Disclaimer

SMUD's 2013 PowerStat Study

Final Report
March 31, 2014

A comprehensive study looking at the effects of price-based and incentive-based utility controlled and customer controlled demand response

Powering forward. Together.

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Executive Summary

SMUD's 2013 PowerStat study studied three program options designed to reduce summer peak loads through time-of-use (TOU) rates, critical peak pricing (CPP), and direct load control (DLC) of air-conditioning (AC) units via communicating thermostats.

The primary objective of this evaluation was to determine how these incentives and load management strategies affected average hourly electric loads during the summer of 2013, categorized into three impact types: (a) event or "Conservation Day" peak demand, (b) non-event weekday peak demand, and (c) summer energy. A secondary objective was to determine customer choice preferences when presented with the three voluntary program options. The final objective as to assess the technology and customer's comfort.

Hourly kilowatt (kW) values measured at the individual customer level by SMUD's existing metering infrastructure were analyzed using mixed-effects models with levels for customer, day, and hour. The main findings are described below.

Customer Choice of Program Offerings

The study was designed as a customer choice model in which three basic options were presented to the customer to choose from. In two of the options a sub-category needed to be elected for the temperature offset of their choice.

The first option was the CPP group (self managed group with TOU/CPP rate): the customer had control of the thermostat. 39 participants chose this group. CPP+DLC was the second group where SMUD sent a demand response signal to the customer and raised the thermostat set point a few degrees. They were also on the TOU/CPP rate. The customer elected either a 2, 3 or 4 degree offset. 288 selected this group. The third group was the DLC group. They received an incentive while remaining on their standard rate and were given a credit for full participation in the event. 509 joined this group.

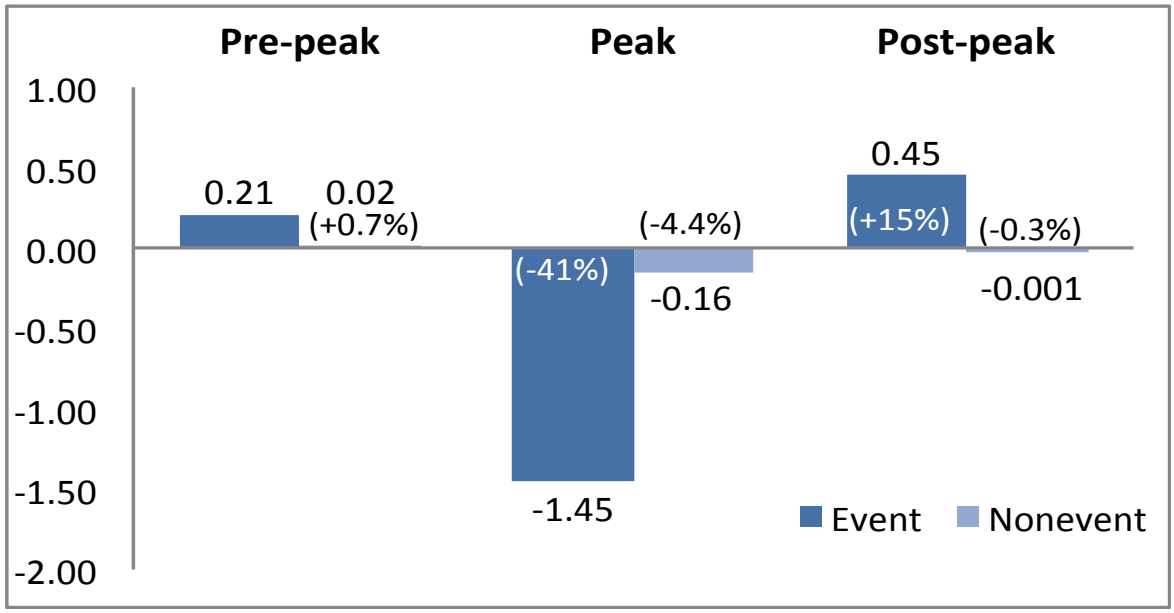
An analysis of customer preferences for the three program offerings was biased by a lack of clarity in the Participation Agreement about the CPP group offering . Essentially, the material offered two choices: TOU/CPP rate or an incentive. The confusion was in the TOU/CPP group selection whereby the customer had to check a box to select the

degree offset if they wished for SMUD to provide the signal. Unfortunately, many customers did not understand that if they left it blank, they could control their offset value even though wording described this option.

Load Impacts

Aggregate Impacts. Results indicate that Powerstat participants reduced the 4-7 pm peak loads by an average of 1.45 kW (41%) per participant on Conservation Days, with statistically significant increases in the pre-peak and post-peak periods. On non-event weekdays, Powerstat participants saved an average of 4.4% over the 3 peak hours, with no statistically significant change in demand during the pre-peak or post-peak periods.

FIGURE 1. AVERAGE 3 HOUR LOAD IMPACTS AT 106°F, EVENT VS. NON-EVENT WEEKDAYS



Program Group Impacts. Event impacts were significant for all three program options, with load shed ranging from -39% to -46% during peak, and load increases ranging from +7.0% to +16% in the pre-peak and post-peak periods. Contrast analysis indicated the following statistically significant results:

- CPP and CPP+DLC peak sheds were greatest, and statistically indistinguishable from each other.
- DLC provided the smallest peak load shed: 0.31 kW less than CPP, 0.35 kW less than CPP+DLC.
- There were no significant differences in the Pre-peak or Post-peak load impacts.

FIGURE 2. AVERAGE 3-HOUR LOAD IMPACTS ON A 106°F EVENT DAY, BY PROGRAM GROUP

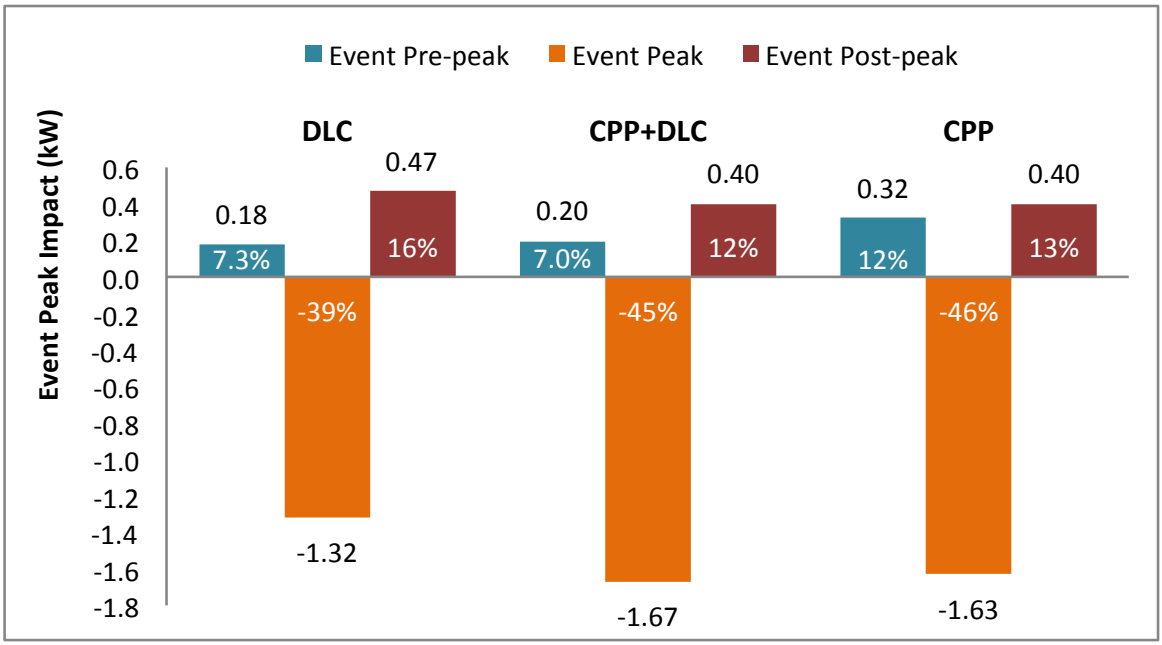
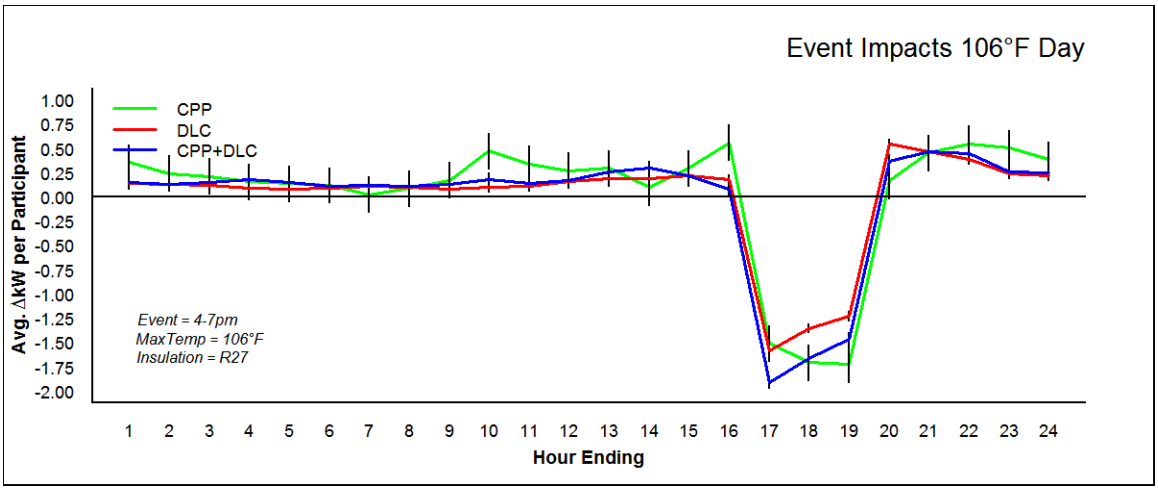


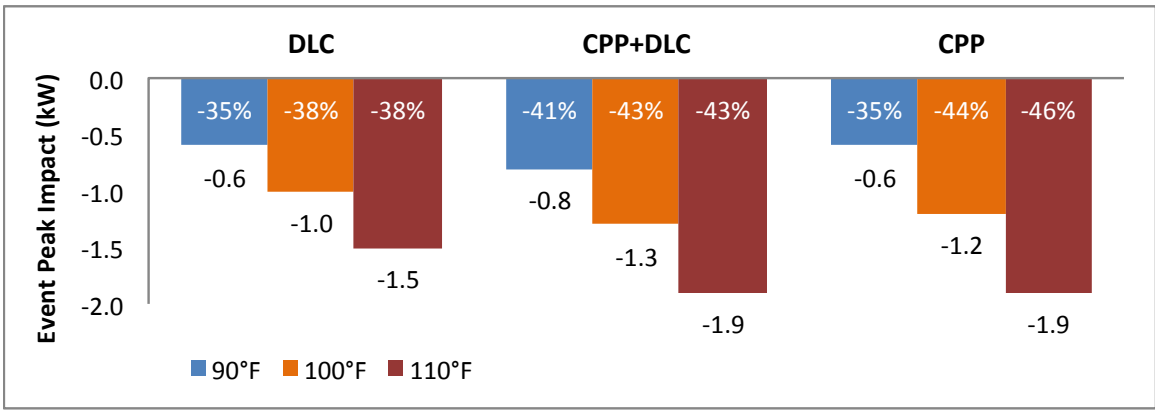
Figure 3 illustrates the hourly load impacts for the three program groups. Here, one can see that the peak load impacts for the two groups with utility managed thermostats (DLC and CPP+DLC) slope upwards over the 3 peak hours, indicating that the demand response resource starts off strong, but is reduced as AC units come back to life in the second and third hours of the event. In contrast, the CPP load impacts show the opposite trend, starting off at the same level as the DLC group, but then increasing in the second and third hours, perhaps as occupants initiate manual load reductions. This pattern suggests that these two program types might be used well in combination to affect the desired system load shape in real time.

FIGURE 3. HOURLY EVENT IMPACTS AT 106°F, BY PROGRAM GROUP



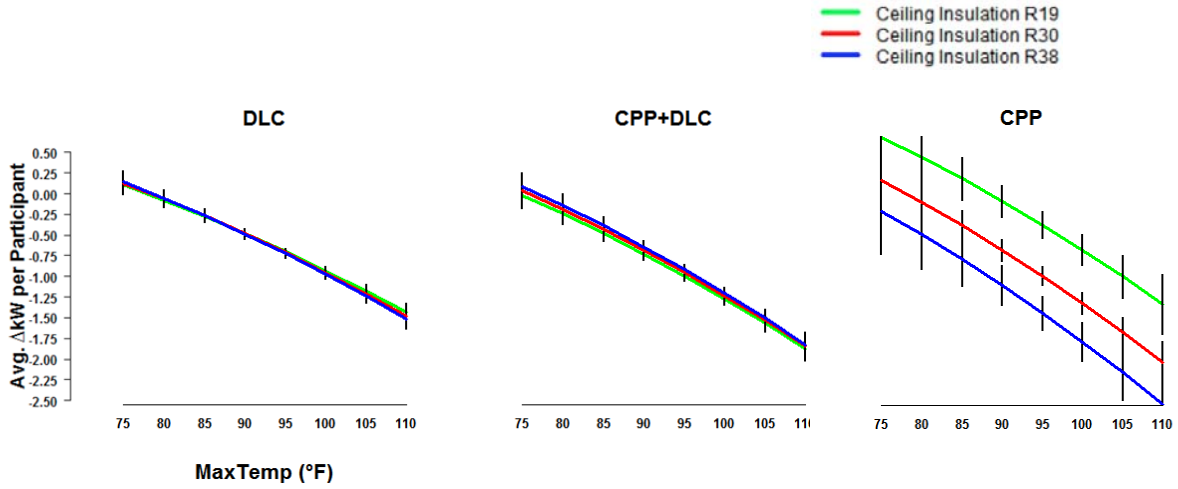
Temperature Effects. To estimate the effect of outdoor temperature on event impacts, the mixed model was populated with three different temperature profiles, defined by maximum hourly temperatures of 90, 100, and 110 degrees. For all program groups, higher temperatures increased load shed measured in kW—however, only the CPP group increased response measured as a percentage of baseline.

FIGURE 4. EFFECT OF OUTDOOR TEMPERATURE ON EVENT IMPACTS, BY PROGRAM



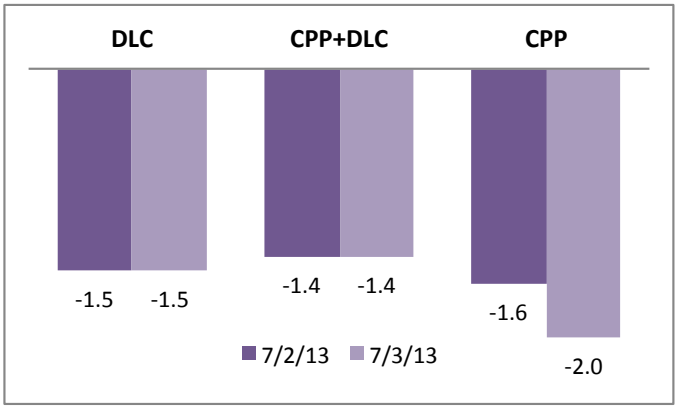
Insulation Effects. Figure 5 shows the relationship between maximum temperatures and event peak impacts. Of interest is the similar pattern of the DLC and CPP+DLC groups, where insulation had no effect on the load shed, as indicated by the collinearity of the green, red, and blue lines. The CPP group, in contrast, shows a significant effect of insulation on event peak load shed, such that higher ceiling insulation levels were associated with significantly higher event impacts. The CPP results should be viewed with caution, however, given the small sample size.

