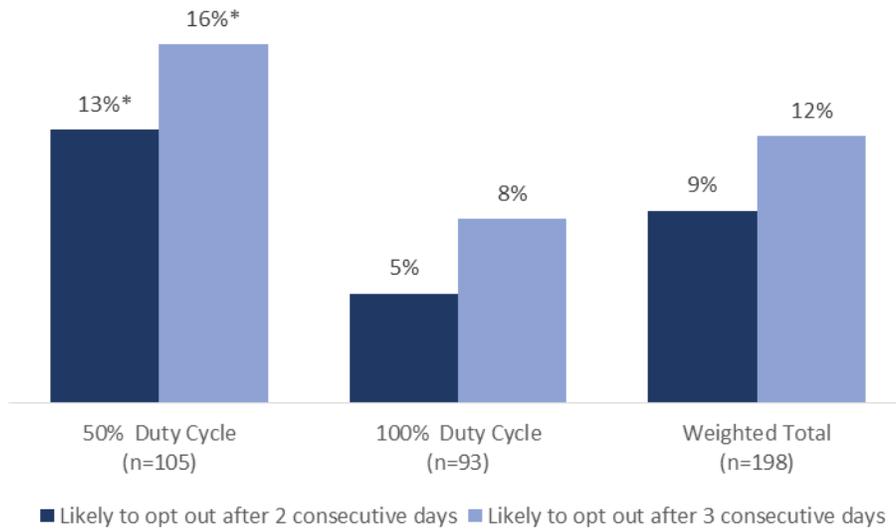
Note: * The difference between duty cycles is statistically significant at the 90% confidence level.

A slightly larger number of nonresidential participants are likely to leave the program after two (18%) or three (19%) consecutive event days.

Figure 37. Nonresidential Participants' Likelihood of Leaving Program after Consecutive Events
(Percentage of Participants who rated 7-10, where 0 is "very unlikely" and 10 is "very likely")
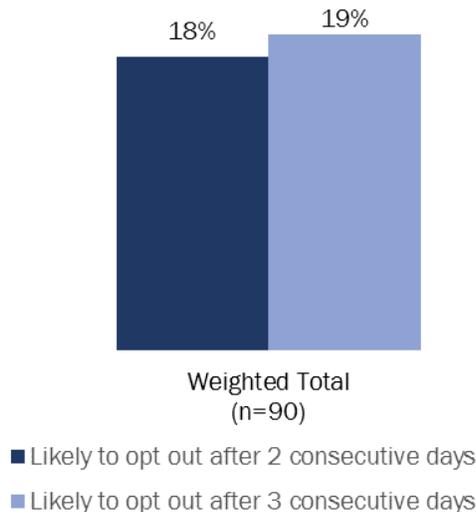
7.7.8   Participant Behavior during Events

Participant Comfort and Effects on Business Operations

Among residential participants who noticed a 2013 Summer Saver event (98 in total), three-quarters (75%) reported feeling a change in comfort level. While the group of coastal participants who recalled

Summer Saver events is small, it appears there is a trend that inland participants are more uncomfortable during Summer Saver events.

Figure 38. Percentage of Residential Customers who Experienced a Change in Comfort
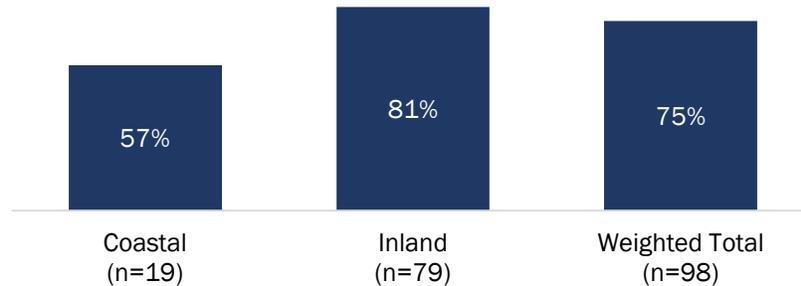
One-quarter (27%) of the 48 nonresidential participants who noticed an event reported adverse effects on their business (or one-fifth, 18%, of all nonresidential participants). While the sizes of sub-groups are small and data should be interpreted with caution, it appears that a larger share of inland participants' operations are negatively affected during events (Figure 39). Ways in which businesses reported being adversely affected include lower work productivity, employees or customers were uncomfortable and facility temperature did not recover for the rest of the day.

Figure 39. Nonresidential Participants Reporting Events Adversely Affected their Business (n=48)
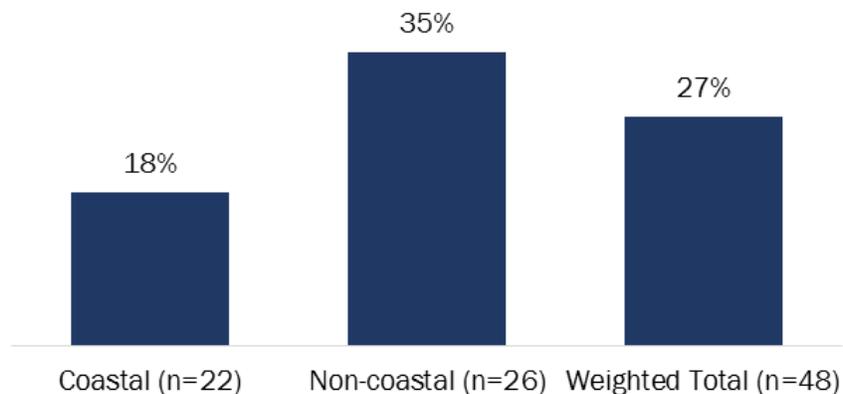
Additional Energy Savings

Among participants who noticed 2013 events (98 residential, 48 nonresidential), more than two-thirds (70%) of residential and half (53%) of nonresidential participants state that they undertake additional energy-saving activities during events.

Table 95. Energy-Saving Behaviors during Events

Behaviors	Residential Weighted Total (n=98)	Nonresidential Weighted Total (n=48)
Undertakes additional energy savings during events	70%	53%
Does not undertake additional energy savings during events	29%	43%

Behaviors	Residential Weighted Total (n=98)	Nonresidential Weighted Total (n=48)
Don't know	1%	4%

Table 96 lists additional energy-saving activities participants undertake during event times. Residential participants commonly report delaying use of clothes washers (33%), almost one-quarter say they use the fan instead of the AC (23%), and 22% shut curtains to keep the house cool.

Among nonresidential participants, the single most dominant way to conserve additional energy is by turning off lights (67%).

Table 96. Energy-Saving Behavior during Summer Saver Events (multiple responses)

Energy-Saving Activities	Residential Weighted Total (n=68)	Nonresidential Weighted Total (n=26)
REDUCE ENERGY USE	65%	78%
Run clothes washer earlier or later in the day	33%	0%
Turn off lights	19%	67%
Run dishwasher earlier or later in the day	17%	4%
Unplug appliances	15%	2%
Line dry clothes	8%	0%
Don't cook/bake	6%	0%
Change settings (lower or increase) in thermostat	4%	8%
Use as little energy as possible (general)	4%	7%
Turn off HVAC unit	3%	0%
KEEP HOUSE/FACILITY COOL	38%	17%
Use the fan instead of the AC unit	23%	11%
Close down curtains to keep house/facility cool	22%	6%
Close windows/doors	8%	2%
OTHER/DON'T KNOW	16%	6%
Other	13%	2%
Don't know	3%	4%

7.7.9   Snapback Effects

Snapback or snapback effects can occur when energy demand spikes in the aftermath of induced low-usage periods, for example to cool down the premise in the aftermath of a Summer Saver event. Opinion Dynamics examined participants' behavior that may suggest such snapback, as well as increased load prior to events (in case of pre-cooling a premise in anticipation of their AC unit cycling).

Lowering Thermostats after Summer Saver Events

Across residential participants who recalled events, more than two-thirds (69%) reported that they never change their AC unit settings after an event. Almost one-quarter (23%) changed the settings after all events, and only 4% reported they had done so after some of the events they recalled.

Two-thirds (66%) of nonresidential participants who noticed an event reported not changing their AC unit settings to cool the facility after event periods. The share of participants who cooled their facility after all events is the highest among nonresidential inland 30% duty cycle participants.

Table 97. "Have you ever changed the temperature settings of your AC unit after an event?"

Lower Thermostat After a Summer Saver Event	Residential Weighted Total (n=98)	Nonresidential Weighted Total (n=48)
Yes, after all events	23%	18%
Yes, after some events	4%	16%
No	69%	66%
Don't know	3%	1%

Pre-Cooling before Summer Saver Events

The majority of residential participants (61%) stated they would not pre-cool their house had they known about upcoming events. However, fewer coastal 50% duty cycle participants assert that they would not pre-cool their house (35%, compared to 65% of coastal 100% duty cycle participants).

Almost two-thirds (62%) of nonresidential participants indicated they would not pre-cool their facility if aware of an upcoming Summer Saver event.

Table 98. Would you pre-cool your premise if you were aware that an event would take place?

Would you pre-cool your facility before Summer Saver events if you were aware that an event would take place?	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
Yes, after all events	10%	26%
Yes, after some events	22%	10%
No	61%	62%
Don't know	7%	2%

7.7.10   Reduce Your Use Program

Reduce Your Use (RYU) is a voluntary SDG&E program targeted at residential and small business customers where they are eligible to earn a bill credit for using less electricity on specific days. Reduce Your Use Days may occur on hot summer days and last from 11 a.m. to 6 p.m. Until this past year, all SDG&E residential customers with a smart meter were eligible to participate in this program and were automatically defaulted. As a result, the Summer Saver and RYU programs' customer bases overlap. As of 2013, RYU-eligible customers can set up email or text alerts online (sdge.com/reduce use) to receive day-ahead event notification, and SDG&E will consider RYU event participants only those who signed up for notification, thus reducing overlap with Summer Saver program participants.

SDG&E customers who respond by reducing their energy use on RYU Days receive a credit of $0.75 per reduced kWh on their next energy bill. SDG&E provides conservation goals by customer through their website, which also displays how much energy customers used and saved during the RYU Day.

One-fifth (22%) of all residential participants indicate that they have signed up to receive RYU alerts. The share of RYU alert recipients is significantly higher among 100% duty cycle participants (30%) compared to 50% duty cycle participants (14%, Figure 40).

Figure 40. Overlap of RYU Customers with Residential Summer Saver Program Participants

Note: * The difference is statistically significant at the 90% confidence level.

During the summer of 2013, SDG&E issued one RYU alert on Saturday, August 31, after three consecutive days of Summer Saver events (August 28 to 30). One-third (32%) of the 42 dually enrolled participants recalled this specific alert.).

Given that the RYU day occurred right after three consecutive Summer Saver events, we asked respondents whether they were inconvenienced by this frequency of demand response events. The majority (60%) of the 42 dually enrolled report that they had no issue with consecutive Summer Saver program and RYU event days. An additional 14% state that although not in favor, they accepted the situation if it is deemed necessary by decision-makers.