FIGURE 5. TEMPERATURE-INSULATION INTERACTION, BY PROGRAM



Sequential Events. On the second of two sequential event days, called on July 2 and July 3, the CPP program showed a 25% *greater* load shed, while the DLC and CPP+DLC groups showed no change (Figure 6).

FIGURE 6. LOAD IMPACTS ON SEQUENTIAL EVENT DAYS, JULY 2ND AND 3RD, BY PROGRAM

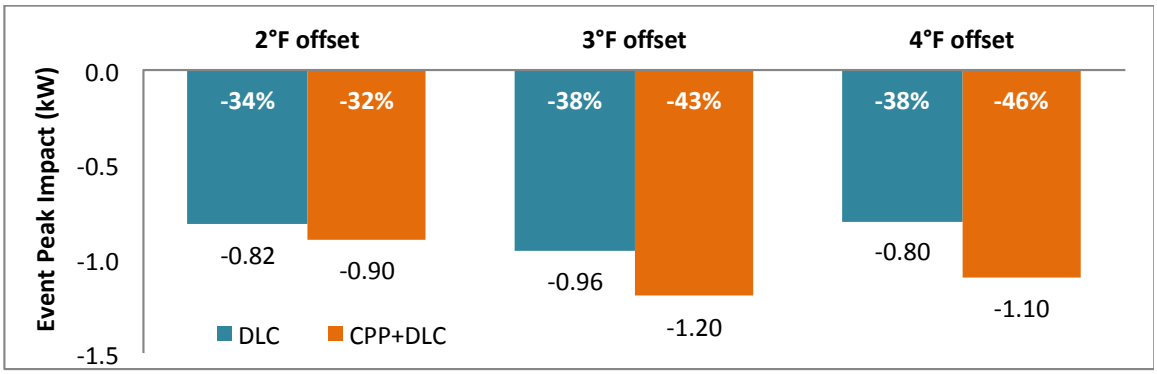


Limited opt outs. An analysis of opt out patterns implies that limiting DLC program opt outs to 1 per summer is likely to be counterproductive. There was no significant change in average participant load impacts when customers with multiple opt outs were excluded from the analysis. Worse, the smaller number of participants resulted in an overall 7% *reduction* in the demand response resource.

Offset Subgroups. DLC and CPP+DLC subgroups were defined by event offsets of 2, 3 or 4 degrees. In all cases, participants in the CPP+DLC program outperformed those in the DLC program, as expected, since CPP+DLC participants have an incentive to reduce more than just AC loads. While one would also expect impacts to increase with offset, analysis of impacts by subgroups showed a slightly different story—i.e. the

magnitude of response for those in the 4°F offset subgroup was *smaller* than for those in the 3°F offset subgroup. This counterintuitive finding is largely the result of smaller initial loads in the 4°F subgroup, since, as a percentage of baseline load, the 3°F and 4°F subgroups had nearly identical results (Figure 7).

FIGURE 7. DLC AND CPP+DLC AVERAGE EVENT IMPACTS, BY EVENT OFFSET OF 2°F, 3°F OR 4°F

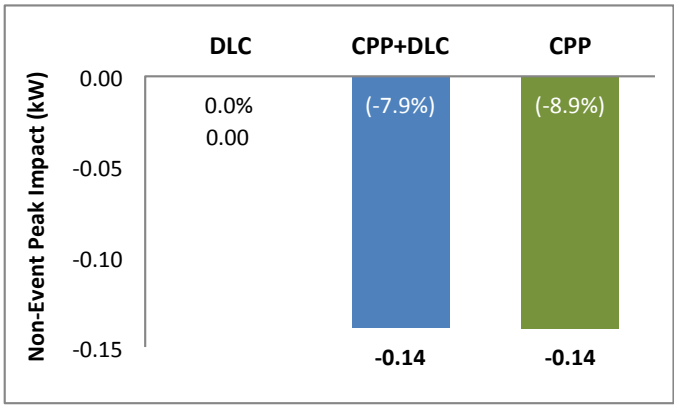


Incentive Structures. Based on an analysis of incentives and event impacts at the subgroup level, payments for the 3°F and 4°F offset DLC subgroup incentive levels are too high, and should be lowered to $2 for a 3°F event offset and $3 for a 4°F event offset. Although the incentive payment of $2 per event is appropriate for the 2°F offset DLC subgroup, SMUD might consider offering just $1 per event to maintain pricing consistency.

Customer Characteristics. Load sheds during events were significantly greater for customers who had larger homes, had more thermostats, received event notification by SMS text messages, and used scheduled thermostat programming all or part of the time. Load sheds during events were significantly smaller for participants who lived in homes with only one occupant, lived in homes with at least one occupant over age 65, or manually adjusted their thermostat settings on a regular basis.

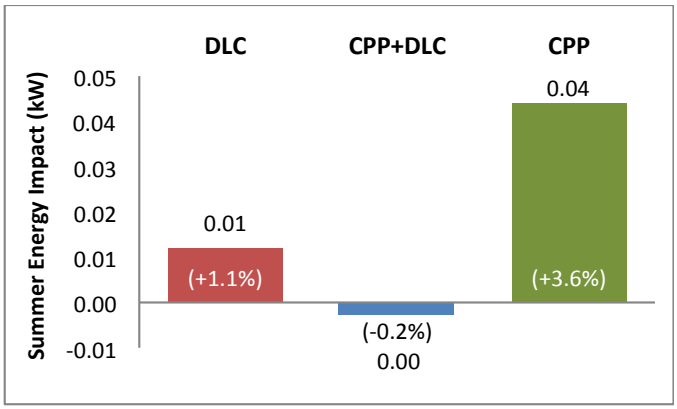
Non-Event Day Load Impacts. As expected, the two program groups on the TOU-CPP rate reduced load significantly during the weekday peak in response to the higher peak rate, while the DLC group showed no statistically significant change from their energy use patterns of the prior year.

FIGURE 8. NON-EVENT DAY LOAD IMPACTS, BY PROGRAM



Summer Energy Impacts. Overall, summer energy use changed very little, but increased slightly—by +1.1% and +3.6% for the DLC and CPP groups, respectively.

FIGURE 9. SUMMER ENERGY IMPACTS, BY PROGRAM



Technology

Based upon our assessment of the thermostat performance as it relates to working on the meter mesh network was that it had very high reliability to stay connected to the mesh. We were able monitor the device health and note whether the thermostat was communicating or not. One area that could be improved upon is making the thermostat more user friendly.

One area that was indentified for improvement was upgrading Silver Spring Networks' HCM application to a newer version. With the version that we were running, we noted that it takes a few minutes to "rebuild" the demand response programs for dispatch in the HCM application. Silver Spring Networks' indicated that a new version would fix that

situation but it is not in SMUD plans to take the upgrade until 2016 due to the dependency with other upgrade projects in the queue to be done.

Participant Comfort

Across the season, an average 84% of participants surveyed indicated that they were at home for at least 30 minutes between the hours of 4PM and 7PM on the Conservation Day. Of these, 57% indicated that the temperature in their home was comfortable during peak hours on Conservation Days, 39% rated it a bit too hot, and 4% stated that it was much too hot. In Appendix I, the customer survey evaluation report by True North Research can be found.

Recommendations

The results of the 2013 PowerStat study indicate that a program of this type has the potential to provide 1.45 kW demand relief per voluntary customer on a 106°F event day, and another 4.4% peak load shaving on non-event weekdays. Based on this analysis, the authors make the following recommendations:

- Given the successful peak load reductions, a similar program should be offered to an expanded number of SMUD customers in 2014 to validate the load reduction potential.
- Operate the program for another year with an expanded number of customers to see if those enrolled in the CPP program continue to increase their kW savings during the Conservation Day event If this proves to continue, then it will have a complimentary effect to those enrolled in a DLC or a CPP+DLC program. It may be beneficial to operate these programs on a Conservation Day at the same time to achieve a more consistent load reduction across duration of the event.
- Design the 2014 recruitment materials carefully to avoid confusion bias in customer program choices.
- Design the 2014 recruitment materials so that the customer clearly knows which program they are enrolled in.
- Increase the communication to enrolled participants about the program, conservation day events, and how to operate the thermostat.
- Having participants enroll in pricing programs results in greater load reduction potential than those on a standard rate. Show the benefits to customers to guide them to price-based programs.

- The study used direct mail to recruit small commercial participants. Explore other methods to reach the small commercial sector to obtain greater participation, including exploring whether other commercial smart meters have ZigBee radios that can be turned on and used to connect to communicating thermostats.
- While the use of event opt-outs was low, assess whether limiting the number of opt-outs available would affect their program participation or not.
- Participants found the thermostat hard to use. Explore using other manufacture's thermostat that is more user friendly.
- Plan to upgrade Silver Spring Networks' HCM application to provide faster response in "rebuilding" demand response programs when dispatched for use.
- Internal processes required a lot of manual work and spreadsheets to manage the installation process. Consider using a work order management system and equipment inventory control system that is geared to support this type of work.
- Run a similar pilot for 2014 and continue to assess whether incentive levels need to be modified as recommended in this report.
- Consider the recommendations in the lessons learned section of this report.

Background

In 2009, the Department of Energy announced that over $4 billion in federal grants funded by the American Recovery and Reinvestment Act (ARRA) would be available through the Smart Grid Investment Grant Program (SGIG) and the Smart Grid Demonstration Program (SGDP). The purpose of the SGIG is to stimulate the implementation of smart grid technologies with a goal of modernizing the nation's electricity grid. Later that same year, SMUD submitted an SGIG application and received a grant to implement the SmartSacramento® smart grid project. SMUD's goal is to empower their customers with options for increasing energy efficiency, protecting the environment, reducing global warming and lowering the cost to serve the region.

To date, the SmartSacramento® project has deployed an end-to-end advanced metering infrastructure that covers 100% of the load in SMUD's service territory. When completed, SMUD intends that the new architecture will be a customer-centric system, designed to enable informed participation by customers, improve the reliability and efficiency of utility operations, facilitate integration of distributed and intermittent forms of clean and renewable energy, and optimize asset utilization along the entire energy chain, from electricity generation to customer end uses.

The SmartSacramento® project is comprised of seven major components:

- Smart Meters
- Consumer Behavior Study
- Demand Response
- Customer Applications
- Distribution Automation
- Cyber SecurityE
- Smart Grid Infrastructure

SMUD's demand response efforts under the SGIG funding include implementation of a demand response management system, the implementation of automated demand response programs for medium and large commercial customers, and direct load control programs for residential and small commercial customers. This report describes the efforts and results of the 2013 Residential and Small Commercial PowerStat Load Control Study.

Study Overview

Introduction and Objectives

Direct load control programs that involve the remote control of customer air-conditioning (AC) units by electric utilities have been used and studied extensively for decades. To expand upon the existing knowledge in this field, the Sacramento Municipal Utility District (SMUD) in collaboration with Herter Energy Research Solutions designed a customer-choice study to investigate the customer preferences for and load impacts of potential program options currently under consideration at SMUD.

The three main program options offered in this study were designed to reduce peak loads during 12 summer Conservation Day events, making use of weekday time-of-use (TOU) rates, event-driven critical peak pricing (CPP), customer-managed smart thermostats, and direct load control (DLC) of air-conditioning (AC) by the utility via smart thermostats.

The primary objective of this load impact evaluation is to determine how these incentives and load management strategies affected (a) hourly loads for the 12 Conservation Days called during the summer of 2013, (b) hourly loads on non-event weekdays, and (c) overall summer energy use. The basic analytical approach involved a difference in differences (DID) regression model using hourly kilowatt (kW) values measured at the customer level by SMUD's existing metering infrastructure. Hourly load values were modeled using pooled mixed-effects models at two points in time—before and after treatment—for both the treatment and control groups. Treatment effects were then calculated as the difference between the changes seen in the two groups across time.

As a customer-choice study, this study is designed to test the effects of presenting all three program options to customers at the same time, allowing each to choose the one that best meets their needs and preferences. Should critical flaws in any of the individual offerings be uncovered in the process, a larger study scheduled for 2014 would take such findings into consideration, potentially adding, modifying, or eliminating options as appropriate.

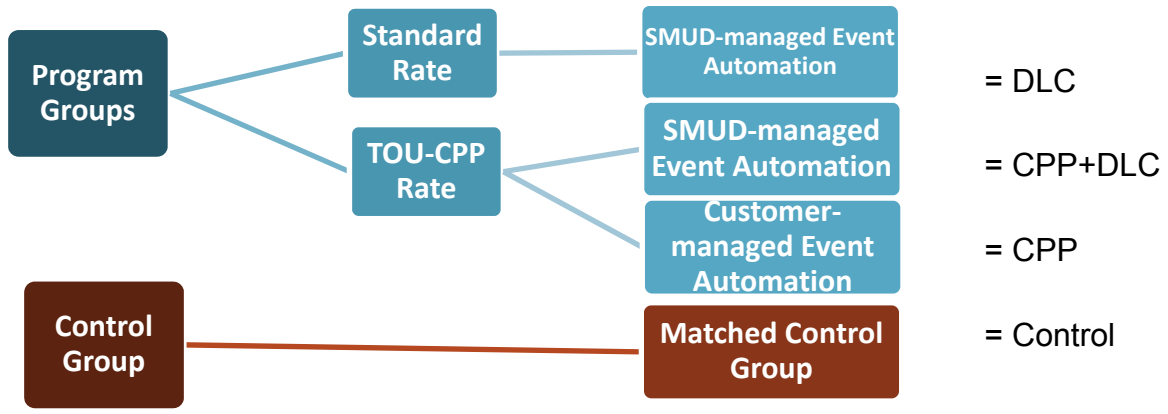
Study Design

The design of this study involves the introduction of an experimental TOU-CPP rate and one of two thermostat management options—customer managed event response or SMUD managed event response—giving birth to a total of three program groups as follows.

1. **CPP**—Participants choose to switch to a TOU rate with 12 summer CPP events. Participants can automate AC event response from +1°F to +5°F by programming their customer-managed thermostats in advance. Both AC and non-AC loads can be managed in real time to maximize demand response and bill savings.
2. **CPP+DLC**—Participants choose to switch to a TOU rate with 12 summer CPP events. Utility-managed thermostats automatically respond to events by +2°, +3°, or +4° without payment. Customers can override any or all events. Both AC and non-AC loads can be managed in real time to maximize demand response and bill savings.
3. **DLC**—Participants stay on the standard tiered rate and choose to be paid $2, $3 or $4 for each of 12 AC load-control events of +2°, +3°, or +4°, respectively. AC response to each event is automated with utility-managed thermostats. Customers can override any or all events, but forfeit the payment for each event override. Management of non-AC loads is not incentivized.

An overview of the basic sample design is illustrated in Figure 10. Note the three treatment groups described above are shown here along with a fourth—the Control group—which was used to adjust load impact estimates for non-program effects as described on page 64.

FIGURE 10. BASIC SAMPLE DESIGN



Invited customers were given the choice of one of two rate options. The *standard tiered* rate started for all customers at the Base rate of 10.45 cents per kilowatt-hour (kWh) and increase to the Base Plus (Base+) rate of 18.59 cents per kWh for all electricity use exceeding 700 kWh in a billing cycle. The experimental *TOU-CPP* rate consisted of higher rates during the 4-7 pm weekday peak periods, with discounted tiered rates outside the peak period. These rates are further described on page 18.