There appears to be a trend toward higher acceptance for consecutive Summer Saver program and RYU days among 50% duty cycle participants.

■ Among 50% duty cycle participants, 80% state they have no problem with consecutive event days.

■ In comparison, only half (50%) of 100% duty cycle participants state they do not mind consecutive event days. About one-fifth (21%) of these participants also stated that although not in favor, they would understand that SDG&E may need to trigger consecutive events, if necessary.

Table 99. Response to Joint RYU Alerts and Summer Saver events

How do you feel about having a Reduce Your Use event day following consecutive Summer Saver event days?	50% Duty Cycle (n=15)	100% Duty Cycle (n=27)	Weighted Total (n=42)
No problem with consecutive RYU and Summer Saver event days	80%	50%	60%
Not in favor, but alright if necessary	0%	21%	14%
I would like to be notified	7%	0%	2%
Other	0%	4%	2%
Don't know	13%	25%	21%

7.7.11 Overriding Summer Saver Events

The Summer Saver program does not allow participants to override participation in a specific event, although it allows participants to leave the program at any time, with no waiting period to re-enroll.

Opinion Dynamics asked participants whether they would want to override events, with the trade-off of receiving a lower incentive payment. The majority of participants reported that they would not want to make this trade-off. While more than half of residential participants (60%) have no interest of overriding events, 17% said they would make the trade-off between the ability to override and receiving a smaller incentive. Only 6% noted they would like to override without any reduction in incentive levels. More 50% duty cycle participants noted they would want to override if the option were available.

- 100% duty cycle: Three-quarters (75%) stated they would <u>not</u> trade-off the incentive amount for the ability to override events, in comparison to half (47%) of 50% duty cycle participants.

- 50% duty cycle: One-fifth (21%) explicitly stated that they would like the option to override event participation in exchange for a lower incentive payment.

Figure 41. Residential Participants' Overriding Events in Exchange for Lower Incentives
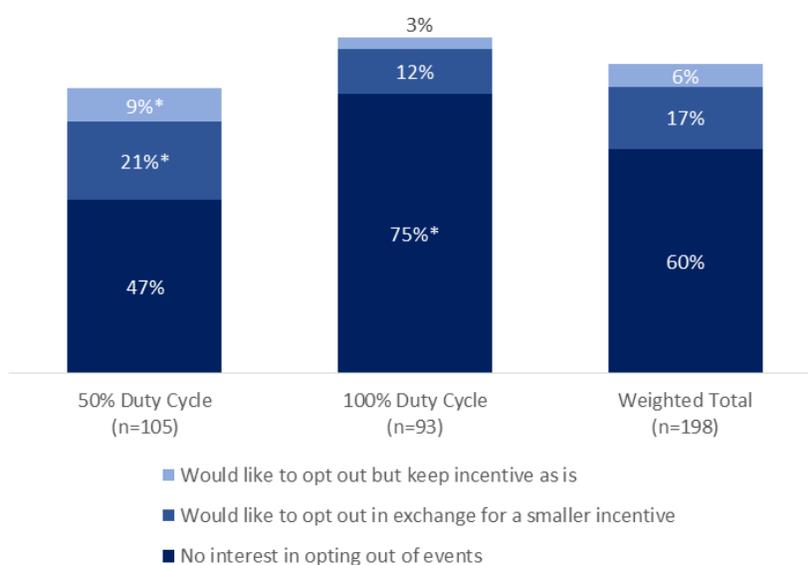
(*) The difference is statistically significant at the 90% confidence level.
The figure omits the following responses: "Other", "Don't know" and "Refused"

Slightly more nonresidential (25%) than residential (17%) participants state they would want to override events in exchange for a lower incentive payment. Figure 42 shows that there are important differences between 50% and 30% duty cycle nonresidential participants. Similar to the residential customer segment, significantly more nonresidential 30% duty cycle participants (36%) state they would take advantage of an event override option in exchange for a lower incentive payment.

Figure 42. Nonresidential Participants' Overriding Events in Exchange for Lower Incentives
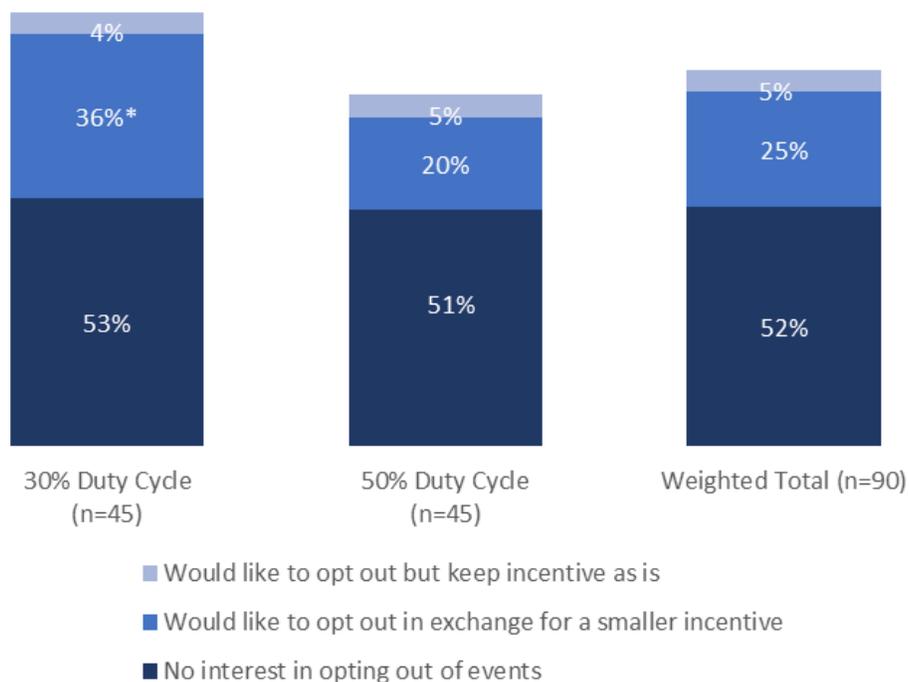
Notes: (*) The difference is statistically significant at the 90% confidence level. The figure omits "Other", "Don't know" and "Refused" responses

These findings indicate that a significant share of Summer Saver program participants may possibly take advantage of an override option if offered in the future, with the potential to reduce the predictability of load shed (although other AC Cycling programs report low overriding levels where this offer is available). The load shed capacity would likely decrease among participants subscribed to the lower duty cycle options as they are the most likely to note they would want to have this ability. The lapsed customer survey confirms higher interest in the ability to override, especially among lower duty cycle participants suggests that an override option may help reduce attrition.

7.8   Program Communication

When asked about whether they would want to receive more frequent communication about the program, under half (45%) of residential participants stated they would. This differs across customers segments. Almost two-thirds of coastal participants (62%) would like to receive more information in comparison to 41% of inland participants. Furthermore, half of all 50% duty cycle participants (53%) indicate they would like more frequent information in comparison to only one-third (38%) of 100% duty cycle participants.

Table 100. Desire for More Frequent Communication Among Residential Participants

	DUTYCYCLE		CLIMATE ZONE		Weighted Total (n=198)
	50% (n=105)	100% (n=93)	Coastal (n=40)	Inland (n=158)	
Yes	53%*	38%	62%**	41%	45%
No	45%	59%	38%	56%	52%
Don't know	2%	3%	0%	3%	3%

Notes:
(*) Difference is statistically significant at the 90% confidence level.
(**) Difference is statistically significant at the 90% confidence level.

Half (51%) of all nonresidential participants indicate they would want to receive more frequent communication about the program.

Direct mail is the preferred way of receiving program information (Table 101). Almost half (43%) of residential participants favor email, and one-quarter (26%) prefer information in direct mail hardcopy or newsletters. Almost two-thirds (63%) of nonresidential participants favor email.

Table 101. Preferred Way of Receiving Program Information

Communication Method	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
MAIL	88%	87%
Email	43%	63%
Direct mail/newsletter	26%	24%
Bill insert	19%	0%
PHONE	8%	3%
Phone call	7%	2%
Text message	1%	1%
OTHER	3%	6%
Website	2%	0%
Personal contact	1%	3%
Social Media Message	0%	2%
Other	0%	1%
Don't know / Refused	1%	1%
I don't want more information	0%	2%

7.9   Customer Support

The program offers customer support through a dedicated call center, which addresses program questions, processes opt-outs by remotely deactivating the load switch, changes participants' duty cycle options, and schedules truck rolls to premises that report HVAC or load switch issues.

Table 102 shows that program participants are most familiar with SDG&E's customer support tools such as the utility's website (81% residential, 86% nonresidential) and toll free line (59% residential, 62% nonresidential). In comparison, only than one-third of residential (28%) and nonresidential (33%) participants are aware of the dedicated Summer Saver program line.

Table 102. Residential Customers' Awareness of Customer Support Tools

Customer Support Tools	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
SDG&E's website	81%	86%
SDG&E's toll free line	59%	62%
Summer Saver support toll free line	28%	33%

7.10 Reasons for Leaving the Summer Saver Program

SDG&E's program tracking designates customers who have left the program with the following flags:

■ Account termination date
■ Program status (Removed or Out of Service)

To minimize recollection bias, we prioritized lapsed customers who left the program since 2012. There were 2,070 residential customers and 582 nonresidential customers who left the program since 2012. Even though residential customers represent the majority of the program participants, in order to identify statistically meaningful differences between the groups, Opinion Dynamics conducted lapsed customer surveys with 135 customers, of which one-third were from the nonresidential sector.

We established the sample to yield a minimum of 90% confidence with a +10% precision at the program level.

7.10.1 Lapsed Customer Occupancy Patterns

Opinion Dynamics wanted to establish whether lapsed customers might have experienced DR events by examining their typical premise occupancy schedule. Table 103 shows that the majority of residential customers and virtually all nonresidential customers are likely to have experienced an event when they were active program participants. There were no significant differences in summer occupancy patterns among lapsed customers (i.e., by duty cycle or climate zone). Further, there were no significant differences in event recall among those typically home between 2 p.m. and 7 p.m. and those with inconsistent schedules.

Table 103. Participant Occupancy Pattern During Likely Summer Saver Program Days

	Weighted Total
Residential Lapsed Customers	(n=96)
Inconsistent home schedule	42%
At home between 5 and 7 p.m.	100%
At home between noon and 5 p.m.	95%
Not home during afternoon/early evening (2-7p.m.)	5%
Nonresidential customers	(n=45)
Open through 6 p.m.	100%
Open from 6 p.m. to 7 p.m.	91%

About two-thirds of lapsed customers reported experiencing events (70% residential; 66% nonresidential).

Table 104. Recalled Event

Customer Segment	Recalled Events	Did not Recall Events or Don't Know
Residential	70%	30%
Nonresidential	66%	30%

Notes: Rounded percentages

Table 105 and Table 106 show that inland lapsed customers recalled events more frequently than coastal customers did. This may be an expected outcome however, as milder temperatures experienced by coastal customers yield less participant use and/or dependence on the cooling load of their AC units.