Invited customers were also given the choice of two thermostatic control options during events. Under the DLC option, customers could choose a level of event response at the beginning of the summer—a 2, 3 or 4 degree increase—and signed over control of this response, allowing SMUD to manage their thermostats during events. Customers who did not choose this option could still program (in advance) and manage (in real time) their own AC response of between 1 and 5 degrees for each event throughout the summer (Table 1).

TABLE 1. RESIDENTIAL ELECTRICITY RATES AND AC CONTROL STRATEGIES DURING EVENTS, BY TREATMENT

Group	Price per kWh During Events	Payment per Event*	AC Control Strategy During Events	Event offset options (°F)	Event Overrides per Summer
DLC	Base: $0.1045 Base+: $0.1859	$2, $3, or $4	Chosen by customer prior to summer	+2°, +3°, or +4°	Unlimited
CPP+DLC	CPP: $0.7500	None	Chosen by customer prior to summer	+2°, +3°, or +4°	Unlimited
CPP	CPP: $0.7500	None	Chosen/modified by occupant at any time	+1°, +2°, +3°, +4° or +5°	(NA)

* Payments are not made when events are overridden

Note that customers who chose either of the two utility-managed DLC thermostat options were also required to choose the level of management: 2, 3 or 4 degrees temperature increase during events. This choice was documented in the signed participation agreement, and was intended to be a one-time decision that could not be changed over the course of the summer. In contrast, those who chose the customer-managed thermostat option could program their thermostats to increase between 1 and 5 degrees during events or use the 3 degree default setting if no changes were made,

and could change this setting in their thermostat at any time in advance of or during events.

Rate Options

Residential PowerStat participants were given the option to sign up for a time-of-use (TOU) rate with critical peak pricing (CPP) events. Compared to the standard 2-tier rate, the TOU-CPP rate offered discounted off-peak pricing that accounted for 91% of the summer hours, higher peak pricing that accounted for 8% of the summer hours, and event pricing that was initiated in 3-hour blocks, 12 times per summer, for a total of less than 1% of the summer hours (Table 2).

TABLE 2. RESIDENTIAL RATE OPTIONS: STANDARD TIERED AND TOU-CPP RATES (SUMMER)

Period Name	Period Timing	Tier	Standard Tiered Rate *($/kWh)*	TOU-CPP Rate *($/kWh)*	% of Summer Hours
Event	4:00–7:00 p.m.	Base	$ 0.1045	$ 0.7500	1%
		Base+	$ 0.1859		
On-peak	4:00–7:00 p.m. Non-holiday weekdays	Base	$ 0.1045	$ 0.2700	8%
		Base+	$ 0.1859		
Off-peak	All other hours	Base	$ 0.1045	$ 0.0721	91%
		Base+	$ 0.1859	$ 0.1411	

Participant Options for Air-conditioning Automation

PowerStat participants were allowed to choose from two thermostat automation options in responding to event signals:

Customer-managed event response. The first option, available only to those who signed up for the TOU-CPP rate described above, was for the participant to program their own event strategy through a feature provided by the smart thermostats. Participants could program the thermostat to automatically increase from the normal peak setting by 1 to 5 degrees or use the 3 degree default setting. Occupants could change this automation setting at any time, including during events.

SMUD-managed event response. The second option, available regardless of the rate chosen, was for SMUD to manage the thermostat during events. Participants who

chose this option were required to choose one of three event strategies—2, 3 or 4-degree increase during events—to be applied to all events throughout the summer. Occupants could override any or all of the SMUD-managed events. Participants who chose this option and stayed on their existing rate were paid $2, $3, or $4 per event, respectively, for all events they did not override. Participants on the TOU-CPP rate who signed up for this rate were not paid for events, but rather benefited from the savings accrued through avoidance of the critical peak price.

Participant Benefits and Costs

The 2013 PowerStat Pilot offered customers the following benefits:

- **A smart thermostat.** All participants received an Energate Pioneer Z100, a programmable thermostat with the ability to communicate to and from SMUD's demand response management system (DRMS) through the smart meters using ZigBee Smart Energy Profiler version 1.1. Through this connection, the thermostats were able to receive SMUD's Conservation Day event signals and initiate automated event response by raising cooling temperature settings. Occupants could override this event response at the thermostat unit. Because communications were routed via SMUD's smart meter rather than via the Internet, participants did not have the ability to remotely adjust temperatures or schedules. The thermostat and its installation were free of cost to participants.
- **The opportunity for lower energy bills.** Participants on the TOU-CPP rate had the opportunity to save money as a result of the off-peak rate, which was about 30% lower than the standard rate. Participant could maximize bill savings by reducing peak loads or by shifting them to the off-peak period.
- **The opportunity to earn $24, $36, or $48 under DLC option.** Participants who stayed on the standard rate and enrolled in the load control option were paid $2, $3 or $4 for allowing SMUD to increase their temperature setting by 2, 3 or 4 degrees, respectively, during each of the 12 summer events.
- **Other potential benefits.** For many customers, participation in peak reduction programs is about feeling that they are doing the right thing: benefiting the environment and reducing strain on the electric grid to improve reliability for the community. Some customers enjoy the game of avoiding high rates, while others enjoy feeling like they are part of a team.

Customer costs included:

- Being present for the thermostat installation
- The potential for bill increases on the TOU-CPP rate due to higher peak rates

Schedule and Staffing

Table 3 outlines the major phases of project activity in 2013 and corresponding research tasks.

TABLE 3. PROJECT SCHEDULE

Task	Dates	Activities
Field Study Preparation	July—December 2012	• Project design and planning • Recruitment materials • Website
Recruitment	February—May 2013	• Invitation mailings and follow-up • Participant database
Installation & Survey	February—June 2013	• Install thermostats • Inventory database • Pre-treatment surveys
Field Study	June 2013—September 2013	• Call 12 events • Interim (post-event) surveys • Customer service
Final Evaluation	October 2013—March 2014	• Satisfaction surveys • Retrieve load database • Data analysis and reporting

Project Resources

Table 4 outlines the resources needed to implement the study. There was a combination of internal and external resources.

TABLE 4. PROJECT RESOURCES

Resource	Tasks
SMUD Senior Project Manager	Project design and oversight; Evaluation report
SMUD Project Manager	Project design and planning; Evaluation report

Resource	Tasks
SMUD Product Services Coordinator	Customer service; Equipment Inventory; Installation/Service work management
SMUD Principal Market Analyst	Development of customer lists
SMUD Business Technology Analyst	Troubleshoot device issues in systems that generate exceptions
SMUD Billing Representative	Placement of customer on and off program; removal of, and place back on, Peak Corps customers. Worked exception report.
SMUD Customer Service Assistant	Developed processes for customer sign up and associated tasks
SMUD Customer Training	Provided program, process, and systems training for: Contact Center, Customer Solutions, and the installation contractor
SMUD Residential Account Services	Assisted customer with program questions; directed customer escalation issues.
SMUD Contact Center Supervisor	Implemented program plans for Customer Service staff
SMUD Channel Management Professional	Developed technological adaptations for Contact Center
SMUD Customer Planning	Developed staffing levels; provided documentation
SMUD Marketing Advertising Specialist	Recruitment and other customer materials; Website design
SMUD Multimedia	Website development
SMUD Customer Research Professional	Surveys and survey evaluation; assistance with customer list development
SMUD Energy Specialist	Developed technical applications for customer documentation and reporting before and after customer recruitment
SMUD Office Process Support	Received and reviewed customer submitted application/agreement; customer support with recruitment materials; database entry; general troubleshooting
Outside Vendor—Metro Mailing	Print and assemble mail recruitment materials

Resource	Tasks
Outside Vendor—GoodCents	Provided appointment scheduling, service and installation of thermostats; technical troubleshooting
Outside Vendor—New Direction Services	Provided welcome kit bags, refrigerator magnets
Outside Vendor—Wallrich Creative Communications	Collateral design of brochure and user guide
Outside Vendor—Thomas/Ferrous	Design customer brochure
Outside Vendor—Apple One	Communication outreach
Outside Vendor—NexLevel	Document process flows
Outside Vendor—Lockheed Martin	Provided the Demand Response Management System
Outside Vendor—Energate	Provided the thermostats, auxiliary switches, wall plates
Outside Vendor—True North Research	Designed and administered the participant surveys, conducted the survey data analysis, and wrote report
Outside Vendor—Herter Energy Research Solutions	Assisted with project design; conducted load impact evaluation; Assisted in the evaluation report, developed use cases

Project Costs

From January 1 through December 31, 2013, approximately $2,000,000 was spent on the study. The study was funded with grant monies from the Department of Energy and co-funded by SMUD. Labor costs were the primary driver because of the indirect labor assessments applied to the direct labor charges. Outside Services and material and equipments costs were secondary. SMUD labor costs where high due to increased labor hours associated with implementing new programs from the ground up. Table 5 is a high-level breakdown of the various project costs.

TABLE 5. PROJECT COST SUMMARY

Item	Cost
SMUD Labor	$1,120,000
Outside Services	$465,000
Materials & Equipment	$438,000
Total	$2,023,000

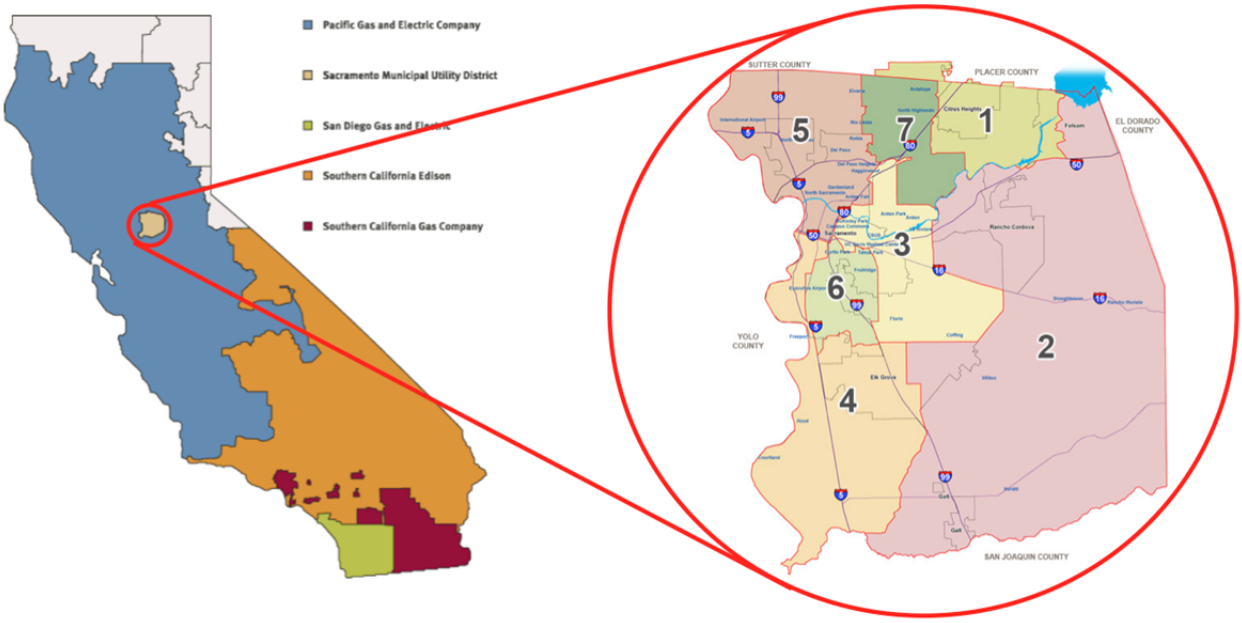
Implementation

Study Area and Context

The Sacramento Municipal Utility District (SMUD) service territory is located in California's central valley, covering the state capital of Sacramento and surrounding suburban areas (Figure 11). SMUD is currently the sixth largest community-owned electric utility in the nation, spanning 900 square miles. SMUD serves over half a million residential customers and 68,000 business customers.

Sacramento weather is characterized by rainy, mild winters and hot, dry summers. On average, the maximum daily temperature exceeds 90 °F on 74 days annually, and exceeds 100 °F on 15 days annually.

FIGURE 11. SMUD SERVICE TERRITORY



SMUD installed interval meters on all residential and commercial customers between 2009 and 2012. The residential meters record energy use hourly and commercial data is recorded every 15 minutes.

SMUD's only full-scale residential demand response program is Peak Corps, an air-conditioning load control program that uses private VHF communication to signal air-conditioning compressor switches during events. The program is considered an "emergency only" resource, and is not used to manage system peak loads on a regular basis. More than 93,000 of SMUD's residential customers (about 20%) receive

incentives of $2, $4 or $6 per event (depending upon cycling intensity) to allow the District to cycle their air conditioner during critical hours between June 1 and September 30 each year.

Other Smart Sacramento Pilots

In addition to the study described in this document, SMUD implemented several other pilots between 2011 and 2013 to test time-based pricing, real-time information, and advanced control technologies designed to lower energy use and peak demand, including:

- Residential Summer Solutions 2011-2012
- Residential Direct Load Control Precooling Study (2012 PowerStat Pilot)
- SmartPricing Options 2012-2013
- Residential Smart Thermostat Pilot 2013
- Low-income Weatherization, IHD and Smart Thermostat Pilot 2013
- In-home Display (IHD) Checkout Pilot 2013
- EV Innovators TOU Rate Pilot 2013
- Multi-family Summer Solutions 2013

Each pilot program was unique amongst itself in scope and objectives. However, some pilots used the same TOU/CPP rate and in almost all pilots an assessment of the load and energy impacts was done.

System Architecture

In another part of the SmartSacramento's DOE grant project, a new demand response management system was implemented. This new software platform enables the ability to management all of SMUD's demand response going forward in the future. This system opened three communication paths to customer's devices: 1) Broadband Internet, 2) OpenADR using the Internet, and 3) using the smart meter mesh network. The later path was used for this project. Figure 12 is a high level graphic presentation of the system.

FIGURE 12. SYSTEM ARCHITECTURE

The system architecture was developed in coordination with SMUD's information technology and cyber security staff to ensure that the various systems would be safe and reliable. Due to the cybersecurity concerns, a detailed description of the various subsystems and their interaction with each other are not being discussed in this report. SMUD built the system to be fully integrated with many of its current business systems to enable enrollment, messaging, demand response program creation, dispatch operations, billing settlement, device management, event analysis, and load reduction forecasting processes.

Thermostats

Each participant in the study received a two-way communicating Energate Z100 Pioneer 2 thermostat. Participants could receive up to two thermostats, if they had two compatible HVAC systems. The thermostat communicates to the smart meter installed at the premises using ZigBee Smart Energy Profile version 1.1. Table 6. Thermostat Informationindicates the specific version of the thermostat used in this study.

TABLE 6. THERMOSTAT INFORMATION

Item	Value
Model	Z100 Pioneer 2 Smart Thermostat
Part Number	0001290161
ZigBee Smart Energy Version	1.1
ZigBee Certificates	Production
Hardware Version	PL000582-F
Thermostat Firmware Version	OS000640 (version 2.2.0.2)
Radio Module Firmware Version	OS000418-G (version 1.3.3.0)

The Pioneer Z100 is a core component of Energate's home energy management solution that lets consumers and utilities manage energy use and reduce peak demand. With its slim, sleek design, the Pioneer Series is a full featured thermostat with a graphical display and an user interface. There are several communications options available. In a single radio configuration there is a ZigBee Smart Energy Profile certified version.

The following provides a summary of the key features and functionality of the smart thermostat.

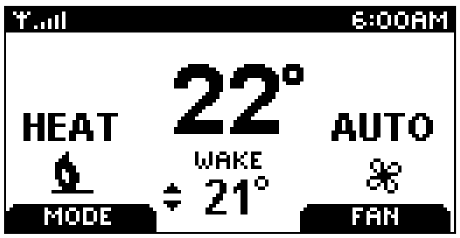
Key features include:

- Advanced environmental control algorithms that accurately and precisely control the temperature
- Multiple load control categories and capabilities for Demand Response programs
- Flexible price control profiles to support a variety of dynamic rate plans including TOU rates
- Menu-driven user interface with extensive help screens
- Fault/message notification for easier and more successful installations (i.e., survives & helps diagnose wiring problems)
- ZigBee Smart Energy compliant
- "Over the air" fully upgradeable firmware
- Text messages can be sent & acknowledgement requested
- Multiple LEDs indicate active events

As one of the first products to receive ZigBee Smart Energy certification, Energate's Pioneer Z100 smart thermostats provide interoperability with other ZigBee enabled components used in the Advanced Metering Infrastructure (AMI) and the Home Area Network (HAN).

The Pioneer series of smart thermostats are compatible with over 90% of HVAC equipment in the market today. This means one thermostat can be used for a majority, if not all of your customers and provide a full suite of features and functionality including:

- Up to 2 Heat/2 Cool stages on conventional equipment & up to 3 Heat/2 Cool stages for heat pumps.
- Powered by 24VAC with 5-10 year battery back-up & a low battery indicator.
- Highly accurate temperature control (±0.9˚F).
- Can display temperature in °F or °C.
- Multiple hold options (i.e., temporary, timed, permanent and vacation).
- 12/24 hour clock display for the user to select from.
- Auto changeover hysteresis with a default setting of 2˚F (option of 0 to 6˚F).
- Fault/message notification and short circuit protection for more successful installations.
- Comes equipped with the Energy Star program as the default program and supports 7 day, 5/2 day and 5/1/1 day schedules.
- LCD graphical display can render complex messages and graphics.
- The menu-driven multi-lingual (English and Spanish) user interface along with extensive help screens provide a superior user experience.
- 2.5"x1.25", 128x64 pixel LCD display with white backlighting.
- Password locking of the devices.
- The Pioneer series includes an intuitive signal strength indicator and can optionally display the customer's per KWh energy rate if desired.



The Pioneer series of smart thermostats also supports the following demand response capabilities:

- Direct Load Control—either immediate or schedule setbacks (set point offsets, duty cycle control, or specific temperatures) with the ability for the consumer to opt-out of load control events. This feature is an optional one that can be controlled by the utility. Also provides event verification and consumer notification.
- Supports multiple levels of participation in voluntary load control events as well as supporting multiple mandatory load control events.
- Visible alerts include color LED's on the faceplate that are tied to both load control and price driven events as well as through pre-defined and custom text messages.

Thermostat Configuration Settings

We were not able to use the thermostat as it came "off-the-shelf". The thermostat required a lot of forethought before purchasing the thermostat so that the manufacturer could deliver a thermostat that meet the business requirements of the various program offerings. Working with the thermostat manufacturer, we were able to custom configure a number of settings at the time of manufacturer. The key settings were the thermostat schedule and the price to comfort level.

Thermostat Schedule Table

Each thermostat was configured at time of manufacture with the following weekday and weekend schedules as shown in Table 7. Thermostat ScheudleFour time periods along with its heat and cool set points were preset. At time of installation, the installer working with the participant could change the settings depending on the participant preferences.

TABLE 7. THERMOSTAT SCHEUDLE

Monday – Friday			
START TIMES	**SETPOINT**		
	NAME	**HEAT**	**COOL**
6:00 am	Wake	68.0° F	78.0° F
8:00 am	Leave	62.0° F	80.0° F
6:00 pm	Return	68.0° F	78.0° F
10:00 pm	Sleep	62.0° F	78.0° F
Saturday – Sunday			
START TIMES	**SETPOINT**		
	NAME	**HEAT**	**COOL**
8:00 am	Wake	68.0° F	78.0° F
11:00 pm	Sleep	62.0° F	78.0° F

Price to Comfort Level Configuration Settings

At time of thermostat manufacture, the following relative price to comfort settings was configured as shown in Table 8. The relative price factor is calculated by dividing the current price by the lowest price received by the thermostat in the current and proceeding days. When the price factor is between two specified levels, the percentage is interpolated between the corresponding two percentage values. The percentage reflects the proportion of a 9° Fahrenheit change that will be applied based on the relative price and comfort level.

During critical peak periods (Conservation Days), the red LED on the thermostat would light-up and participant would have the ability, when enrolled in the CPP program to be able to adjust their temperature offset from 1 (9 degrees x .11) to 5 degrees (9 degrees x .55).

TABLE 8. PRICE TO COMFORT LEVEL CONFIGURATION SETTINGS

RELATIVE PRICE FACTOR	LED DISPLAY	COMFORT LEVEL				
		Max Savings	Savings	Balanced	Comfort	Max Comfort
1 x	None	0%	0%	0%	0%	0%
1.5 x	Yellow	0%	0%	0%	0%	0%
2.5 x	Orange	0%	0%	0%	0%	0%
6 x	Red	0%	0%	0%	0%	0%
10 x and greater	Red	55%	44%	33%	22%	11%

Non-Functioning Thermostat Findings

Over the course of the study, a total of 42 thermostats were returned to the manufacturer due to the thermostat not performing as intended or they appeared to not work at all. The manufacturer conducted a root cause analysis on each thermostat to determine what was causing the thermostat to not perform and recommended a course of action. Table 9 shows the root causes.

TABLE 9. ROOT CAUSE

Root Cause	Quantity
Incorrect configuration file programmed by the manufacturer	18
Transistor failed possibly due to transient voltage	4
Component	3
Eprom corruption	2
Total	27

The manufacturer recommends the following corrective actions which shall correct 92.5% of the issues:

- Manufacturing workflow improvement were made to reduce the risk of improper configuration programming
    - The person doing the programming will only be able to program one configuration at a time.

    - The manufacturer will perform verification on items being shipped directly from the manufacturer to the customer.
- TVS diodes are being added to all output stages to improve protection against transient voltage outside normal operating specifications.
- A battery pull tab will be added to the thermostat to prolong the battery life.
- The documentation will be improved to reduce the risk of cracking the LCD display.
- Later versions of the thermostat firmware will reduce the risk of eprom corruption.

The remaining 15 thermostats had the following issues as shown in Table 10. These were either damaged at the time of installation, not following procedures to commission devices to the network or the customer's HVAC system causes the thermostat to overvoltage.

TABLE 10. ROOT CAUSE (OTHER)

Root Cause	Quantity
No Fault found	9
LCD display cracked	3
Electrical overstress	2
No thermostat in box to test	1
Total	15

Field Study Activities

Recruitment/Enrollment/Participant Sample

A residential sample was randomly selected and screened to exclude customers enrolled in the following programs/pilots and rates:

- Smart Grid Investment Grant Pilots: Smart Pricing Options, Weatherization, Smart Thermostat, Summer Solutions 2013, Electric Vehicle Pilot
- Budget Billing
- Photovoltaic
- SolarShares
- TOU rate
- Medical Rate
- Multifamily
- Well rate

The residential sample was broken up into two different waves and used for recruitment by direct mail. The first wave was mailed out between February and April and included ACLM non-EAPR and ACLM EAPR and non-ACLM standard and non-ACLM EAPR customers. ACLM customers are those on the current Air Conditioner Load Management program and EAPR customers are on the Energy Assistance Program Rate. The samples contained a percentage of each that reflected the population at large. Each of these customers was mailed to twice during this period minus those who already responded to first mailing. A second residential sample was obtained afterward for additional recruitment due to an insufficient response from the small commercial recruitment effort. The second wave consisted of only ACLM standard/EAPR customers. These customers were mailed to only once in May.

The first wave consisted of 25,047 unique customers that were mailed to and the second wave included an additional 17,324. The total is 42,371. A total of 1,618 applications/agreements were received from the two recruitment efforts, which translates into an overall response rate of 3.82%. From the responses, 851 customers had new thermostat installations.

Thermostat Installation

Installation appointments were scheduled as a four-hour window in which the installer would arrive at the customer's home. On average, the installation took about one hour. The installation contractor verified that the customer had a HVAC system that was compatible with the new thermostat being installed. They also checked that the HVAC system was in working condition. Existing thermostats removed from the Customer's home that contained mercury were disposed of a required by AB 2347. Old thermostats that did not contain mercury were given to the customer. At any time during the study, the participants could request that the old thermostat be reinstalled, a service provided at no cost to the customer.

In situations where the HVAC system did not already have a common wire, which is required by the Energate thermostat, an auxiliary switch was installed. Figure 13 shows the auxiliary switch.

FIGURE 13. AUXILIARY SWITCH

Approximately 12% of the thermostat installations required the auxiliary switch. Of these, most were split system HVAC systems as opposed to package units.

Each installer was responsible for completion of a work order before leaving the home. Information captured denoted the customer installation status (i.e. installed, cancelled, not compatible, etc), and data about the premises and air conditioning characteristics. The work order was then delivered to the installer office for processing of the relevant information and then forwarded onto SMUD for data retention. Of primary importance was the square footage of the premises and the ceiling insulation R-value. And estimation of the R-value was made if one could not be directly ascertained. The R-value was used in conjunction with the analysis in this report. A copy of the work order is located in Appendix A.

Participant Education and Support

Installer Interaction

The installer provided the customer with a brief tutorial on the operation of the installed thermostat, including familiarizing them with the default temperature settings and schedules. If the customer requested a different setting the installer would provide hands-on help with the setting modification. In addition, the self-managed group of participants was provided details on the comfort dial function. The default value was three degrees, which was set during manufacturing. If the participant requested a setting other than three degrees, the installer set it for them.

Welcome Kit

A welcome kit in a nylon mesh bag was delivered to the customer by the installer at the time of installation. Two separate welcome kits were developed for the two main program offerings. The welcome kit bag contained the following components:

- Inserts—Welcome, Contact Us, Peak Hours & Conservation Days, Notification of Conservation Days, Meet the Energate Pioneer Z100 Thermostat (basic navigation).
- Energate Thermostat User Manual—Manual for customer use to navigate thermostat features.
- Refrigerator Magnet—included separate contact information for study and technical/thermostat inquiries.

Reminder Package

A reminder package was sent to the customer just prior to the evaluation period beginning (June) for the purpose of providing the customer information on what was going to happen during the summer as well as other materials. The reminder package included:

- Summer Notification Letter
- Buck slip: Text Opt in
- Flyer on energy saving tips
- Smart Thermostat User Guide

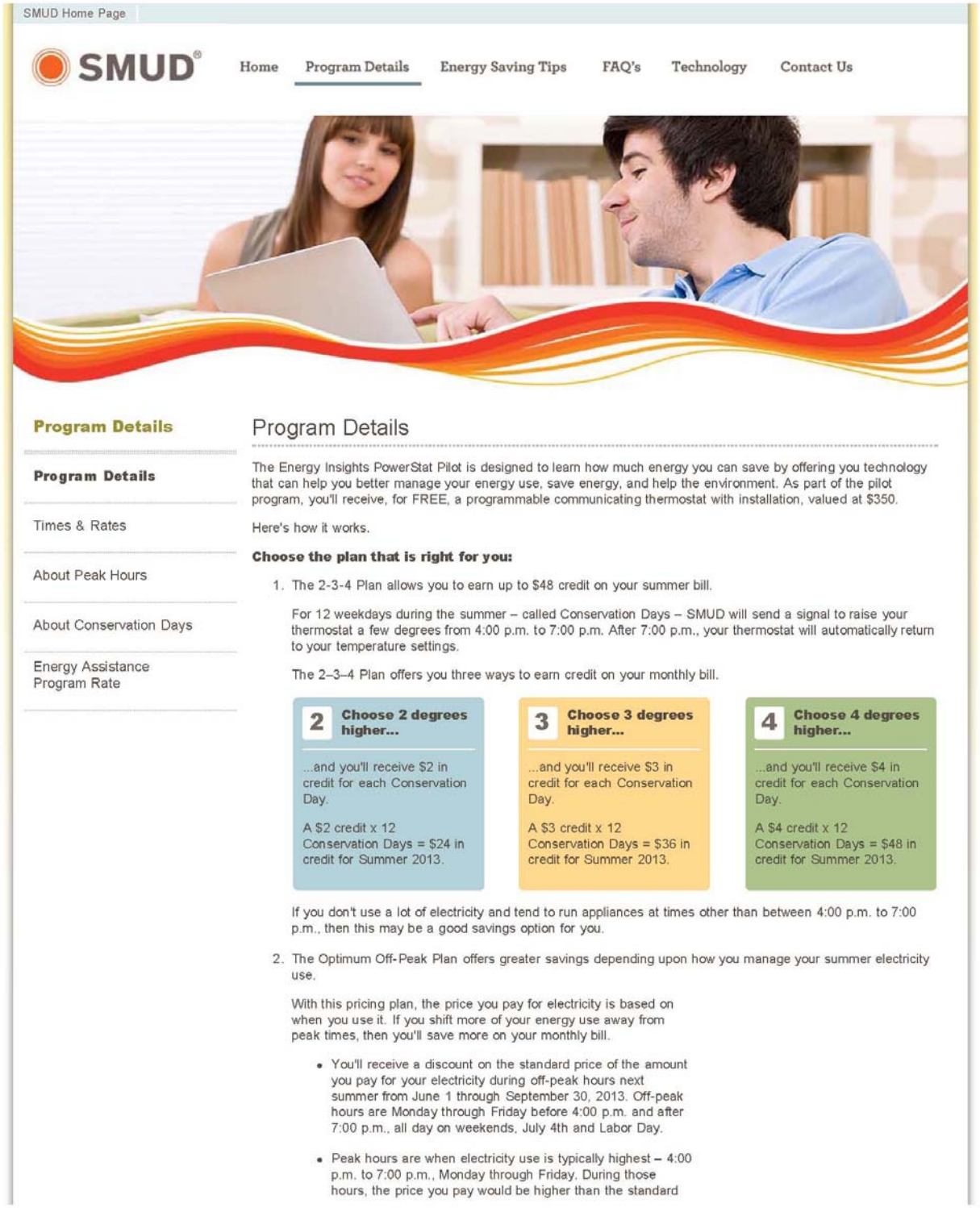
PowerStat Website

The PowerStat website was built to be a “micro-site” for participants enrolled in the study but could not be navigated to from SMUD’s corporate website (www.smud.org) as it was a controlled participant study. The landing page featured two choices in which to proceed: Residential Customers and Commercial Customers. Figure 14 shows screen shots of the micro-site which provided participants with program details, energy saving tips, answers to frequently asked questions, the technology used with the Energate thermostat user manual, and contact information.

FIGURE 14. MICRO-SITE WEBPAGES

smud.org | Energy Insights PowerStat Pilot

https://www.smud.org/2013powerstat/residential/index.htm[3/12/2014 2:03:34 PM]



SMUD Home Page

SMUD

Home | Program Details | Energy Saving Tips | FAQ's | Technology | Contact Us

Program Details

- **Program Details**
- Times & Rates
- About Peak Hours
- About Conservation Days
- Energy Assistance Program Rate

Program Details

The Energy Insights PowerStat Pilot is designed to learn how much energy you can save by offering you technology that can help you better manage your energy use, save energy, and help the environment. As part of the pilot program, you'll receive, for FREE, a programmable communicating thermostat with installation, valued at $350.

Here's how it works.