Table 105. Event Recall among Residential Lapsed Customers Types (n=96)

	Duty Cycle		Climate Zone		Weighted Total (n=96)
	100% (n=36)	50% (n=60)	Coastal (n-21)	Inland (n=75)	
Recalled events	72%	68%	52%	75%*	70%
Did not recall events/ Don't know	28%	32%	48%*	25%	30%
Total	100%	100%	100%	100%	100%

Notes: Rounded percentages
(*) Difference is statistically significant at the 90% confidence level

Table 106. Event Recall Among Nonresidential Lapsed Customers Types (n=45)

	Duty Cycle		Climate Zone		Weighted Total
	50% (n= 34)	30% (n=12)	Coastal (n=23)	Inland (n=22)	
Recalled events	64%	67%	52%	77%*	66%
Did not recall events/ Don't know	36%	33%	48%*	23%	34%
Total	100%	100%	100%	100%	100%

Notes: Rounded percentages
(*) Difference is statistically significant at the 90% confidence level

7.10.2   Reasons for Leaving the Program

Residential lapsed customers noted multiple reasons for leaving the Summer Saver program:
- A large proportion (37%) cited life events (i.e., moving, illnesses, and new babies).
- Slightly more than one-third (36%) noted discomfort during the event.
- About 2% of respondents did not realize they were no longer program participants.

Overall, there were no meaningful statistical differences in the reasons given for leaving the program among the residential lapsed customers based on climate zone (coastal vs. inland) or duty cycle (100% vs. 50%).

Table 107. Reasons Residential Lapsed Customers Left the Program (multiple response)

Reasons for Leaving the Program	Weighted Percent (n=96)
Life Events	**37%**
Moved	33%
On a Medical Baseline tariff/other discounts/ Medical condition/Illness	4%
New baby	1%
AC Cycling Event Issues	**36%**
Felt uncomfortable/hot during event days	34%
Duration of AC Cycling events was too long	2%
Program Design Issues	**16%**
Did not like that utility was controlling my HVAC unit / big brother effect/wanted control	6%
My energy bill increased/thought my bill would increase/ used more energy	6%
Did not need it / did not see program impacts	3%
Could not opt-out of event, so opted out of program	2%
Incentive payments were not enough	2%
Technology Issues	**11%**
Added solar to my home	9%
My HVAC unit was not working/upgraded/replaced	2%
Load switch adversely impacted/not compatible with HVAC/ Contractor removed my control device	1%
Customer Classification Issues	**2%**
Did not know I was no longer a participant/ Did not opt out	2%
Other	**2%**
Something (generally) was not working	1%
Renters may have opted out	1%
Don't know	**1%**

Notes: Category totals are not the sum of the reasons due rounding and avoiding double counting.

The table below shows the reasons nonresidential customers left the Summer Saver program.
- Moving/closing business was the most frequently stated reason (30%).
- Almost one-quarter (23%) noted that either they/their customers/ employees felt hot or uncomfortable during an event.
- About 7% did not realize they were no longer program participants.

Table 108. Reasons Nonresidential Lapsed Customers Left Program (multiple response)

Reasons for Opting Out	Weighted Percent (n=45) [a]
Change in Operations	**37%**
Moved/ No longer on premise	30%
Closed account	7%
AC Cycling Event Issues	**27%**
Felt uncomfortable/hot during event days	23%
Did not want to inconvenience my customers/students/staff	4%

Reasons for Opting Out	Weighted Percent (n=45)[a]
Adversely affecting my business processes (i.e. manufacturing products, storing products, etc.)	2%
Customer Classification Issues	**7%**
Did not know I was no longer a participant/ Did not opt out	7%
Program Design Issues	**4%**
Was not using it/ Didn't need it/ Saw no difference and wanted to make a difference in some other way	4%
Technology Issues	**4%**
The switch/technology caused problem with my AC unit	2%
My HVAC unit was not working/upgraded/replaced	2%
Other	**2%**
Not original decision maker	2%
Don't know	**23%**

Notes:
(a)   Rounded percentages
(b)   No significant differences by duty cycle or by climate zone
(c)   Category totals in bold are not the sum of the reasons due to rounding and multiple responses

7.10.3   Duty Cycle Option Changes among Lapsed Customers

Table 109 shows that the majorities of both residential and nonresidential lapsed customers did not change incentive and cycling options after first signing up for the program (78% and 86% respectively). Among the few lapsed residential customers who did change, event days being uncomfortable and saving money were the most frequently cited reasons.

Table 109. Change in Program Options

	Residential (n=96)	Nonresidential (n=45)
Did not change incentive and cycling options after first signing up	78%	86%
Changed incentive and cycling options after first signing up because…	11%	2%
Did not know if changed incentive and cycling options	11%	12%
Total	100%	100%

Notes: (a) Rounded percentages.

Table 110 shows trade-offs residential lapsed customers would make between incentive payment level and the ability to override events. At the program level, almost half of residential lapsed customers (44%) would accept a smaller incentive payment in exchange for the ability override, while approximately the same number (41%) had no interest in overriding events.

Among different climate zone and duty cycle configurations, residential lapsed customers stated the following:

■ 50% duty cycle lapsed customers were more likely to accept a smaller incentive payment in exchange for the ability to override events than 100% duty cycle customers (52% versus 28%).

■ More inland (46%) than coastal customers (27%) stated they had no interest in overriding events if the trade-off was lower incentives.

Table 110. Overriding Events in Exchange for Lower Incentive Payment (Residential)

	Duty Cycle		Climate Zone		Weighted Total (n=96)
	100% (n=36)	50% (n=60)	Coastal (n-21)	Inland (n=75)	
Would have accepted a smaller incentive payment in exchange for the ability to override	28%	52%*	55%	41%	44%
Did not have an interest in override	50%	36%	27%	46%*	41%
Would have liked override but NOT at a lower incentive payment level	6%	3%	5%	3%	3%
Did not know	17%	8%	14%	11%	12%
Total	100%	100%	100%	100%	100%

Notes: Rounded percentages
 (*) Difference is statistically significant at the 90% confidence level

Overall, only a third (34%) of nonresidential participants would want to override an event if the trade-off would be a lower incentive payment. Approximately the same number (32%) had no interest in overriding events.

Inland nonresidential customers appear to be less interested in overriding in exchange for a lower incentive than coastal customers (17% vs. 45%); however, as group sizes are small the data should be interpreted with caution.

Table 111. Overriding Events in Exchange for Lower Incentive Payment (nonresidential)

	Duty Cycle		Climate Zone		Weighted Total
	50% (n= 34)	30% (n=12)	Coastal (n=23)	Inland (n=22)	
Would have accepted a smaller incentive payment in exchange for the ability to override events	32%	42%	39%	32%	34%
Do not have an interest in overriding	32%	33%	17%	45%*	32%
Would have liked to override but NOT receive a lower incentive	0%	8%	4%	0%	3%
Did not know	35%	17%	39%	23%	31%
Total	100%	100%	100%	100%	100%

Notes: Rounded percentages
(*) Difference is statistically significant at the 90% confidence level
(A, B, C, D) reflects a significant difference compared to another duty cycle by climate zone group

7.11 Participants' Suggestions for Program Improvement

Two-thirds of residential (70%) and nonresidential (66%) customers had no suggestion to make the Summer Saver program more appealing to customers. Those who did often recommended more information or education, or more regular communication.

Table 112. Customers Suggestions for Overall Program Improvement (multiple responses)

Suggestions	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
No suggestions	70%	66%
More information / education	9%	4%

Suggestions	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
Better communicate event notification	4%	2%
More regular communication	3%	5%
Improve incentive	2%	3%
Better communication / customer service	0%	5%
Better technology / improved equipment	0%	2%
Shorter cycles	1%	0%
Other	4%	11%
Don't know	7%	8%

Those who did have suggestions requested more program information by mail or email as well as more clarity on program processes or effects.

Table 113. Participants' Suggestions to Better Explain the Program Options (multiple responses)

Participants suggestions to better explain the program options	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
No suggestions	62%	67%
Provide information through a letter/bill inserts/flyer	9%	12%
Better information on effects/program processes	6%	3%
Provide information via email	5%	7%
Provide information through a phone call or text/more direct phone communication	4%	5%
More regular information (i.e. every year)	4%	6%
Provide examples / cheat sheet of cycling options	0%	6%
Provide information through service reps / more personal contact	0%	6%
Provide information through website/smartphone app/online	3%	0%
Explain benefits and incentive to customers	2%	0%
Provide event notification (before events)	2%	0%
Provide information about event days and times (i.e. on bill, on personal usage)	2%	3%
Other	7%	1%
Don't know / Refused	4%	3%

Three-quarters of all residential (74%) and almost half (45%) of nonresidential customers have no suggestions to improve customer support. More information on program options and possible cost savings are dominant recommendations of both customer groups.

Table 114. Participants' Suggestions to Improve Customer Support (multiple responses)

Suggestions	Weighted Residential Total (n=198)	Weighted Nonresidential Total (n=90)
No improvements needed	74%	45%
Provide more information (cost savings/program options)	13%	8%
Increase awareness / advertising (general)	7%	1%
Communicate through letters / bill inserts	3%	1%
Communicate via email	2%	3%
Communicate via phone or text	2%	4%

Suggestions	Weighted Residential Total (n=198)	Weighted Nonresidential Total (n=90)
Communicate via website or web	2%	0%
Communicate through service reps	1%	1%
Other	5%	6%
Don't know / Refused	17%	30%

When asked about changes to incentive levels, approximately one-third of residential (27%) and nonresidential (38%) customers cited higher incentives. Some statistically significant differences exist as higher incentives appear to be more important to residential participants on higher duty cycle options:

A significantly larger share of 100% duty cycle participants suggested higher incentive payments (35% in comparison to 20% of residential participants on the 50% duty cycle) although their incentive levels are already more than double. This might be because incentive payments and expected bill reductions were more important drivers of program participation for 100% than 50% duty cycle participants.

Table 115. Participants' Suggested Changes to Incentive Levels (multiple responses)

Suggested changes to incentive levels	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
None	47%	34%
Higher incentives	27%	38%
Rate discounts or bill credits	10%	0%
Other	0%	0%
Don't know	11%	13%

Note: off-topic responses not captured, thus, summed percentages less than 100%

While the majority of residential (74%) and nonresidential (63%) customers do not desire changes to duty cycle options, some did provide suggestions. Most commonly, participants suggested shorter event length. Other recommendations include event notification, more duty cycle options and the ability to override events.

Table 116. Participants' Suggested Duty Cycle Options

Suggested changes to cycling options	Residential Weighted Total (n=198)	Nonresidential Weighted Total (n=90)
None	74%	63%
Shorter events	6%	10%
Provide event notification	6%	5%
More duty cycle options	2%	1%
Ability to opt out of events	2%	2%
Intermittent cycling	1%	0%
Less frequent events	0%	1%
Other/Don't know	9%	20%

7.12   Program Data Tracking

Only a few issues arose with the Summer Saver program database that we present below along with suggestions to improve tracking data for future evaluations.

The SDG&E tracking data for the Summer Saver program maintains participation records by devices, where each device is entered with device number, contact information and other program participation data. In the process of preparing the survey sample, the following issues emerged:

- **Missing "Opt-out Reason":** While the Summer Saver program database captures the program participation status and opt-out date, it does not record the reason why a participant left the program. We recommend adding lapsed codes such as moving, the medical baseline, and discomfort to better track lapsed customers reason for leaving.

- **Discrepancy between date variables:** The program tracking data included 5,428 records with the same account number, premise address and device number. This occurs as new data record is created when changes to the customer data are made. In order to determine the most current record, assumption had to be made based on three date variables (account termination date, the status end date and the status date). As discrepancies between these fields existed in some cases, we recommend numbering new data entries to more easily identify the latest record.

- **Discrepancies between account termination and program status:** The tracking data identifies a lapsed customer through the program status or the account termination date variable. In some cases (4,642), devices were marked with an account termination date but had with a program status of "A" (active). Consider reviewing and updating these records accordingly.

Appendix A.   PG&E SmartAC Sampling and Survey Methods

This section describes the sampling plan, response rates and weights used for the PG&E SmartAC program participant and lapsed customer surveys.

PG&E SmartAC Participant Survey Sample

Opinion Dynamics based the survey sample on the information contained in the program-tracking database. We established the sample to yield a statistically valid survey result at 90% confidence with a + 10% level of relative precision of survey results at the program level. Specifically, we designed a sample meeting those criteria for currently active residential program participants and a separate, smaller sample for lapsed customers.

We began proportional samples of different program design categories. Then, to ensure appropriate representation of all program designs, we created minimum quotas for completed surveys to include:

1. **Customer s**tatus: whether they participate in the SmartAC Program only, or whether they were also simultaneously enrolled in the SmartRate Program ("dually enrolled")

2. Climate zones: Inland, Mid and Coastal. PG&E provided letter-designated climate zones. We established the Inland/Mid/Coastal designation based on PG&E's territory map18 as follows:
   - Coastal zones are: V, T, Q
   - Inland zones are: R, S, W
   - Mid zones are: P, X. Y and Z

3. **Technology types:** While the program currently offers the load switch as the only design option, several active customers signed up when the program offered a thermostat.

As the PG&E SmartAC process evaluation focuses on the PY2013, we explicitly excluded nonresidential customers from the surveys as the program no longer targets this segment since early 2012. Table 123 shows the quotas for the enrollment options, technology options and climate zones within the PG&E service territory.

Table 117. PG&E Smart AC Participant Survey – Sample Plan-Applying Quotas

Program Design	Residential Participants only			
	Inland	Mid	Coastal	Total
SmartAC-only				
Load Switches	65	65	10	140
PCT	20	20	10	50
Subtotal	85	85	20	190
Dually enrolled				
Load Switch	45	45	10	100
PCT	15	15	3	33
Subtotal	60	60	13	133
TOTAL	145	145	33	323

It is important to note that if we were using an exactly proportional sample design for each sample cell, it would have taken only 269 sample points to meet the 90% confidence with + 10% relative

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18 Source: http://pgeandsolar.com/?page_id=29.

precision level, assuming a CV of 1.0. However, this approach would have resulted in a very small sample in some of the quota cells (in the single digits). Opinion Dynamics determined that it would not be appropriate to rely on a very small number (sometimes only one interview) to represent several thousand participants. Thus, we set quotas to over-sample in some cells, and under-sample in others. This method requires weighting all analyses performed at the program level. Weighting, especially when the difference between the largest and smallest weights is large, can reduce the power of the sample to produce estimates with confidence and desired precision. Since the weights for the initial adjusted sample plan were very disparate, our team made additional adjustments so that the effective sample size would be 269, which is what is required for our confidence and precision criteria given our assumptions about sample variation. To achieve an effective sample size of 269, with the cell distributions as shown above, requires an interviewed sample of 323, distributed as shown above.

We completed 328 interviews with SmartAC program participants from February 4 to February 21, 2014. The response rate was 9%[19] and the cooperation rate was 31%[20]. To ensure proportional representation of the participant population, all reported numbers are weighted. Table 118 shows the number of survey completes per stratum and their respective survey weight.

Table 118. Smart AC Participants Survey Completes and Weights

Strata	Percent in Program Population	Interviews Completed	Percent of Interviews Completed	Weight
Coastal Climate Zone				
SmartAC-only – load switch	0.48%	17	5%	**0.09**
SmartAC-only - PCT	0.04%	3	1%	**0.04**
Dually enrolled – load switch	0.18%	10	3%	**0.06**
Dually enrolled – PCT	0.01%	3	1%	**0.01**
Midrange Climate Zone				
SmartAC-only – load switch	28.21%	65	20%	**1.42**
SmartAC-only - PCT	3.48%	20	6%	**0.57**
Dually enrolled – load switch	10.82%	46	14%	**0.77**
Dually enrolled – PCT	1.24%	18	5%	**0.23**
Inland Climate Zone				
SmartAC-only – load switch	35.06%	65	20%	**1.77**
SmartAC-only - PCT	7.06%	20	6%	**1.16**
Dually enrolled – load switch	11.12%	46	14%	**0.79**
Dually enrolled – PCT	2.31%	15	5%	**0.50**
Total	100%	328	100%	1.00

PG&E SmartAC Lapsed Customer Survey Sample

Customers may choose to leave the program for three possible reason categories:
1. They move
2. They are in the medical baseline tariff
3. All other reasons

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[19] AAPOR Response Rate 3
[20] AAPOR Cooperation Rate 3

PG&E's program tracking designates customers who have left the program with the following flags:
- Deactivated – Moved: designates customers who moved
- Deactivated – Medical/Comfort: customers who no longer qualify given that they are in the medical baseline tariff
- Removed: customers who left the program for reasons other than moving/medical baseline tariff.

While we reported on the number of deactivated customers by reason, we fielded the lapsed customer survey only to customers who are noted in the participant tracking data as "Removed." For lapsed customers we have assumed a CV of 0.5, resulting in a total target of 68 complete surveys across the SmartAC-only and the dually enrolled lapsed customers. We established sample sizes to yield a 90% confidence with a $\pm$ 10% precision in survey results for lapsed customers at the program level.

The cells within the lapsed customer survey sample are set up to be approximately proportionally representative of program residential participants. We did not follow exactly proportional allocation of sample points across SmartAC-only and dually enrolled because this would have left virtually no data points to represent dually enrolled participants. We assigned a minimum cell size of 20 interviews. To accomplish this as well as keep the total lapsed sample size at 68, the (proportional) number of completes for SmartAC-only had to be reduced.

Table 119. PG&E Smart AC Lapsed Customer Survey Sample Plan - applying Quotas

Program Component	Target Completes
SmartAC-only	48
Dually enrolled	20
Total	**68**

We completed 68 interviews with lapsed SmartAC customers from February 7 to February 17, 2014. The response rate was 4%[21] and the cooperation rate was 28%[22]. To ensure proportional representation of the participant population, all sub-groups were weighted for analyses performed at the program level. Table 120 shows the number of survey completes per stratum and their respective survey weight.

Table 120. SmartAC Lapsed Customer Weights

Strata	Percent in Program Population	Interviews Completed	Percent of Interviews Completed	Weight
SmartAC-only	90.64%	48	70.59%	1.28
Dually Enrolled	9.36%	20	29.41%	0.32
Total	**100.00%**	**68**	**100.00%**	**1.00**

Survey Response Rate Calculation

The survey response rate is the number of completed interviews divided by the total number of potentially eligible respondents in the sample. We calculated the response rate using the standards

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[21] AAPOR Response Rate 3
[22] AAPOR Cooperation Rate 3

and formulas set forth by the American Association for Public Opinion Research (AAPOR).[23] We chose to use AAPOR Response Rate 3 (RR3), which includes an estimate of eligibility for these unknown sample units. We present the formulas used to calculate RR3 below, where I are Completed Interviews, P are Partially Completed interviews, R are Refusals, NC are Non-Contacts, O stands for Other, e for the estimated proportion of cases of unknown eligibility, UH the number of Unknown Households, and UO for unknown other.

Equation 1: AAPOR Response Rate 3 (RR3)

$$RR3 = I/((I+P) + (R+NC+O) + e(UH+UO))$$

We also calculated a cooperation rate, which is the number of completed interviews divided by the total number of eligible sample units actually contacted. In essence, the cooperation rate gives the percentage of participants who completed an interview out of all of the participants with whom we actually spoke. We used AAPOR Cooperation Rate 3 (COOP3), which is calculated as:

Equation 2: AAPOR Cooperation Rate 3 (RR3)

$$COOP3 = I/((I+P)+R))$$

where I are Completed Interviews, P are Partially Completed interviews, and R are Refusals.

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[23] *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*, AAPOR, 2011. http://www.aapor.org/AM/Template.cfm?Section=Standard_Definitions2&Template=/CM/ContentDisplay.cfm&ContentID =3156

Appendix B.   SCE Summer Discount Plan Sampling and Survey Methods

This section describes the sampling plan, response rates and weights used for the SCE Summer Discount Plan program participant and lapsed customer surveys.

SCE Summer Discount Plan Participant Population

We reviewed the program tracking database as of PY2013 and used its data as a basis to create approximately proportional samples of different program design categories to ensure that survey results are representative of customer experience across the SCE service territory. We targeted the sample to yield 90% confidence with a $\pm$10% relative precision level in survey results. However, when simply establishing a proportional sample, some categories end up with a very small target number of completed surveys. To ensure that we have statistically meaningful results, we oversampled some particular groups to adequately represent them in the survey results.

The tracking data indicated that there were 304,733 active customers in the program, 97% of them residential. The nonresidential population represent 2.8% of the participating population, with the large commercial businesses representing the largest proportion with 82% of the nonresidential participants.

Table 121. SCE Summer Discount Program Population (prior to data cleaning)

Program Segment	CUSTOMER COUNTS			
	30%	50%	100%	Total
Residential Summer Discount Program	0	1,117	12,104	13,221
	0	23,321	211,426	234,747
	0	3,418	44,894	48,312
Sub-Total Residential	0	27,856	268,424	296,280
Small Nonresidential customers	7	60	149	216
	79	236	820	1,135
	5	20	108	133
Sub-Total Small Residential	91	316	1,077	1,484
Large Nonresidential Customers	81	217	642	940
	431	1147	3,801	5,379
	44	95	511	650
Sub-Total Large Nonresidential	556	1,459	4,954	6,969
Total Active Customers	647	29,631	274,455	304,733

Data Cleaning & Sample Preparation Steps

The SCE tracking dataset is organized by account ID and service account ID, therefore the initial data count for the program corresponded to the number of devices enrolled (or no longer in the program). For sampling purposes however, we focused on the number of unique customers so that we could target the decision maker in the household or business to speak about their experience in the program. We also wanted to ensure that we properly classify customers according to their climate zone and duty cycle option. Therefore, we undertook the following steps to count unique customers from which to prepare a sample strategy.