Choose the plan that is right for you:

1. The 2-3-4 Plan allows you to earn up to $48 credit on your summer bill.

   For 12 weekdays during the summer – called Conservation Days – SMUD will send a signal to raise your thermostat a few degrees from 4:00 p.m. to 7:00 p.m. After 7:00 p.m., your thermostat will automatically return to your temperature settings.

   The 2–3–4 Plan offers you three ways to earn credit on your monthly bill.

2 Choose 2 degrees higher...	3 Choose 3 degrees higher...	4 Choose 4 degrees higher...
...and you'll receive $2 in credit for each Conservation Day.	...and you'll receive $3 in credit for each Conservation Day.	...and you'll receive $4 in credit for each Conservation Day.
A $2 credit x 12 Conservation Days = $24 in credit for Summer 2013.	A $3 credit x 12 Conservation Days = $36 in credit for Summer 2013.	A $4 credit x 12 Conservation Days = $48 in credit for Summer 2013.

   If you don't use a lot of electricity and tend to run appliances at times other than between 4:00 p.m. to 7:00 p.m., then this may be a good savings option for you.

2. The Optimum Off-Peak Plan offers greater savings depending upon how you manage your summer electricity use.

   With this pricing plan, the price you pay for electricity is based on when you use it. If you shift more of your energy use away from peak times, then you'll save more on your monthly bill.

   - You'll receive a discount on the standard price of the amount you pay for your electricity during off-peak hours next summer from June 1 through September 30, 2013. Off-peak hours are Monday through Friday before 4:00 p.m. and after 7:00 p.m., all day on weekends, July 4th and Labor Day.
   - Peak hours are when electricity use is typically highest – 4:00 p.m. to 7:00 p.m., Monday through Friday. During those hours, the price you pay would be higher than the standard

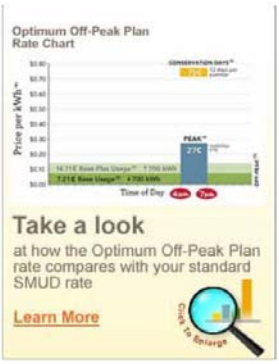
SMUD

price. That means that 90% of the time, you get a discount!

- For 12 weekdays during the summer – Conservation Days – the peak price you pay will be higher than your usual peak price. Peak hours on Conservation Days are from 4:00 p.m. to 7:00 p.m. That is just 36 hours or 1% of the summer!

SMUD can help manage your Optimum Off-Peak Plan for you.

As an added convenience, you can choose to have SMUD help you manage your electricity use. On the 12 Conservation Days from 4:00 p.m. to 7:00 p.m., SMUD can send a signal to electronically set your thermostat to conserve electricity. The signal will increase your thermostat by your choice of 2, 3 or 4 degrees. You decide on the energy savings you want and SMUD will manage the rest for you. It's a great way to lower your energy bill and have one less thing to think about.



Take a look

at how the Optimum Off-Peak Plan rate compares with your standard SMUD rate

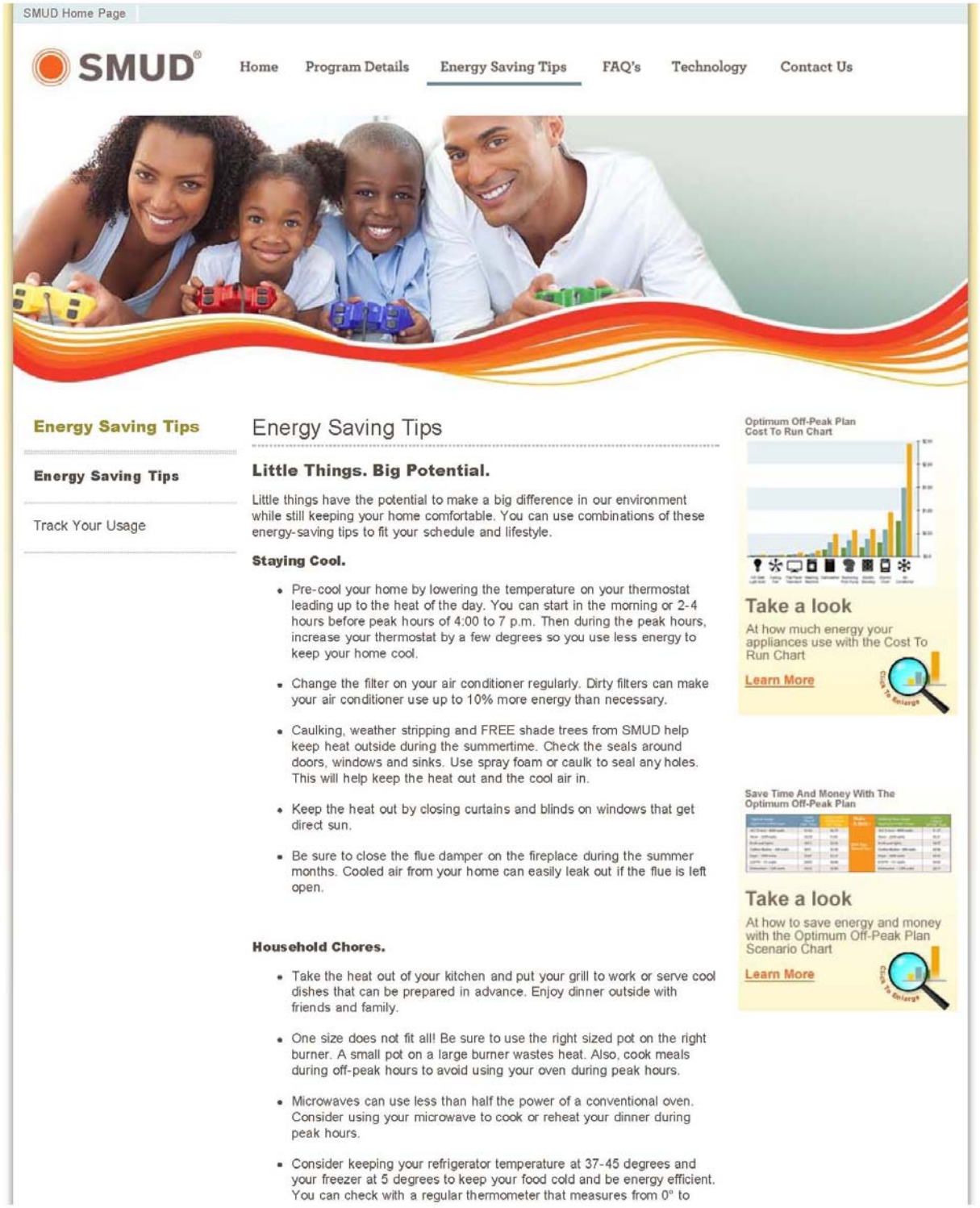
Learn More

Click to Enlarge

EAPR Customer?

There's a Optimum Off-Peak Plan for **Energy Assistance Program Rate** customers too

Learn More



SMUD Home Page

SMUD

Home | Program Details | Energy Saving Tips | FAQ's | Technology | Contact Us

FAQ's

- Background
- Participation
- Thermostat
- Peak & Off-Peak
- Conservation Days
- Billing

Frequently Asked Questions

Background

Why is SMUD doing this pilot program?
Our Energy Insights PowerStat Pilot is designed to provide our customers with new opportunities to lower their electricity usage while staying comfortable. We thank you in advance for your participation.

How long will this pilot program last?
The pilot program begins when your FREE programmable communicating thermostat is installed by a SMUD contractor. During the course of the pilot program, we'll learn how much electricity you save by utilizing the service. You'll participate in the pilot program until December 31, 2013.

Why should I participate?
The pilot program will provide you the opportunity to:

- Save on your electricity bill
- Automate energy savings
- Help the environment
- Try a new technology for free
- Become a part of an exclusive community of customers to help SMUD determine the best way to bring this opportunity to all of our customers in the future.

How will the pilot program work?
A SMUD contractor will come to your home to install your new thermostat. SMUD will coordinate and complete the installation at no cost to you.

Participation

What are the participation requirements?
You are eligible to participate in the pilot program if you meet the pilot conditions (see Application). You agree to have SMUD's contractor install the thermostat. Finally, you'll complete up to ten surveys throughout the pilot period.

The pilot program is available on a first-come, first-served basis. We will accept participants in the order Application and Participation Agreements are received, until we have reached capacity. It is possible that when the SMUD contractor arrives to install your thermostat, your home may be ineligible if, for example, your heating and cooling system isn't compatible or if it isn't operating properly.

How was I chosen for this pilot program?
A small group of customers were randomly selected for the PowerStat Pilot. Only those customers who were randomly selected are qualified for the pilot program.

Who can I call if I have questions about the pilot program?
You can call us toll-free at 1-855-253-1824 or email us at 2013powerstat@smud.org and we'll assist you with any questions you may have about the pilot.

SMUD

100°.

- Run your dishwasher with a full load and use the air-dry option if available.
- Hang clothes to dry outside or on a drying rack inside instead of using the dryer.
- Wait to do laundry until you have enough for a full load. Front-loading machines use 30 percent less water and 50 percent less energy than regular machines.
- Set your dryer to automatically turn on when it senses the clothes are sufficiently dry. This saves unneeded dryer time - and energy!
- If you have an electric water heater, lower the temperature to 120 degrees.
- Consider replacing your bathroom's ventilation fan with an ENERGY STAR® fan to reduce your energy usage. Be sure to turn the fan off when you leave the bathroom.

Electronics and Entertainment.

- Be sure all electronic devices that are not in use are shut off completely. Even a sleeping computer or TV set uses energy. Use smart strips so that you can easily turn off multiple appliances at once.
- Use the tools on this website and on smud.org to learn how much power your devices use so that you can manage their use during peak hours on Conservation Days.
- During peak hours on Conservation Days, consider activities that don't use energy, such as board games or playing with water toys outside.
- Turn off the lights when you leave a room. Unplug unused appliances, too.
- When you're buying appliances and electronics, look for the ENERGY STAR label.
- To make sure outdoor lights aren't on during the day, install light-sensitive controls or timers to automatically turn off lights when not needed.
- Decorative lights in the yard are a fun part of summer - but choose solar-powered lights or replace the bulbs with compact fluorescent lights (CFLs) or light-emitting diodes (LEDs).
- Consider replacing your light bulbs with energy efficient CFLs or LEDs.
- Consider using a solar-powered charger for your household's cell phones.
- Desk lamps focus the light where you actually need it, rather than wasting energy lighting the entire room.

Pools and Spas.

- Set your pool heater to a constant 78 degrees or lower. You'll use about 40% less energy than if you were to set it at 82 degrees. You'll still be comfortable and save money.

What happens if I choose not to participate?
You don't need to do anything. Nothing will change about your current service.

What if I enroll, and then I change my mind?
Please call us toll-free at 1-855-253-1824 to let us know you have changed your mind. You will be dropped from the pilot program and the thermostat will not be installed. If your thermostat was already installed, the SMUD contractor can re-install your old thermostat, if requested.

What data will be collected for the pilot program?
We'll see if your whole house energy consumption changes and ask you about your experience with periodic surveys. We, and our research partners, will keep your personal data confidential. Only summary or aggregate data, not associated with any identifiable customer(s), will be reported or made public as a part of this pilot program.

Can I participate if I move?
This pilot program is only available to randomly selected customers based on the home they live in when they were selected. If you do happen to move during the pilot program, please contact us toll-free at 1-855-253-1824 and you'll be removed from the pilot program.

What if my home has two thermostats?
Your home may have up to two thermostats, but no more than one per central air conditioner. Both thermostats will be replaced at no cost to you.

How do I enroll?
If you meet the requirements listed on the Application, simply fill it out, and review and **sign** the Participation Agreement. Mail them back to SMUD at P.O. Box 15830, Mail Stop A203, Sacramento, CA 95852-0830, ATTN: Customer Solutions. If you meet the eligibility requirements, and your enrollment is confirmed, you'll be contacted by our SMUD contractor to schedule your thermostat installation.

Why is it important to keep my appointment date?
To properly collect the data for the pilot program, scheduled appointments need to be kept. If you are unable to keep your appointment, please notify us as soon as possible, otherwise your participation in the pilot program may be at risk.

Do I need to be home for the installation?
The customer who received the offer and is listed on the Application needs to be present for the installation appointment.

How many surveys will I need to participate in?
You'll be asked to complete up to ten surveys. The first one will be provided to you after your installation appointment, but before the program begins on June 1, 2013. There will be surveys after a select number of Conservation Days to enable you to share your satisfaction and comfort levels. Finally, a survey will be sent to you after the conclusion of the pilot program on September 30, 2013.

What happens at the end of the pilot program?
At the end of the pilot program, SMUD will send you one final survey to learn about your experience with the pilot program and you get to keep your new thermostat.

Can I save money as a participant?
If you choose the Optimum Off-Peak Plan, reducing your energy use during peak hours (4:00 p.m. to 7:00 p.m.) is likely to save you money. The amount each person can save may vary.

Online Service & Thermostat

Who do I contact if I have questions about the service and/or the thermostat?
Please contact Good Cents at 866-380-6052. Visit the Technology page for more information as well.

What happens if I lose power?
As with any loss of power in your home, your heating and cooling systems may not be operational. The thermostat will retain information for proper operation of your heating and cooling system. The display will not show any information. Once power is restored, your thermostat will continue operating with your current settings. If your system is still not functioning, please call Good Cents at 866-380-6052.

What happens if I make manual temperature adjustments to my thermostat?
The scheduling program breaks the 24 hour day into 4 time periods: Morning, Day, Evening, and Night. If you make a manual adjustment to the temperature during one time period, the thermostat will go back to the programmed set point when the next time period starts. If this action is taken during the peak period (4:00 p.m. to 7:00 p.m.) of a Conservation Day, then you have "opted-out" of the event and your thermostat will return to the next programmed temperature value.

What settings do you recommend?
SMUD recommends the following thermostat settings to achieve the greatest savings and comfort:

- During the summer, 78 degrees or higher when you're home and 85 when you're away (Please note, the default "away" setting of the Energate is 80 degrees. If you would like a higher setting, you can adjust the schedule.)
- During the winter, 68 degrees or lower when you're home and 62 when you're away

Is there a warranty on the thermostat? If so, how long is it under warranty?
The thermostat is under warranty until the pilot program contract ends on December 31, 2013.

What does the acronym 'HVAC' stand for?
HVAC stands for Heating, Ventilation and Air Conditioning.

Do I get to keep the smart thermostat when the pilot program is over?
The thermostat is yours to keep, if you complete the pilot program requirements.

Peak & Off-Peak

When are peak hours?
Peak hours are the hours when electricity use is typically highest – 4:00 p.m. to 7:00 p.m., Monday through Friday, June 1 through September 30, 2013.

When are off-peak hours?
Off-peak hours are Monday through Friday before 4:00 p.m. and after 7:00 p.m., all day on Saturday and Sunday, July 4th and Labor Day.

Why are peak hours from 4:00 p.m. to 7:00 p.m.?
Because that's when electricity use in our community is highest. People are coming home from work and turning on air conditioners, TVs, computers, using their ovens, etc.

Why is peak a problem?
During the summer months, and especially during late afternoon and early evening weekday hours, the electricity use soars. To meet this increased need, we often have to buy energy from very expensive and less environmentally-friendly sources. By reducing electricity use during peak periods, we can avoid purchasing less-desirable forms of energy.

How can I stay comfortable during peak hours and save money?
You can keep your home cooler by doing things like closing curtains and blinds on windows that get direct sun, using fans and not using appliances like your oven. There are more energy-saving tips here.