- **Step 1: Establish count of unique devices:** we established unique devices by their account device status (A for active, I for inactive), their duty cycle percentage and their climate zone.

- **Step 2: Establish count of unique customers:** Next, we grouped the records to count unique customers by customer account ID (see Table 121 below). In various instances, there were customers with multiple devices where program status, rate type (residential vs commercial) or duty cycle options differed between devices. While a customer may subscribe to different program options for a variety of reasons. for sampling purposes, we allocated customers with multiple entries to a mutually exclusive sample group as follows:

  - Designated customers with both active and inactive devices as active participants given that all previously replaced devices were still maintained in the tracking data (3,682 customers).
  - Designated customers with both residential and commercial service accounts to the nonresidential sample (134 customers).
  - Omitted customers with the devices at different duty cycle options from the sample (723 customers).
  - Designated customers who had devices subscribed to nonresidential "small customer" service plan codes (GS1/2) AND nonresidential "large customer" service plan codes (GS3/TOU) to the "large customer group (51 customers).
  - Omitted customers who had neither a GS1, GS2, GS3 nor TOU service plan code as those typically identify customer accounts belonging directly to SCE (50 customers).

- **Step 3: Establish count of unique customers with valid contact information:** In order to contact customers for survey purposes, we need to ensure we had valid contact information. We therefore removed 6,880 records that had duplicate phone numbers. Many of these duplicate phone numbers are a result of residential customer accounts listed with contact information of nonresidential entities such as property managers. Given this discrepancy, and the fact that the program targets single-family homes (whereas these customers appeared to be in either multifamily or senior living properties) we further omitted 17 customers where five or more customer account IDs were associated with one specific phone number. Finally, we removed 92 customers with missing or invalid phone numbers.

Table 122 shows the number of unique customers that comprised the sample frame.

Table 122. SCE Summer Discount Plan Program Sample Frame

Program Segment	30%	50%	100%	Total
Residential	0	1,112	11,960	13,072
	0	23,076	208,864	231,940
	0	3,383	44,113	47,496
Sub-Total Residential	**0**	**27,571**	**264,937**	**292,508**
Small nonresidential	6	49	126	181
	66	192	634	892
	5	17	86	108
Sub-Total Small Residential	**77**	**258**	**846**	**1,181**
Large nonresidential	62	181	453	696
	374	930	2,894	4,198
	34	84	423	541
Sub-Total Large Nonresidential	**470**	**1,195**	**3,770**	**5,435**
Total Participants	**547**	**29,024**	**269,553**	**299,124**

Participant Survey Sample

We established the sample to yield statistically valid survey results at 90% confidence with a $\pm$ 10% level of relative precision at the _program_ level. Specifically, we designed a sample meeting those criteria for currently active residential program participants and a separate, smaller sample for lapsed customers. For the participant survey, we aimed to ensure appropriate representation of different program duty-cycle choices by customer segment as well as climate zones and customer sector. Therefore, we created quotas for completed surveys to include:

1. **Customer Sector**: We established separate sample strata by sector, specifically:
   - Residential
   - Large nonresidential
   - Small nonresidential

2. **Climate zones:** SCE provided customer zip codes as part of the tracking data. We matched customer zip codes to the California Building Climate Zones[24] map. Thus, we established three climate zones as follows:
   - Coastal /cool: 6
   - Midrange: 8, 9, 10, 13, 16
   - Inland/hot : 14, 15

3. **Duty cycles:** We wanted to ensure that we had proportional representation of customers based on their most recent duty cycle selection given program choices.

We assumed, relatively conservatively, a coefficient of variation (CV) of 1.0 to establish total survey sample sizes. This assumption, together with the goal of 90% confidence and a $\pm$10 precision level, requires a sample size of 269 customers. Table 123 shows the quotas for the climate zone and duty cycle options for residential and nonresidential participants in the SCE SDP program. The residential sample focuses on approximately proportional representation by climate zone and duty cycle. We oversampled the nonresidential population to identify meaningful differences between residential and nonresidential customers even though the residential participant population is the most prevalent participant population. We did not further stratify the nonresidential population based on climate zone as the survey samples would be such that would exceed the available budget for the surveys. We did allocate customers to small and large nonresidential strata to be sure both had adequate representation, though not adequate numbers to report them separately. Table 123 shows the survey quotas for the residential and nonresidential participant survey.

Table 123. SCE SDP Participant Survey Sample Plan– Applying Quotas

Climate Zone	30%	50%	100%	Total
Residential Coastal	0	20	20	40
Residential Midrange	0	20	50	70
Residential Inland	0	10	20	30
Residential Subtotal	**0**	**50**	**90**	**140**
Small nonresidential	10	10	20	40
Large Nonresidential	20	30	40	90
Nonresidential subtotal	**30**	**40**	**60**	**130**
Total	**30**	**90**	**150**	**270**

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[24] *http://www.energy.ca.gov/maps/renewable/building_climate_zones.html*

We completed 138 interviews with residential participants and 126 interviews with nonresidential participants between April 3rd and April 16th, 2014. The response rate was 12%[25] and 7%[26], respectively. The cooperation rate was 35% for residential and 28% for nonresidential participants. We weighted the aggregate results of total participants, duty cycle and climate zone to ensure that they proportionally represent the selected strata in the program population. The tables below show the number of survey completes per stratum and their respective survey weights for both residential and nonresidential participants.

Table 124. SCE Residential Participant Weights

Strata	Percent of Program Population	Interviews Completed	Percent Interviews Completed	Weight
50% coastal	0.4%	17	12%	0.03
50% midrange	7.9%	20	15%	0.54
50% inland	1.2%	10	7%	0.16
100% coastal	4%	20	15%	0.28
100% midrange	71%	50	36%	1.97
100% inland	15%	21	15%	1.00
Total	**100%**	**138**	**100%**	

Table 125. SCE Nonresidential Participant Weights

Strata	Percent of Program Population	Interviews Completed	Percent Interviews Completed	Weight
30% small	1%	6	5%	0.23
30% large	7%	20	16%	0.41
50% small	4%	10	8%	0.47
50% large	17%	30	24%	0.73
100% small	13%	20	16%	0.80
100% large	59%	40	32%	1.85
Total	**100%**	**126**	**100%**	

Lapsed Customer Survey

SCE's program tracking designates customers who have left the program with the following flags:
1. Account termination date
2. Program status (Removed or Out of Service)

There were 55,423 residential customers and 1,122 nonresidential customers who opted out of the program according to the tracking data. It is important to note that the program tracking data indicates that the earliest opt-out dates were in 2012, and most records designated as "inactive" do contain a non-participation date. Since this is a long-running program, it seems unlikely that 18% of its participant population left the program in the past two years. However, we included them in the sample frame, for lack of an ability to identify whether these customers may have left the program prior to 2012. For lapsed customers we assumed a CV of 0.5. We decided to oversample some groups to

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[25] AAPOR Response Rate 3
[26] Ibid.

provide meaningful statistical results. These sample sizes were established to yield a 90% confidence with a ± 10% relative precision in survey results for lapsed customers at the <u>program</u> level. The cells within the lapsed customer survey sample are set up to be approximately proportionally representative of residential vs. nonresidential program participation in the program.

Table 126. SCE SDP Lapsed Unique Customer and Sample Count

Program Segment	Climate Zone	Customers (pre data cleaning)	Customers (post data cleaning)	Survey Sample
Residential	Coastal	2,258	2,223	
	Midrange	42,021	41,047	
	Inland	11,144	10,836	
Sub-Total Residential		**55,423**	**54,106**	**70**
Small Nonresidential	Coastal	155	139	
	Midrange	779	680	
	Inland	118	95	
Sub-Total Small Nonresidential		**1,052**	**914**	**30**
Large Nonresidential	Coastal	23	17	
	Midrange	127	110	
	Inland	20	16	
Sub-Total Large Nonresidential		**170**	**143**	**10**
Total Lapsed Customers		**56,645**	**55,163**	**110**

Between April 7 and April 14, 2014, we completed <u>71</u> interviews with residential lapsed customers and <u>40</u> interviews with nonresidential lapsed customers. The response rate was 9%[27] and 11%[28], respectively. The cooperation rate was 36% for residential and 31% for nonresidential lapsed customers. To ensure proportional representation of the participant population, all sub-groups were weighted for analyses performed at the program level. The tables below show the number of survey completes per stratum and their respective survey weights for both residential and nonresidential lapsed customers.

Table 127. SCE Residential Lapsed Customer Summer Completes and Weights

Strata	% of Program Population	Interviews Completed	% Interviews Completed	Weight
Midrange	79%	52	73%	1.08
Inland	21%	19	27%	0.78
Total	**100%**	**71**	**100%**	

Note: No customers in coastal zones

Table 128. SCE Nonresidential Lapsed Customer Survey Completes and Weights

Strata	% of Program Population	Interviews Completed	% Interviews Completed	Weight
Coastal - Small	13%	4	10%	1.29
MidRange - Small	65%	22	55%	1.18
MidRange - Large	11%	9	23%	0.47
Inland - Small	10%	4	10%	0.98
Inland - Large	2%	1	3%	0.67

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[27] AAPOR Response Rate 3
[28] Ibid.

Strata	% of Program Population	Interviews Completed	% Interviews Completed	Weight
Total	100%	40	100%	

Survey Response Rate Calculation

The survey response rate is the number of completed interviews divided by the total number of potentially eligible respondents in the sample. We calculated the response rate using the standards and formulas set forth by the American Association for Public Opinion Research (AAPOR). We chose to use AAPOR Response Rate 3 (RR3), which includes an estimate of eligibility for these unknown sample units. We present the formulas used to calculate RR3 below, where I are Completed Interviews, P are Partially Completed interviews, R are Refusals, NC are Non-Contacts, O stands for Other, e for the estimated proportion of cases of unknown eligibility, UH the number of Unknown Households, and UO for unknown other.

Equation 3: AAPOR Response Rate 3 (RR3)

$$RR3 = I/((I+P) + (R+NC+O) + e(UH+UO))$$

We also calculated a cooperation rate, which is the number of completed interviews divided by the total number of eligible sample units actually contacted. In essence, the cooperation rate gives the percentage of participants who completed an interview out of all of the participants with whom we actually spoke. We used AAPOR Cooperation Rate 3 (COOP3), which is calculated as:

Equation 4: AAPOR Cooperation Rate 3 (RR3)

$$COOP3 = I/((I+P)+R))$$

where I are Completed Interviews, P are Partially Completed interviews, and R are Refusals.

Appendix C.   SDG&E Summer Saver Sampling and Survey Methods

This section describes the sampling plan, response rates and weights used for the SDG&E Summer Saver program participant and lapsed customer surveys.

Opinion Dynamics established the sample to yield statistically valid survey results at a 90% confidence with a ± 10% level of relative precision of survey results at the program level. Specifically, we designed a sample meeting those criteria for currently active residential program participants and a separate, smaller sample for lapsed customers.

Opinion Dynamics reviewed the SDG&E Summer Saver program tracking database as of PY2013 and used its data as a basis to create approximately proportional samples of different program design categories to ensure that survey results are representative of customer experience across the SDG&E service territory. However, when simply establishing a proportional sample, some categories end up with very small target numbers of completed surveys. To ensure that we have statistically meaningful results, we over-sampled some particular groups to adequately represent them in the survey results.

Data Cleaning & Sample Preparation Steps

The SDG&E program database listed 50,598 rows of data. We took the following steps to establish number of unique devices and customers.

- **Step 1: Establish count of unique devices:** we reviewed the data and removed 5,428 excess records (that had matching account number, customer name, service address and device number). Excess records exist because every time a customer chooses a new duty cycle for example, Comverge adds a new entry for that customer into the database reflecting the updated duty cycle selection (while maintaining all other variables constant). For purposes of the survey, we focused on the customer's current duty cycle choice. Where multiple entries existed, we kept the record with the most recent status end date, followed by the most recent status date. In this step, the total device count amounted to 45,170 devices (active or inactive).

- **Step 2: Establish count of unique customers:** Next, we removed customer account number duplicates (where customers may have had multiple devices) to arrive at a count of 32,517 unique customer account numbers.

- **Step 3: Establish count of unique customers with valid contact information:** To ensure that we could contact customers for survey purposes we needed to ensure we had valid contact information. We further removed 297 account numbers of customers who had the same name and phone number but multiple account numbers, keeping the most recent record by status end date and status date. We also established that there were 114 customers with call restrictions, 7,558 customers with missing phone numbers, 166 customers with duplicate phone numbers, and 7 customers with invalid duty cycle options[29]. The final number of unique customers used for sampling purposes then was 24,375.

Step 4: Identifying active vs. lapsed customers. The database tracked participant status. In various cases, customers may have had multiple devices, where one or more were inactive, but others were

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[29] A duty cycle option was deemed invalid if the listed percentage is not available to the customer class (residential / nonresidential).

active. This may be due to data entries about replaced load switches, or that customers with multiple devices may have opted out of the program only for specific devices. In some cases, customers with the same contact information had both residential and nonresidential premises in the program. Customers with multiple active devices had some devices with different duty cycle options. Therefore, for sampling purposes, we allocated customers with multiple entries to specific groups as follows:

- ■ Designated customers with both active and inactive devices as active participants given that all previously replaced devices were still maintained in the tracking data (179 customers).
- ■ Designated duty cycle based on the most recent duty cycle selection as all previous duty cycle selections remained in the tracking data (132 customers).
- ■ Designated customers with both residential and nonresidential premises as nonresidential for sampling purposes (given that there are more available sample for residential customers in general (nine customers).

Table 129. SDG&E Summer Saver Customer Counts (post data cleaning)

	Participants				Lapsed Customers		
Residential Duty cycle	Coastal	Inland	Total		Coastal	Inland	Total
100%	2,696	7,043	9,739		229	767	996
50%	1,606	6,615	8,221		246	951	1,197
Residential subtotal	4,302	13,658	17,960		475	1,718	2,193
Nonresidential Duty cycle	Coastal	Inland	Total		Coastal	Inland	Total
50%	1,500	1,001	2,501		247	209	456
30%	469	610	1,079		86	100	186
Nonresidential subtotal	1,969	1,611	3,580		333	309	642
TOTAL	6,271	15,269	**21,540**		808	2,027	**2,835**

SDG&E Summer Saver Participant Survey

Opinion Dynamics established the sample to yield statistically valid survey results at 90% confidence with a $\pm$ 10% level of relative precision at the program level. Specifically, we designed a sample meeting those criteria for currently active residential program participants and a separate, smaller sample for lapsed customers. For the participant survey, we aimed to ensure appropriately proportional representation of two different program duty-cycle choices by customer segment as well as two climate zones and customer sectors. Therefore, we created quotas for completed surveys to include the following:

1. **Customer Sector**: Established separate samples by residential and nonresidential segments
2. **Climate zones:** SDG&E provided customer zip codes as part of the tracking data. We matched customer zip codes to the California Building Climate Zones[30] map. We began with three climate zones, but there were an insufficient number of participants in the hottest zones to provide a meaningful representation of that group. Thus, we established two climate zones as follows:
   a. Coastal zones are: 6,7
   b. Inland zones are : 8, 10, 14, 15

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[30] *http://www.energy.ca.gov/maps/renewable/building_climate_zones.html*

3. **Duty cycles:** We wanted to ensure that we had proportional representation of customers based on their most recent duty cycle selection given program choices.

We assumed, relatively conservatively, a coefficient of variation (CV) of 1.0 to establish total survey sample sizes. This assumption, together with the goal of 90% confidence and a ± 10 relative precision level, requires a sample size of 269 customers. Table 130 shows the quotas for the climate zone and duty cycle options for residential and nonresidential participants in the SDG&E Summer Saver program, including some over-sampling to assure adequate representation of certain subgroups (we established minimum cell sizes of 20). As a result, we planned to complete 285 participant interviews in support of the process evaluation, as this will provide an effective sample size of 269 after weighting the over-and under-sampled cells.[31]

Table 130. SDG&E Smart AC Participant Survey Sample Plan-Applying Quotas

	Unique Customers		
Residential customers	Coastal	Inland	Total
100% duty cycle	20	70	90
50% duty cycle	20	85	105
Residential Subtotal	40	155	195
Nonresidential customers	Coastal	Inland	Total
50% duty cycle	20	25	45
30% duty cycle	20	25	45
Nonresidential Subtotal	40	50	90
Active Participant Total	**80**	**205**	**285**

We completed 198 interviews with residential participants and 90 interviews with nonresidential participants between March 6th and March 24th, 2014. The response rate was 6%[32] and 5%[33], respectively. The cooperation rate was 30%for residential and 19% for nonresidential participants. We weighted the aggregate results of total participants, duty cycle and climate zone to ensure that they proportionally represent the selected strata in the program population. The tables below show the number of survey completes per stratum and their respective survey weights for both residential and nonresidential participants.

Table 131. SDG&E Residential Participant Survey Completes and Weights

Strata	Percent of Population	Interviews Completed	Percent Interviews Completed	Weight
50% Coastal	10.36%	20	10.10%	1.03
50% Inland	40.68%	85	42.93%	0.95
100% Coastal	13.56%	20	10.10%	1.34

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[31] If we were using an exactly proportional sample design for each sample cell, it would have taken only 269 sample points to meet the 90/10 criteria, assuming a CV of 1.0. However, this approach would have resulted in some of the quota cells to have a very low number of interviews (in the single digits). Our team determined that it would not be appropriate to rely on, e.g. only one interview to represent several thousand participants. Thus, we set quotas to over-sample some cells, and under-sample others. This method requires weighting all analyses performed at the program level. Weighting, especially when the difference between the largest and smallest weights is large, can reduce the power of the sample to produce estimates with confidence and precision. Since the weights for the initial adjusted sample plan were very different, our team made additional adjustments so that the effective sample size would be 285, which is what is required for a confidence and precision criteria.
[32] AAPOR Response Rate 3
[33] Ibid.

Strata	Percent of Population	Interviews Completed	Percent Interviews Completed	Weight
100% Inland	35.40%	73	36.87%	0.96
Total	100.00%	198	100.00%	

Table 132. SDG&E Nonresidential Participant Survey Completes and Weights

Strata	Percent of Population	Interviews Completed	Percent Interviews Completed	Weight
30% Coastal	13.16%	20	22.22%	0.59
30% Noncoastal	17.55%	25	27.78%	0.63
50% Coastal	40.82%	20	22.22%	1.84
50% Noncoastal	28.46%	25	27.78%	1.02
Total	100.00%	90	100.00%	

SDG&E Summer Saver Lapsed Customer Survey

SDG&E's program tracking designates customers who have left the program with the following flags:
1. Account termination date
2. Program status (Removed or Out of Service)

In order to minimize recollection bias, we prioritized lapsed customers who left the program since 2012. There were 2,070 residential customers and 582 nonresidential customers who opted out of the program since 2012 with the appropriate program status flag, which we used as the sample frame.

For lapsed customers we assumed a CV of 0.5, which would require 68 surveys. We decided to oversample some groups to provide meaningful statistical results that adequately represents each stratum. With the weights that were required to adjust the estimates for the total sample, it was necessary to increase the total target to 135 completed surveys across the residential and nonresidential participant population customers. These sample sizes were established to yield a 90% confidence with a + 10% relative precision in survey results for lapsed customers at the program level. The cells within the lapsed customer survey sample are set up to be approximately proportionally representative of residential vs. nonresidential program participation in the program.

Table 133. SDG&E Summer Saver Lapsed Customer Survey Sample Plan—Applying Quotas

	Unique Customers		
Residential	**Coastal**	**Inland**	**Total**
100% duty cycle	15	30	45
50% duty cycle	15	30	45
Residential Subtotal	30	60	90
Nonresidential	**Coastal**	**Inland**	**Total**
50% duty cycle	10	15	25
30% duty cycle	10	10	20
Nonresidential Subtotal	20	25	45
TOTAL	50	85	135

Between March 10 and March 24, 2014, we completed 90 interviews with residential lapsed customers and 45 interviews with nonresidential lapsed customers. The response rate was 13%[34] and 11%[35], respectively. The cooperation rate was 38% for residential and 25% for nonresidential lapsed customers. To ensure proportional representation of the participant population, all sub-groups were weighted for analyses performed at the program level. The two tables below show the number of survey completes per stratum and their respective survey weights for both residential and nonresidential lapsed customers.

Table 134. SDG&E Residential Lapsed Customer Survey Completes and Weights

Strata	Percent of Population	Interviews Completed	Percent of Interview Completed	Weight
50% Coastal	12.97%	15	15.63%	0.83
50% Inland	49.92%	30	31.25%	1.60
100% Coastal	9.00%	21	21.88%	0.41
100% Inland	28.11%	30	31.25%	0.90
Total	100.00%	96	100.00%	

Table 135. SDG&E Nonresidential Lapsed Customer Survey Completes and Weights

Strata	Percent of Population	Interviews Completed	Percent of Interviews Completed	Weight
30% Coastal	11.96%	4	8.89%	1.35
30% Inland	14.51%	6	13.33%	1.09
50% Coastal	38.98%	17	37.78%	1.03
50% Inland	34.55%	18	40.00%	0.86
Total	100.00%	45	100.00%	

Survey Response Rate Calculation

The survey response rate is the number of completed interviews divided by the total number of potentially eligible respondents in the sample. We calculated the response rate using the standards and formulas set forth by the American Association for Public Opinion Research (AAPOR).[36] We chose to use AAPOR Response Rate 3 (RR3), which includes an estimate of eligibility for these unknown sample units. We present the formulas used to calculate RR3 below, where I are Completed Interviews, P are Partially Completed interviews, R are Refusals, NC are Non-Contacts, O stands for Other, e for the estimated proportion of cases of unknown eligibility, UH the number of Unknown Households, and UO for unknown other.