Do I have to change how I use my electricity to save?
Many customers may save based on the way they use electricity today. If you're already using less electricity during peak hours, you may save without making any additional changes. You can save even more if you shift your electricity use to the off-peak period. Everyone can save by managing their peak electricity use but the amount each person can save is different.

Will SMUD restrict my electricity use during peak hours?
No. You'll have control of your electricity use at all times.

Will SMUD shut my air conditioner off during peak hours?
No. You have control over your air conditioner and all of your electrical appliances.

What appliances/electronics should I use less during peak hours?
The biggest electricity user in your home is your air conditioning system. You'll see the most savings if you reduce or eliminate air conditioner use during peak hours. You can also reduce – or just not use – appliances like large, flat screen TVs, your pool filter or your oven. Since it is still very light out during peak periods, be sure to turn off any lights you are not using.

Why can't SMUD just buy more energy during peak periods?
We can buy more electricity but it's often from more expensive and less environmentally friendly sources.

What is less desirable energy?
Less desirable energy is energy that costs more or is not environmentally friendly.

Conservation Days

What is a Conservation Day?
Conservation Days may be based on predictions of particularly high electricity use, high market prices, or system emergencies. This summer, from June 1 through September 30, 2013, we will identify 12 weekdays as Conservation Days. Conservation Days will never be on July 4th or Labor Day.

Is there a schedule of Conservation Days?
No, because Conservation Days are based on predictions of particularly high electricity use, high market prices, or system emergencies, we don't have a schedule of which days will be Conservation Days.

How much notice will I get before a Conservation Day?
We will notify you the day before a Conservation Day, using the method you've requested (email, text or by phone) so that you can plan your activities accordingly.

When are peak hours on Conservation Days?
Peak hours on Conservation Days are from 4:00 p.m. to 7:00 p.m.

Are consecutive Conservation Days a possibility?
Yes, there could be several Conservation Days in a row.

Will there be more than 12 Conservation Days?
No, there will be exactly 12 Conservation Days next summer, from June 1 through September 30, 2013.

Time-Based Electricity Pricing

Learn more about how time-based electricity pricing works.

View video

Billing

When does the Optimum Off-Peak Plan go into effect?
This Optimum Off-Peak pricing plan runs through this summer, starting on June 1, 2013 and it is in effect until September 30, 2013. Your current rate will not change prior to June 1, 2013.

What is a watt?
A watt is the amount of energy a device uses in performing its function. Example: a 100 watt light bulb uses 100 watts.

What is a kilowatt?
A kilowatt is 1,000 watts.

What is a kilowatt hour (kWh)?
A kilowatt-hour (kWh) is the term used to measure the amount of electrical power used in one hour. Kilowatt-hours are what the electric meter on the side of your house measures. This is the basis for calculating your monthly electric bill.

What is Base Usage?
Your residential electricity rate has a baseline amount each monthly billing period. That amount is up to 700 kWh. Your total Base Usage cost reflects the cents per kWh and the amount of electricity you use up to the baseline amount. (Customers with wells on their property receive an additional 300 kWh of Base Usage for a total of 1,000 kWh.)

What is Base Plus Usage?
When you exceed your Base Usage amount (more than 700 kWh) of electricity during the monthly billing period, the cost per kWh increases. Your total Base Plus Usage cost reflects the cents per kWh and the amount of electricity you use beyond the Base Usage amount.

How much can I save?
Everyone's energy use is different but if you reduce the amount of electricity you use between 4:00 p.m. and 7:00 p.m., especially on Conservation Days, you should save on this plan.

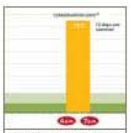
Could my bill go up?
Yes, if you don't reduce your electricity use during peak hours, especially on Conservation Days, your bill could increase.

What if my bill increases? Will you work with me on payments, or adjust my billing if I decide I want to go back to my standard rate?
If your bill increases and you decide that you no longer want to be on the plan, you can go back to your standard rate. You'll no longer be able to participate in the PowerStat Pilot. While we can't adjust your bill, you can request to make payment arrangements by calling our Customer Service Center at 1-855-253-1824.

Will I receive guaranteed savings on the Optimum Off-Peak Plan?
You'll have the opportunity to save on your bill if you reduce your electricity use during peak hours or shift your electricity use to off-peak hours, however, the plan does not provide guaranteed savings.

Learn more:

Time-Based Electricity Pricing


Rate Comparison Chart

Customer Surveys

True North Research was hired to design three different surveys to be administered to customers at various stages of the study, conduct the research and write a report of the findings.

Customers received email invitations (and reminder emails when necessary) to participate in the surveys through a secure, password protected website hosted by True North. Customers who did not participant online in response to the email reminders also received telephone calls for the purpose of conducting interviews via telephone. A summay of the three survey types is described below. The full report can be found in Appendix H.

Pre-treatment Survey. Following the installation of the new thermostat, this survey included questions about he customers' reasons for participating in the program and expectations of the program, as well as evaluative questions regarding the enrollment process, the thermostat installation process, initial impressions of the thermostat, and overall opinions about SMUD.

Interim Survey. There were multiple interim surveys distributed online throughout the evaluation period. The surveys were sent out the day after the Conservation Day event and included questions regarding Conservation Day awareness, behaviors, comfort level of the respondent during peak hours, and opinions regarding the PowerStat study.

Post-Treatment Survey. At the end of summer, all participants were e-mailed a link to an online Post-Treatment Survey. The survey measured the satisfaction and perceptions of SMUD and GoodCents customer service. For customers enrolled in the CPP program offering, the survey included questions about their typical Conservation Day settings.

Conservation Day Events

Conservation Day Events were called on twelve weekdays from June through September 2013, as listed in Table 11. Participants were notified by email, text and/or phone on the day before each event according to the customer's preference. Multiple channels could be selected by the customer.

TABLE 11. EVENT DATES AND TEMPERATURES

Date	Day of the Week	Minimum Temperature	Maximum Temperature
6/28/13	Friday	67°F	104°F
7/2/13	Tuesday	74°F	103°F
7/3/13	Wednesday	69°F	105°F
7/19/13	Friday	59°F	100°F
8/15/13	Thursday	62°F	95°F
8/19/13	Monday	71°F	102°F
9/6/13	Friday	55°F	92°F
9/9/13	Monday	61°F	100°F
9/10/13	Tuesday	63°F	88°F
9/13/13	Friday	60°F	92°F
9/19/13	Thursday	53°F	90°F
9/30/13	Monday	60°F	78°F

At 4:00 p.m. on event days, target temperatures on the utility-controlled thermostats of the DLC and CPP+DLC participants were raised by 2, 3, or 4 degrees higher than the minimum scheduled set point during the peak period. CPP participants were raised by the default of 3 degrees, unless the participate chose to change the offset value from between 1 degree and 5 degrees. As a condition of using the pilot TOU-CPP rate, a total of 12 events had to be called for the summer season (June-September). As a result, the last four events in September were called at less than ideal outdoor temperatures. These low temperature conditions serve as more data to observe how participants use their air conditioner and other appliances when outdoor temperatures are mild.

Event Opt Out

Three options were provided for the customer in which to opt out of a Conservation Day event. The first was for the customer to place a call to the Contact Center after

receiving the day-ahead notification where a customer service representative would access the customer interface record. The customer service representative would then select the next day and opt the customer out of the event. Of note are two items: the customer had to call in call in to opt out the day before as each program (treatment) in the DRMS was defined as “day ahead” as one of the parameters, which resulted in locking down each treatment at midnight the day before the Conservation Day and a customer-driven online opt out platform was to be made available for study participants but due to a developmental delay in a broader online customer platform in which this offering was to be integrated, the online option was tabled. As such, the call in option was used very rarely as it was estimated that 10 requests were made by customers to opt out.

The second option was for the customer to select a permanent opt out from the thermostat. A permanent opt out is a feature that requires the customer to drill down multiple levels for access. This option election results in the customer being permanently opted out of all future Conservation Day events unless the customer essentially goes in and turns the feature off, thus opting back in to receive Conservation Day events. This feature applied to only those participating in the SMUD controlled groups (applicable to DLC and CPP+DLC). In the participant material provided in the Reminder Package, a warning was given to participants about using this option as they may forget to opt back in if they use this feature.

Event Override

The third option, and by far the most widely used, was for participants to opt out of the event by overriding the increased thermostat setting after the event had started by utilizing a temporary hold feature on the thermostat. DLC participants would forego their event bill credit when an override is used. CPP and CPP+DLC participants would pay the critical peak price. The event overrides were tracked in the Demand Response Management System and the information was used for monthly electric bill charges and credits.

Data

The 2013 PowerStat study was originally designed to test the impacts of peak electricity rates and load control in the residential and small commercial sectors. Due to time and resource constraints, the small commercial recruitment effort was limited. As such, the bulk of this report focuses on the implementation, evaluation and results of the residential participants, while a more limited description and evaluation of the small commercial study is provided in the appendix.

Table 12 lists the datasets and sources used in this evaluation.

TABLE 12. SUMMARY OF DATA USED IN THE 2013 POWERSTAT PILOT EVALUATION

Source	Data	Use(s)
SMUD Customer Database	Name, address, etc.	Treatment designation, Mapping
Interval Meters	Hourly electricity use	Load impacts, Bill impacts
MesoWest.utah.edu	Hourly temperatures	Temperature effects on load impacts
Installer Checklist	Ceiling R-value	Insulation effects on load impacts
Surveys **Pre-treatment** **Post-event** **Post-treatment**	Building characteristics Comfort ratings Program-related behaviors	Demographics-impact correlations Comfort-impact correlations Behavior-impact correlations

Table 13 provides the start and end dates for which hourly load and temperature data were collected.

TABLE 13. EVALUATION PERIOD START AND END DATES

Evaluation period	Start date	End date
Pretreatment	6/1/12	9/30/12
Treatment	6/1/13	9/30/13

Sample Sizes

In aggregate, the two rate options, two thermostat management options, and three DLC options combined to create a total of 7 individual participant groups and subgroups for each sector. Table 14 lists the number of residential and small commercial participants in each group.

TABLE 14. RESIDENTIAL GROUPS AND SUBGROUP SIZES

Program Group	2-3-4 Subgroup	Residential Participants	Commercial Participants
DLC	DLC2°	57	2
	DLC3°	99	0
	DLC4°	353	6
CPP+DLC	CPP+DLC2°	65	0
	CPP+DLC3°	70	0
	CPP+DLC4°	156	2
CPP	--	37	2
Total		807	12

Potential Sources of Bias

The term “self selection” is commonly associated with the word “bias.” In this study, however, self-selection is desired or even required, being the natural outcome of a voluntary offering. The PowerStat study was designed to offer the study participants the same self-selection criteria as will be ultimately be offered to future program participants. Thus, the recruitment effort was intended to mimic the rollout of a full-scale program that provided all three program options—CPP, DLC, and CPP+DLC –allowing customers to choose the option that best suited their household, with the hope that study sample size ratios would approximate the proportions SMUD might expect in a larger rollout. So while *self-selection* is an intentional part of this study, there should be no self-selection *bias* with respect to extrapolating the program results to the final

program target market, because the same types of people are expected sign up for the same offering and respond in the same way.

The unfortunate caveat here is that the PowerStat recruitment materials failed to explain the availability of customer-managed event automation for the TOU-CPP option, leading to an unusually low recruitment number for the CPP group. Table 15 shows the program choices listed on the Participation Agreement. The full Participation Agreement can be found in Appendix A.

TABLE 15. PROGRAM CHOICES SECTION OF THE PARTICIPATION AGREEMENT

Group	Participation Agreement Choice
CPP	A. ☑ Optimum Off Peak Rate + Energate Thermostat ❑ YES, I will allow SMUD to automatically raise my thermostat temperature up 2, 3, or 4 degrees during Conservation Days.
CPP+DLC	A. ☑ Optimum Off Peak Rate + Energate Thermostat ☑ YES, I will allow SMUD to automatically raise my thermostat temperature up 2, 3, or 4 degrees during Conservation Days.
DLC	B. ☑ 2, 3, 4 Plan + Energate Thermostat

Participants who switched to the TOU-CPP rate checked the orange box for plan A, and then had the option to add the SMUD-controlled temperature adjustments during Conservation Day events. Unclear in the agreement was the fact that those who did not choose the automatic temperature control option could still set their thermostats to respond automatically to event signals. Thus, it seems probably that some TOU-CPP customers signed up for the automatic temperature control option solely to gain the automated response, not realizing they would have automation either way.

The result of this issue is that there are likely to be participants in the CPP+DLC group that would have chosen the CPP group had they been better informed. It is also likely that there are invited customers who chose not to sign up for PowerStat study at all, because they did not know there was a customer-managed thermostat option. The extent of the bias related to this issue is unknown, but an expanded study planned for 2014 will provide revised recruitment materials in an effort to remedy this issue.

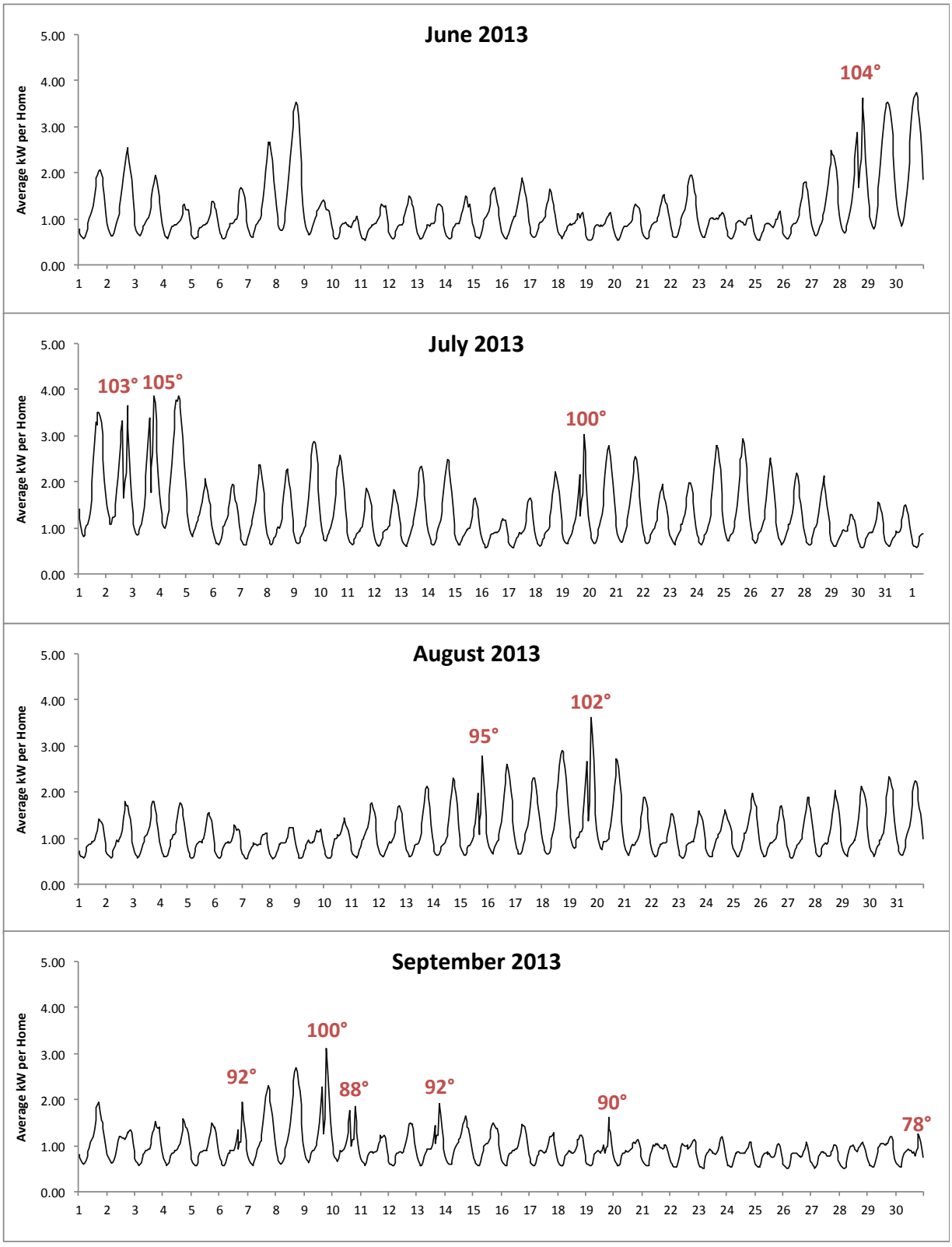
Observed Summer Load Data

SMUD records hourly electric loads from all residential customers and 15-minute loads from commercial customers. A database of interval load data for June-September 2012 and June-September 2013 for all PowerStat participants was organized and analyzed to determine the load impacts of the program.

Figure 15 illustrates the placement of Conservation Days and maximum temperatures in the context of hourly summer loads for all PowerStat participants. Clearly visible are the twelve Conservation Days, which are labeled with their corresponding maximum temperature for that day.

Of interest is the late June start date for the first event and the late season rush in September, resulting in several events that did not meet the desired temperature criteria of having at least one hour in the day exceeding 100°F.

FIGURE 15. MEAN HOURLY LOADS FOR ALL POWERSTAT PARTICIPANTS WITH EVENT TEMPERATURES



Individual plots of observed loads on event days are provided in Appendix B.

Figure 16 plots the average observed weekday loads for summer 2012, the pretreatment period prior to pilot recruitment, for all treatment groups plus the control group. After correction for weather and exogenous effects through regression analysis and modeling, these load shapes will provide the summer baseline for each respective group. Thus, while visible differences may indicate self-selection into treatment groups, they do not bias the results, which will be valid for a voluntary program with the same offering.

FIGURE 16. AVERAGE WEEKDAY LOADS, SUMMER 2012

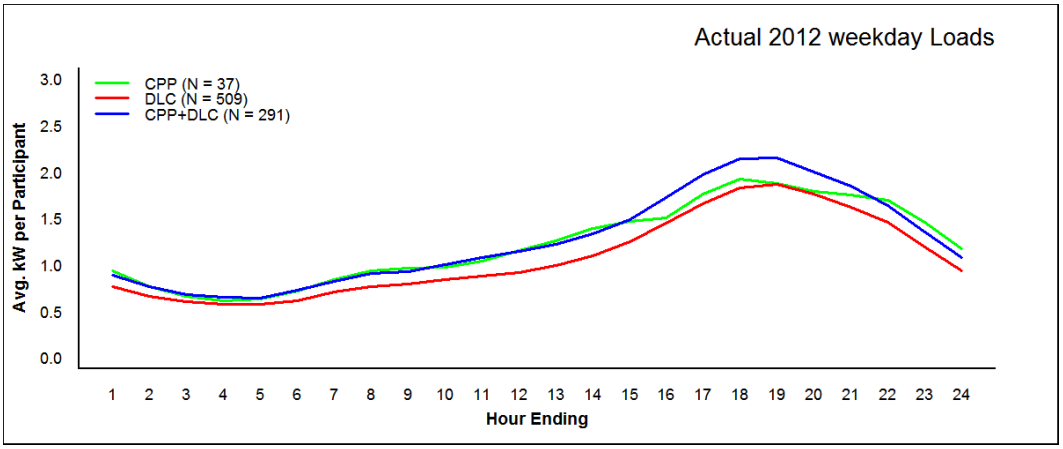


Figure 17 plots the average observed nonevent weekday loads for summer 2013 for all three program groups. These data were collected in the summer treatment period during which the TOU rate was in effect and Conservation Days were not in effect. They will comprise the summer *nonevent* weekday treatment loads for each respective group. These loads should not be compared directly to each other. Instead, they will be compared to their respective baselines, comprised of the pretreatment load shapes shown in Figure 16, after they are corrected for average weekday weather and exogenous effects.

FIGURE 17. AVERAGE WEEKDAY LOADS, SUMMER 2013 (NON-EVENT)

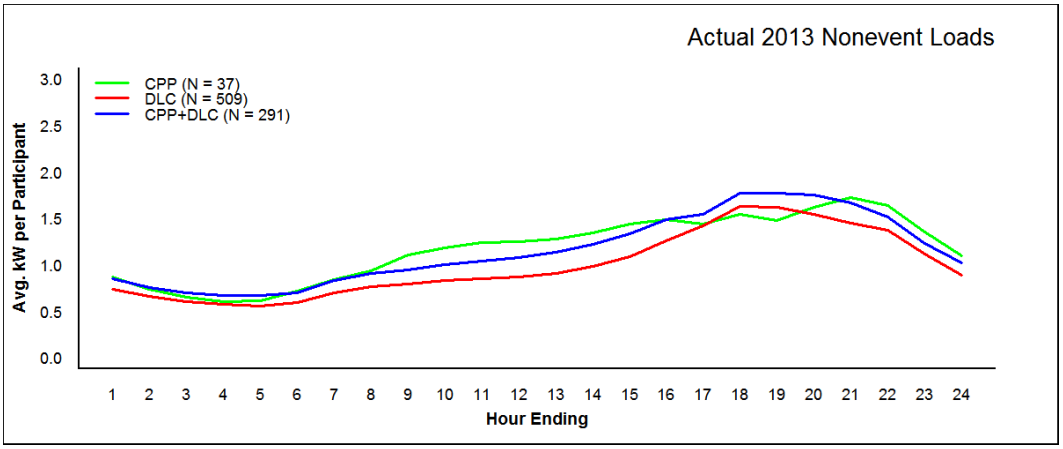
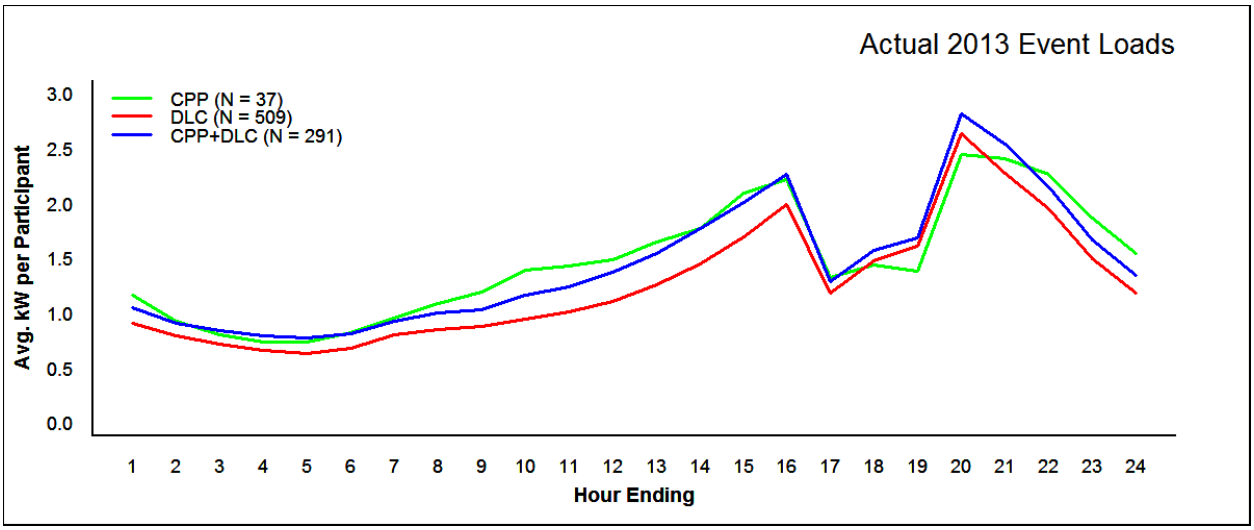


Figure 18 plots the average observed Conservation Day (event) loads for summer 2013 for all three program groups. These load shapes will comprise the event loads for each group. These loads should not be compared directly to each other. Instead, these loads will be compared to their respective baselines, comprised of the pretreatment loads shapes shown in Figure 16 corrected for event day weather and exogenous effects.

FIGURE 18. AVERAGE CONSERVATION DAY LOADS, SUMMER 2013



Temperature Data

Hourly temperature data were downloaded for ten from MesoWest[1] weather stations with good data in the SMUD service territory (Figure 19). To ensure as-accurate-as-possible outdoor temperatures, participants were each assigned to the data recorded at the station closest to their home.

FIGURE 19. WEATHER STATIONS USED FOR LOAD IMPACT EVALUATION

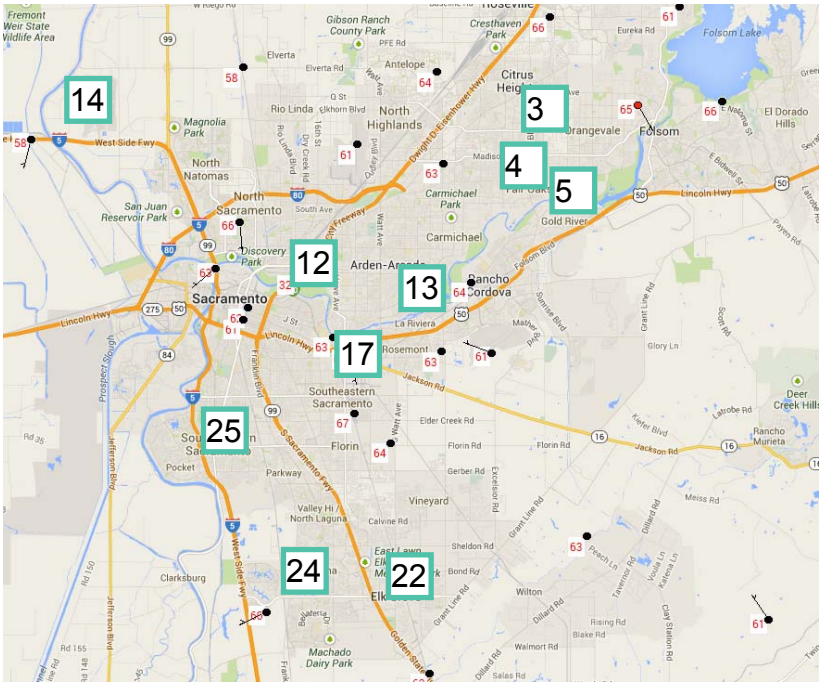


Figure 20 plots the average hourly summer temperatures at each of the ten weather stations used in this analysis. Note that there are visible differences in temperatures across stations due to local microclimates, thus justifying the multiple-station approach.

[1] MesoWest Historical Weather Data. *University of Utah.* Retrieved November 17, 2013 from http://mesowest.utah.edu

FIGURE 20. AVERAGE HOURLY TEMPERATURE READINGS, SUMMER 2013

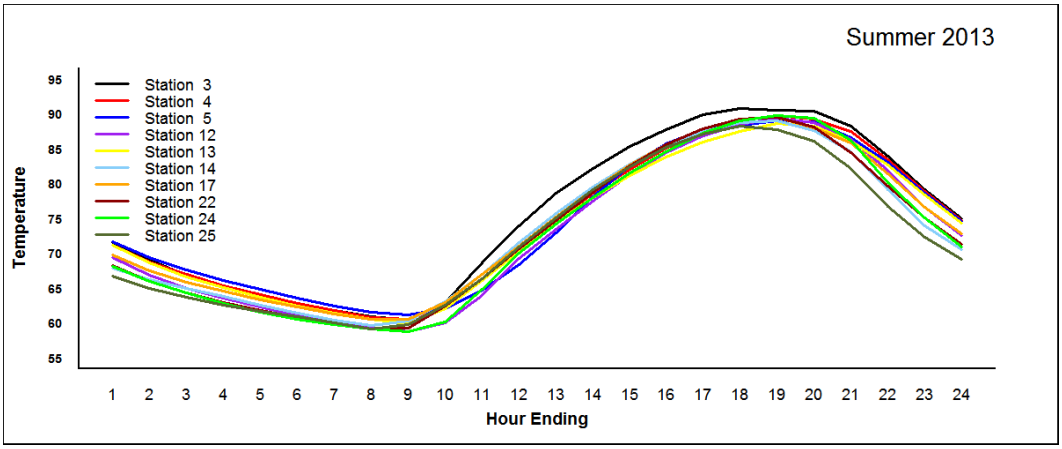


Figure 21 provides the distribution of hourly temperature measurements at each weather station for the summer of 2013, with the centerline of each box indicating the median, and the bottom and top edges of the boxes the first and third quartiles, respectively. Whiskers extend to the most extreme data point that is no more than 1.5 times the interquartile range. All points beyond the whiskers are outliers.

FIGURE 21. BOX PLOTS OF HOURLY TEMPERATURE READINGS, SUMMER 2013

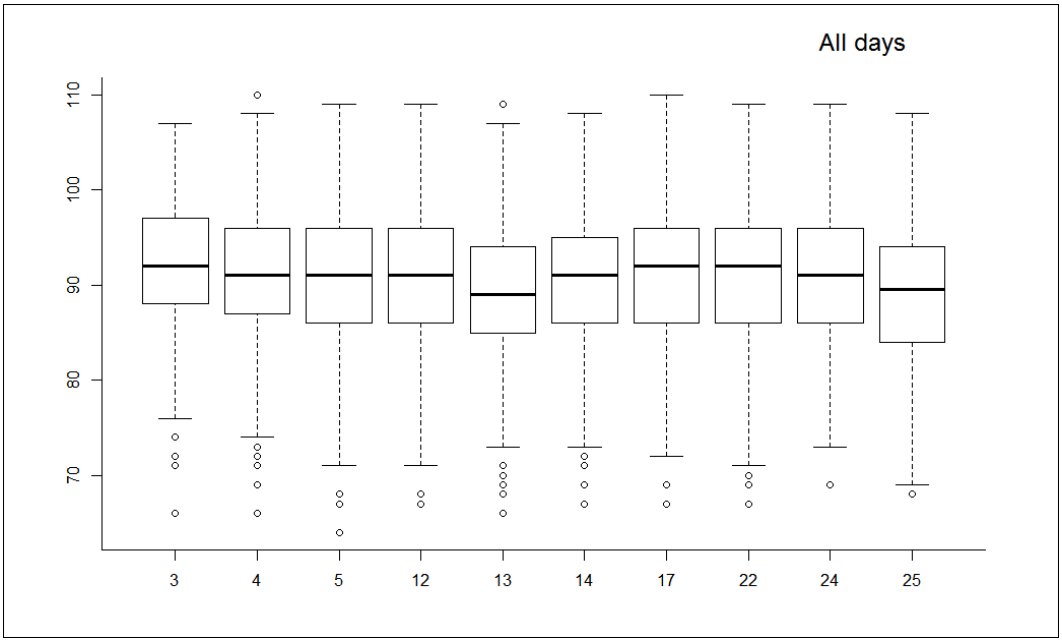
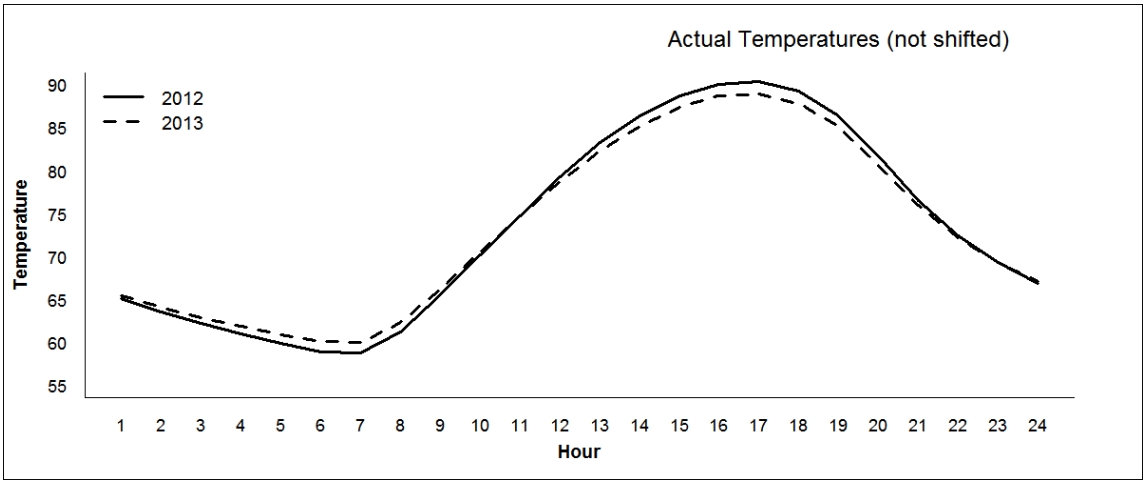


Figure 22 plots the average hourly temperatures for the pre-treatment and treatment summers of 2012 and 2013, respectively. These temperatures are averaged over 13 individual weather stations located in the SMUD service territory, and are shifted by 2 hours before modeling to account for the heat transfer delay between outdoor and indoor temperatures.