Equation 5: AAPOR Response Rate 3 (RR3)

$$RR3 = I/((I+P) + (R+NC+O) + e(UH+UO))$$

We also calculated a cooperation rate, which is the number of completed interviews divided by the total number of eligible sample units actually contacted. In essence, the cooperation rate gives the

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[34] AAPOR Response Rate 3

[35] Ibid.

[36] *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*, AAPOR, 2011. http://www.aapor.org/AM/Template.cfm?Section=Standard_Definitions2&Template=/CM/ContentDisplay.cfm&ContentID =3156

percentage of participants who completed an interview out of all of the participants with whom we actually spoke. We used AAPOR Cooperation Rate 3 (COOP3), which is calculated as:

Equation 6: AAPOR Cooperation Rate 3 (RR3)

$$COOP3 = I/((I+P)+R))$$

where I are Completed Interviews, P are Partially Completed interviews, and R are Refusals

Appendix D. PG&E SmartAC Survey Demographics

Table 136 shows the demographics for the SmartAC active participants and lapsed customers at the program level.

Table 136. SmartAC Participants Demographics

	Participants Weighted Percent (n=328)	Lapsed Customer Weighted Percent (n=68)
Household Size		
Two or fewer	65%	70%
More than two	30%	26%
Refused/Don't Know	5%	4%
Household Income		
Less than $75,000	40%	39%
$75,000 or greater	35%	28%
Refused/Don't Know	24%	33%
Education		
Not a college graduate	38%	35%
College graduate or higher	54%	55%
Refused/Don't Know	8%	10%
Age		
Younger than 65	40%	41%
65 years or older	48%	49%
Refused/Don't Know	12%	10%
Square Feet of House		
Less than 2,000	41%	53%
2,000 or more	44%	35%
Refused/Don't Know	14%	12%
Age of Home		
Built before 1986	53%	50%
Built in 1986 or after	34%	34%
Refused/Don't Know	12%	16%
Race/Ethnicity		
White/ Caucasian	67%	61%
Hispanic, Mexican, Latino, Puerto Rican, other Hispanic	4%	9%
Other Asian or Pacific Islander	5%	4%
Indian or South Asian	3%	2%
Black/ African American	2%	-
Chinese	2%	-
Other	3%	2%
Refused/Don't Know	15%	22%

Notes: Rounded percentages

Key characteristics include:

- Almost two-thirds (65%) of participants live in a household of two or fewer people. One-third of SmartAC-only participants (32%) have more than two residents in their household, compared to 22% of dually enrolled customers.
- One-third has a combined household income of more than $75,000
- Slightly over half (54%) of all program participants is at least college educated
- Almost half (48%) of all program participants are 65 years or older and subsequently near or at retirement age
- Dually enrolled customers have significantly smaller homes: While almost half (47%) of all SmartAC-only customers have a house with 2,000 square feet or more, only 37% of dually enrolled customers do so

There were two statistically significant differences between SmartAC-only and dually enrolled customers.
- One-third of SmartAC-only active participants (32%) have more than two residents in their household, compared to 22% of dually enrolled customers.
- Dually enrolled customers have significantly smaller homes: While almost half (47%) of all SmartAC-only customers have a house with 2,000 square feet or more, only 37% of dually enrolled customers had homes of such size.

Table 137. Demographic Difference by Participant Type

	SmartAC-only Percent (n=190)	Dually enrolled Percent (n=138)
Household Size		
Two or fewer	64%	69%
More than two	32%*	22%
Don't Know / Refused	4%	8%
Square Feet of House		
Less than 2,000	40%	47%
2,000 or more	47%*	37%
Don't Know / Refused	14%	16%

Notes: Rounded percentages
(*) Difference is statistically significant at the 90% confidence level.

Among lapsed customers, the only statistically significant differences between SmartAC-only and dually enrolled customers were in the income data:
- Compared to SmartAC-only lapsed customers, dually enrolled lapsed customers were more likely to have household incomes less than $75,000 (75% vs. 35%).
- SmartAC-only lapsed customers were more likely to refuse to state their household incomes than dually enrolled lapsed customers were (33% vs. 10%).

Appendix E.   SCE Summer Discount Plan Surveys Demographics and Firmographics

Participant Survey

The tables below show residential demographics and nonresidential participant firmographics at the program level:

Table 138. SDP Active Participants' Demographics

	Weighted Total (n=198)
HOUSEHOLD SIZE	
Two or fewer	51%
More than two	83%
Don't Know / Refused	2%
HOUSEHOLD INCOME	
Less than $75,000	38%
$75,000 or greater	44%
Don't Know / Refused	18%
EDUCATION	
Not a college graduate	44%
College graduate or higher	54%
Don't Know / Refused	2%
AGE	
Younger than 45	30%
45-64 years	34%
65 years or older	32%
Don't Know / Refused	4%
SQUARE FEET OF HOME	
Less than 2,000	44%
2,000 or more	49%
Don't Know / Refused	7%
AGE OF HOME	
Built before 1965	26%
Built 1965 – 1985	23%
Built in 1986 or after	45%
Don't Know / Refused	6%
RACE / ETHNICITY	
White/ Caucasian	62%
Hispanic, Mexican, Latino, Puerto Rican	19%
Other Asian or Pacific Islander	4%
Chinese	1%
Indian or South Asian	1%
Black or African American	2%

	Weighted Total (n=198)
Other	5%
Don't Know / Refused	6%

Table 139. SDP Active Participants Firmographics

	Total (n=126)
SQUARE FOOTAGE	
50,000 square feet or less	75%
50,001 to 100,000 square feet	2%
100,001 to 200,000 square feet	3%
More than 200,000 square feet	5%
Don't know / Refused	16%
NUMBER OF EMPLOYEES	
1 to 10	54%
11 and 20	18%
21 and 50	10%
51 and 100	4%
101 and 500	1%
More than 500	2%
Don't know / Refused	11%
OWNERSHIP OF FACILITY	
Own	52%
Rent	40%
Don't know / Refused	8%
TYPE OF BUSINESS (multiple responses)	
Church/Non-profit	18%
Manufacturing	11%
Retail - Single Tenant	12%
School/Educational Facility	10%
Warehouse	5%
Service (unspecified)	5%
Commercial Office - Multi Tenant	4%
Healthcare/Hospital	4%
Retail - Multi Tenant	4%
Hospitality	3%
Repair/construction service	3%
Restaurant/Food Service	3%
Commercial Office - Single Tenant	3%
Food Processing	2%
Greenhouse	1%
High Tech	1%
Other	7%
Don't know / Refused	10%

	Total (n=126)
TIME FACILITY IS BUSIEST	
6:00 AM - 12:00 noon	20%
12:00 noon - 6:00 PM	37%
6:00 PM - 10:00 PM	7%
Other times	27%
Don't know / Refused	9%
GREEN MARKETING	
Yes	23%
No	69%
Don't know	7%
ADVERTISE SDP PARTICIPATION	
Yes	8%
No	92%

Lapsed Customer Surveys

Table 140 shows lapsed residential lapsed customer demographics at the program level:

- Most households (57%) consist of more than two members.
- A large proportion of households (40%) has a household income of $75,000 or greater, while another large proportion (36%) has a household income of less than $75,000 (the remaining 23% did not provide usable data).
- Most respondents (58%) are at least college-educated.
- Most respondents were younger than 65 (62%).
- Nearly half the respondents (47%) live in homes of 2,000 or more square feet, while 12% did not provide usable data.
- Nearly half the respondents' homes (46%) were built after 1985, while 19% did not provide usable data.
- Just over half of respondents are white/Caucasian (51%), about one in seven are Hispanic, Mexican, Latino, Puerto Rican, other Hispanic (14%), and 11% did not provide usable data.

Table 140. Lapsed Residential Customer Demographics

	Weighted Percent (n=71)
Household Size	
Two or fewer	37%
More than two	57%
Refused/Don't Know	6%
Household Income	
Less than $75,000	36%
$75,000 or greater	40%
Refused/Don't Know	23%
Education	
Not a college graduate	38%
College graduate or higher	58%
Refused/Don't Know	4%
Age	
Younger than 65	62%

	Weighted Percent (n=71)
65 years or older	30%
Refused/Don't Know	8%
Square Feet of House	
Less than 2,000	42%
2,000 or more	47%
Refused/Don't Know	12%
Age of Home	
Built before 1986	35%
Built in 1986 or after	46%
Refused/Don't Know	19%
Race/Ethnicity	
White/ Caucasian	51%
Hispanic, Mexican, Latino, Puerto Rican, other Hispanic	14%
Other Asian or Pacific Islander	6%
American Indian or Alaska Native	5%
Indian or South Asian	5%
Black/ African American	3%
Mixed or multi-racial	3%
Chinese	2%
"American"	2%
Refused/Don't Know	11%

The table below shows lapsed nonresidential lapsed customer firmographic data at the program level:
- Generally, these are small businesses 50,000 square feet or smaller (85%) and with fewer than ten employees (72%).
- The most frequent business types varied across industrial (22%), retail (16%), service (16%) and office (14%).
- Nearly 2 in 5 (38%) owned their primary location.
- Nearly 2 in 5 (39%) cited 6 a.m. to noon as being their busiest hours.

Table 141. Firmographics

	Weighted Percent (n=40)
Square Footage	
Up to 50,000 square feet	85%
More than 50,000 square feet	7%
Don't know/ Refused	8%
Number of Employees	
Up to 10	72%
11 to 50	15%
51 to 500	6%
Don't know/ Refused	6%
Use "Green" to Market	
Uses "green" to market	26%
Does not uses "green" to market	53%
Don't know/ Refused	20%
Ownership	
Own	38%
Rent	57%
Don't know/ Refused	6%

	Weighted Percent (n=40)
Busiest Hours (multiple response)	
6 a.m. to noon	39%
noon to 6 p.m.	31%
6 to 10 p.m.	7%
10 p.m. to 6 a.m.	7%
Other [b]	14%
Don't know/ Refused	18%
Business Type	
Industrial	**22%**
manufacturing	9%
distribution	6%
food processing	4%
warehouse	3%
Retail	**16%**
single tenant	11%
multi-tenant	4%
Service	**16%**
Unspecified	9%
Repair/construction	7%
Office	**14%**
commercial single tenant	7%
commercial multi-tenant	4%
government	3%
Institutional	**6%**
healthcare/hospital	3%
school educational/facility	3%
Hospitality	**8%**
Church/ Non-profit	**4%**
Other	**6%**
Don't know/ Refused	**9%**

Appendix F.   SDG&E Summer Saver Surveys Demographics and Firmographics

Residential Participant Demographics

Key characteristics include:

■ Most participants live in a household of 2 residents or less (58%)
■ One-third (36%) of the participants has a combined household income under 75,000, slightly more earned more than 75,000 (39%)
■ Two thirds (60%) of all participants are at least college educated
■ Almost half of all participants is 65 or older (46%)

Table 142. SDG&E Summer Saver Participant Demographics

	Weighted Total (n=198)
Household Size	
Two or fewer	58%
More than two	37%
Don't Know / Refused	6%
Household Income	
Less than $75,000	36%
$75,000 or greater	39%
Don't Know / Refused	25%
Education	
Not a college graduate	30%
College graduate or higher	60%
Don't Know / Refused	9%
Age	
Younger than 45	13%
45-64 years	29%
65 years or older	46%
Don't Know / Refused	12%
Square Feet of House	
Less than 2,000	42%
2,000 or more	47%
Don't Know / Refused	11%
Age of Home	
Built before 1965	18%
Built 1965 - 1985	34%
Built in 1986 or after	39%
Don't Know / Refused	9%
Race/Ethnicity	
White/ Caucasian	67%
Hispanic, Mexican, Latino, Puerto Rican, other Hispanic	8%

	Weighted Total (n=198)
Other Asian or Pacific Islander	3%
Chinese	1%
Indian or South Asian	1%
Black or African American	1%
Other	5%
Don't Know / Refused	13%

Nonresidential Participants Firmographics

Key characteristics of nonresidential customers include:
- Most participants (84%) operate a facility of 50,000 square feet
- The majority (82%) has 10 or less employees. This is particularly true for businesses in coastal areas that are subscribed to 50% cycling (95%).
- Almost two-thirds rent the facility
- The program attracts various nonresidential entities. The most common ones include single tenant retail locations (18%) and churches or nonprofits (17%)
- Almost half (44%) of participants state that they are most busy between noon and 6 p.m.
- Most of the organizations (86%) state that they do not market themselves as green.

Table 143. SDG&E Summer Saver Nonresidential Active Participants Firmographics

	Weighted Total (n=90)
SQUARE FOOTAGE	
50,000 square feet or less	84%
50,001 to 100,000 square feet	7%
100,001 to 200,000 square feet	1%
More than 1,000,000 square feet	1%
Don't know / Refused	8%
NUMBER OF EMPLOYEES	
1 to 10	82%
11 and 20	10%
21 and 50	5%
51 and 100	1%
101 and 500	1%
Don't know / Refused	2%
OWNERSHIP OF FACILITY	
Own	37%
Rent	60%
Don't know / Refused	2%
TYPE OF BUSINESS	
Retail - Single Tenant	18%
Church/Non-profit	17%
Commercial Office - Multi Tenant	14%
Manufacturing	11%

	Weighted Total (n=90)
Retail - Multi Tenant	8%
Commercial Office - Single Tenant	6%
High Tech	4%
Food Processing	4%
Healthcare/Hospital	3%
Restaurant/Food Service	3%
Other	9%
Don't know / Refused	2%
TIME FACILITY IS BUSIEST	
6:00 AM - 12:00 noon	30%
12:00 noon - 6:00 PM	44%
6:00 PM - 10:00 PM	5%
Other times	13%
Don't know / Refused	8%
Green Marketing	
Yes	12%
No	86%

Residential Lapsed Customers - Demographics

At the program level:
■ About half of all households (51%) consist of two or fewer members
■ A large proportion of households (41%) has income of $75,000 or greater (although another 33% did not provide usable data)
■ Most respondents (58%) are at least college-educated.
■ Half the respondents were younger than 65 (50%) and about half were 65 or older (46%).
■ Half the respondents (50%) live in homes of 2,000 or more square feet
■ A large proportion of the respondents' homes (49%) were built before 1980
■ The majority of respondents are white/Caucasian (70%)

Disaggregating the respondents by climate zone and duty cycle highlighted a few significant differences in the demographic data:

■ Those in inland climate zones tended to have higher household incomes than those in coastal climate zones (45% vs. 24%).
■ Those in inland climate zones were more educated than those in coastal climate zones (64% vs. 38%),
■ Those with 100% duty cycles had newer homes than those with 50% duty cycles (51% vs. 37%).

Table 144. Lapsed Customer Demographics

	Duty cycle		Climate Zone		Weighted Percent (n=96)
	100% (n=36)	50% (n=60)	Coastal (n=21)	Inland (n=75)	
Household Size					
Two or fewer	51%	52%	38%	56%	51%
More than two	43%	45%	62%	40%	45%

	Duty cycle		Climate Zone		Weighted Percent (n=96)
	100% (n=36)	50% (n=60)	Coastal (n=21)	Inland (n=75)	
Don't know/ Refused	6%	3%	-	4%	4%
Household Income					
Less than $75,000	29%	25%	43%*	21%	26%
$75,000 or greater	37%	44%	24%	45%*	41%
Don't know/ Refused	34%	31%	33%	33%	33%
Education					
Not a college graduate	31%	42%	62%*	31%	37%
College graduate or higher	67%	53%	38%	64%*	58%
Don't know/ Refused	3%	5%	-	5%	5%
Age					
Younger than 65	47%	52%	57%	48%	50%
65 years or older	44%	45%	38%	48%	46%
Don't know/ Refused	8%	3%	5%	4%	4%
Square Feet of House					
Less than 2,000	50%	50%	52%	49%	50%
2,000 or more	36%	45%	43%	41%	42%
Don't know/ Refused	14%	5%	5%	9%	8%
Age of Home					
Built before 1980	31%	58%*	43%	51%	49%
Built in 1980 or after	51%*	37%	43%	41%	41%
Don't know/ Refused	17%	5%	14%	8%	10%
Race/Ethnicity					
White/ Caucasian	60%	76%*	65%	71%	70%
Black or African American	9%	2%	10%	3%	4%
Hispanic, Mexican, Latino, Puerto Rican, or other Hispanic	-	3%	5%	3%	3%
Other Asian or Pacific Islander	6%	2%	5%	3%	3%
Indian or South Asian	-	3%	-	3%	2%
Other	-	3%	-	3%	2%
Don't know/ Refused	26%*	11%	15%	16%	16%

Notes: Rounded percentages
(*) Difference statistically significant at the 90% confidence level with weighted data

The table below provides firmographic information for the nonresidential lapsed customers who completed our survey. Generally, these were small businesses 50,000 square feet or smaller and with fewer than ten employees. Although a large proportion (33%) were single tenant retailers, business type varied (e.g., industrial, office, service, etc.). Just over a quarter (26%) owned their primary location and nearly half (41%) cited noon to 6 p.m. as being their busiest hours. Disaggregating the respondents by climate zone and duty cycle highlighted a few significant differences in the firmographic data:

- Those at the 50% duty cycle were much more likely to have 10 or fewer employees than were those in the 30% duty cycle (88% vs. 64%).

- Those in coastal climate zones were much more likely to rent than those in inland climate zones (83% vs. 57%).
- Coastal premises were likely to be single-tenant retailers than inland premises (48% vs. 17%).

Table 145. Firmographics

	Duty cycle		Climate Zone		Weighted Percent (n=45)
	50% (n=33)	30% (n=12)	30% (n=23)	Coastal (n=22)	
Square Footage					
Up to 50,000 square feet	79%	92%	96%	70%	84%
More than 100,000 square feet	12%	-	4%	13%	8%
Don't know/ Refused	9%	8%	-%	17%	8%
Number of Employees					
Up to 10	88%*	64%	87%	77%	81%
11 to 50	9%	18%	4%	18%	11%
51 to 500	3%	9%	4%	5%	5%
Don't know/ Refused	-	9%	4%	-	3%
Use "Green" to Market					
Uses "green" to market	15%	42%	22%	23%	23%
Does not uses "green" to market	82%	58%	78%	73%	75%
Don't know/ Refused	82%	58%	-	73%	75%
Ownership					
Own	24%	25%	17%	35%	26%
Rent	70%	75%	83%*	57%	70%
Don't know/ Refused	6%	-	-	9%	4%
Busiest Hours (multiple response)					
6 a.m. to noon	38%	27%	36%	34%	35%
noon to 6 p.m.	53%	34%	49%	47%	48%
6 to 10 p.m.	14%	-	9%	12%	10%
Other [b]	-	39%	6%	15%	10%
Don't know/ Refused	3%	-	5%	-	2%
Business Type					
Retail	39%	32%	52%	22%	38%
single tenant	33%	32%	48%*	17%	33%
multi-tenant	9%	-	9%	4%	7%
Industrial	24%	9%	27%	13%	20%
manufacturing	12%	9%	14%	9%	11%
warehouse	6%	-	9%	-	5%
food processing	6%	-	5%	4%	4%
Commercial office	17%	20%	19%	17%	18%
single tenant	6%	20%	15%	5%	10%
multi-tenant	11%	-	5%	12%	8%
Service	19%	11%	10%	23%	17%
Unspecified	8%	11%	6%	12%	9%
Repair/construction	11%	-	5%	12%	8%
Institutional	11%	18%	5%	22%	13%
healthcare/hospital	11%	-	5%	12%	8%
school educational/facility	-	18%	-	10%	5%
Food and Hospitality	3%	9%	-	9%	4%
Hospitality	-	9%	-	5%	2%
Restaurant/Food Service	3%	-	--	4%	2%

(*) Difference is statistically significant at the 90% confidence level

Appendix G.   Benchmarking Utilities Programs

Table 146. Utilities Interviewed for Failure Rates and Marketing Costs per Enrolled Customers

State	Utility	Program Name	Marketing activities	Technology used
AR	Entergy	Summer Advantage	Website; Account representative	Load switch
CO	Xcel	Saver's Switch	Website, direct mails (brochures and letters to customers)	Load switch
DC	PEPCO	Energy Wise Rewards	Website, Direct mail (bill inserts, brochure)	Load switch
GA	Georgia Power	Power credit	Website	Load switch
IA	MidAmerican	Summer Saver	Website; Direct mail (brochure)	Load switch
IL	Commonwealth Edison	Smart Ideas Central AC Cycling	Website, direct mail (bill inserts)	Load switch. Add learning thermostat (Nest) in July 2014
IN	NIPSCO	Air Conditioning Cycling program	Website, direct mail (brochure)	Load switch
IN	IPL	Air Conditioning Load Management	Website, direct mail (brochure)	Load switch
MD	BGE	Smart Energy Rewards	Website, direct mail (bill inserts)	Programmable thermostat and load switch
NC	Duke Energy Progress	Energy Wise Program	Website, TV advertisement	Load switch
NJ	PSEG	Cool Customer	Website	Programmable thermostat and load switch
TX	Reliant Energy	Degrees of difference with Nest	Website, TV advertisement	Learning thermostat (Nest)

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