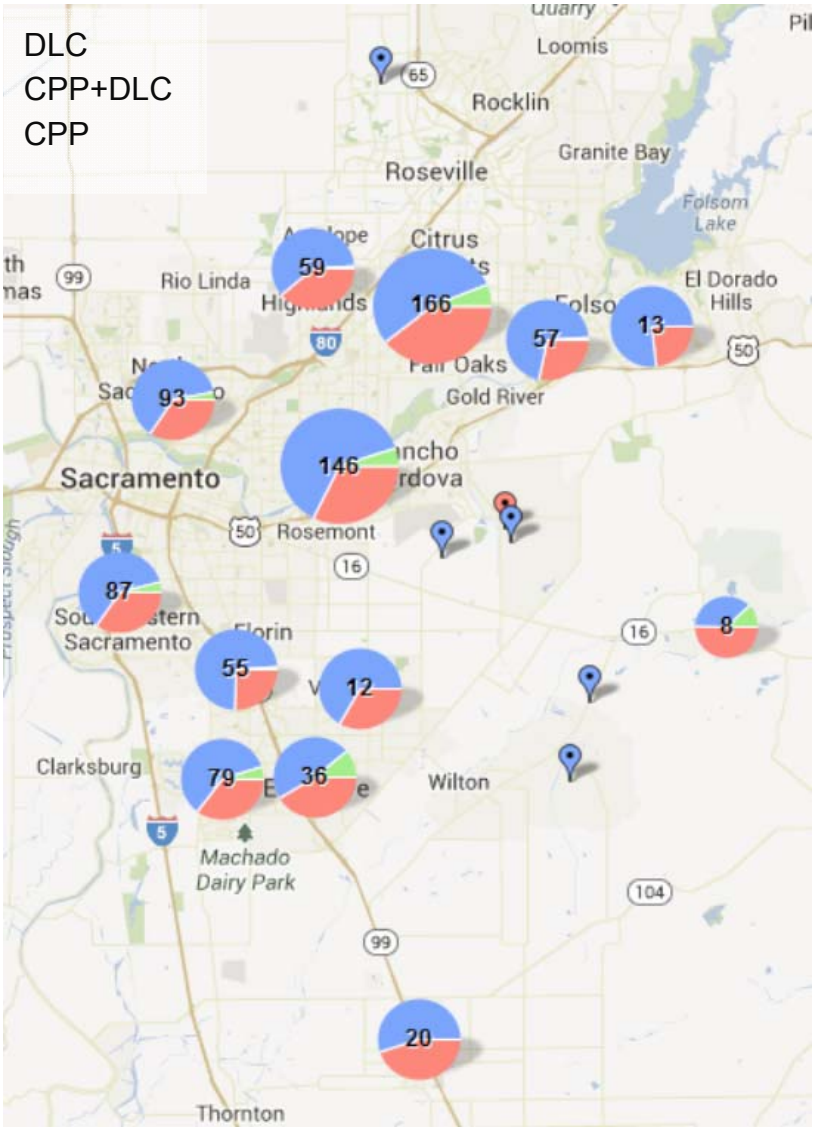
FIGURE 22. AVERAGE HOURLY SUMMER TEMPERATURES



Geographic Data

The locations of the 807 residential participants included in this analysis are mapped in Figure 23, with DLC homes in blue, CPP+DLC homes in red, and CPP homes in green. The reasonably even distribution of the larger DLC and CPP+DLC program groups provides evidence that a strong geographic bias is not present. The smaller CPP group, however, is notably absent from several locations.

FIGURE 23. MAP OF PARTICIPANT HOMES, BY PROGRAM GROUP



Event Opt Outs

Figure 24 shows the percent of participants that opted out of events, by number of opt outs. More than three-quarters (77%) did not opt out of any events, 13% opted out of one event, and 10% opted out of more than one event. Note that opt outs are undefined for CPP events.

FIGURE 24. RESIDENTIAL OPT-OUTS

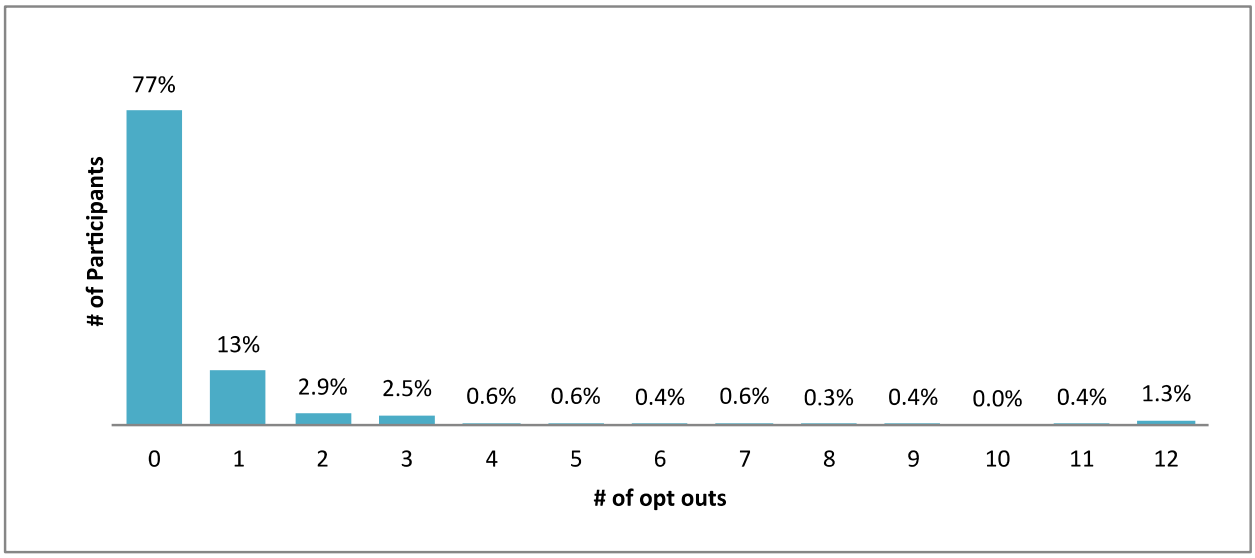


Table 16 shows the distribution of opt outs by program group. Note that the CPP group is not listed because, being in control of their own event response, their changes before or during events are not considered opt outs. Across all subgroups, the percent of opt outs ranged from 4.0% to 7.9%, with a trend toward higher numbers for participants that chose lower temperature adjustments. The average opt out rate across all subgroups was 5.3%.

TABLE 16. RESIDENTIAL OPT-OUTS, BY PROGRAM GROUP

Group	Participants	Potential opt-outs	Actual opt-outs	% opt-outs
DLC2	57	684	50	7.3%
DLC3	99	1188	48	4.0%
DLC4	353	4236	199	4.7%
CPP+DLC2	65	780	62	7.9%
CPP+DLC3	70	840	59	7.0%
CPP+DLC4	156	1872	88	4.7%
Total	800	9600	506	5.3%

Evaluation Approach

This study was designed in expectation of load impact evaluation using a difference in differences (DID) regression model. The basic premise of DID evaluation is to compare the measure of interest at two points in time—before and after treatment—in both the treatment and control groups. The treatment effect is measured as the difference between the changes seen in the two groups across time. Mathematically, this can be describes as $(T_2-T_1)–(C_2-C_1)$, where T_i is the average treatment group load measured during period i, and C_i is the average control group load during period i.

This technique can be thought of as a *within-subjects* estimate of the treatment effect (T_2-T_1) corrected for exogenous effects using the changes seen in a control group (C_2-C_1), where both differences are corrected for weather differences between time 1 and time 2 using standard regression techniques. Without exogenous effects correction, a within-subjects comparison can overestimate or underestimate impacts by associating non-treatment effects with the treatment. For example, let's say that a downturn in the economy causes all customers to reduce their energy use, as was the case in 2008. If this drop in energy use were not measured in the control group and subsequently subtracted from the treatment group impacts, savings attributable to the treatment would be overestimated, when in fact much of the savings was simply a result of the floundering economy.

An unbiased DID methodology requires that the composition of, and exogenous inputs to, the treatment and control groups are as similar as possible. Ideally, this would be accomplished through a random control by (1) recruiting a single population and (2) randomly assigning a portion of the recruited population to the control group for whom (3) treatment is deferred to a later date or denied altogether. Where deferral and denial of the treatment are not feasible, a control group can be selected to closely resemble the treatment group along a subset of relevant variables. This latter alternative is not without bias, because "willingness to participate" is difficult or impossible to measure without putting the control group through the solicitation and recruitment process.

Hourly Load Model

For this study, three main sets of load impact estimates are of interest: annual energy impacts, summer weekday peak demand impacts, and Conservation Day peak event impacts.

Hourly kilowatt (kW) values measured at the individual customer level by SMUD's existing metering infrastructure were analyzed using mixed-effects models with levels for customer, day, and hour. The general form of the load impact model equation is given in Equation 1. For detailed description of the models used in this analysis, see Appendix C.

EQUATION 1. HOURLY LOAD MODEL

$$kw_{ijk} = hour_{ijk} + CDH_{ijk} + MaxTemp_{ij} + CDD_{ij} + hour*CDD^2_{ijk} + hour*MaxTemp^2*DayType_{ijk} + r_i + r_{ij} + \varepsilon_{ijk}$$

Where:
kw_{ijk}: kilowatt load for customer *i* on day *j* at hour *k*
$hour_{ijk}$: categorical variables (1-24) indicating the hour of the day, where hour 1 spans the period from midnight to 1:00 a.m. and hour 24 spans the period from 11:00 p.m. to midnight
CDH_{ijk}: Cooling Degree Hours (CDH), calculated as the number of degrees above 75°F in each hour. Following an analysis of goodness of fit of this variable in the model, CDH values were shifted two hours forward in time, accounting for the lag in the transfer of outside temperatures into the building.
$MaxTemp_{ij}$: maximum temperature on day *j*
CDD_{ij}: cooling degree day calculated as sum of 24 CDH values on day *j*
DayType: categorical variables indicating day type (event, nonevent, pretreatment weekday)
Treat_Event: categorical variables for treatment and event
Treat_Year: categorical variables for treatment and year
Month: categorical variable indicating month
Year: categorical variables indicating year (2012, 2013)
r_i: random effects for customer ~$N(0,\varphi_1)$
r_{ij}: random effects for day ~$N(0,\varphi_2)$
ε_{ijk}: error terms ~$N(0,\delta^2)$

Where estimates of ceiling insulation effects were desired, temperature variables and their interactions with ceiling insulation R-value, hour and treatment were also included in the model.

The load values modeled using Equation 1 are then used to calculate impact values as the difference of the four load shapes as described in Equation 2.

EQUATION 2. CALCULATION OF LOAD IMPACTS

$Load\_Impact_{ijk} = (Part.treat_{ijk}—Part.pretreat_{ijk})—(Control.treat_{ijk}—Control.pretreat_{ijk})$

Where:

Load_Impact: estimate of hourly load change resulting from the treatment

Part.treat: modeled average participant loads during the treatment period

Part.pretreat: modeled average participant loads during the pretreatment period

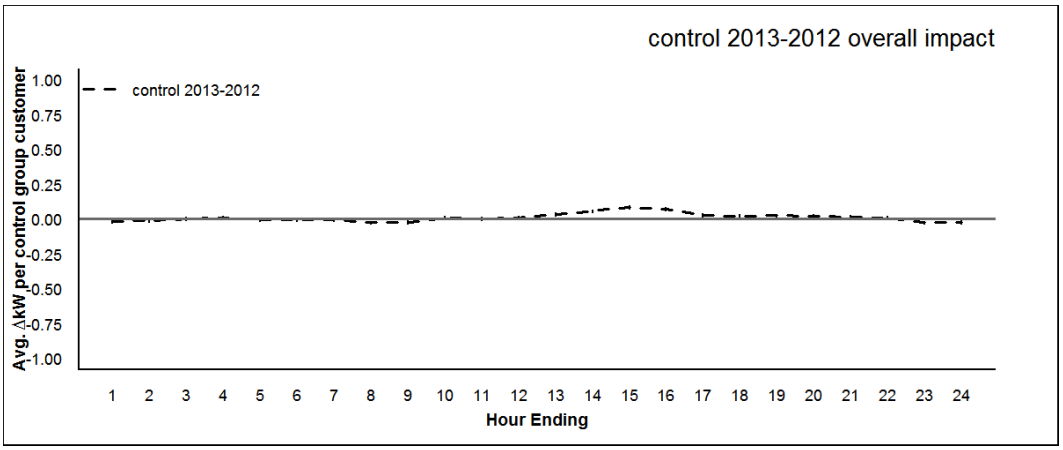
Control.treat: modeled average control loads during the treatment period

Control.pretreat: modeled average participant loads during the treatment period

Control Group and Exogenous effects

A total of 4,000 randomly selected customers from the participant sample frame were set aside as the control group sample frame. For load impact evaluation, data for all geographically matched customers that had hourly load data for the summers of 2012 and 2013 were extracted, supplying a final matched control group of 413 customers. An analysis of control group loads indicated that there was no significant change in the control group between 2012 and 2013 once loads were corrected for temperature differences between the two years (Figure 25). As a result, there was no need to include the control group data in the model as is typically done for a difference in differences analysis.

FIGURE 25. EXOGENOUS EFFECTS



Findings

This section presents the estimated loads and load impacts on event and non-event weekdays, as well as the average summer energy impacts for the 2013 PowerStat participants. Results are presented as average daily load impact graphs accompanied by tabular impacts during three periods of interest as follows:

- Pre-Peak = the 3-hour period immediately preceding the peak = Hours Ending 14-16
- Peak = the 3-hour peak period = Hours Ending 17-19
- Post-peak = the 3-hour period immediately following the peak = Hours ending 20-22

Results for residential 2-3-4 subgroups peak days can be found in Appendix E.
For consistency and ease of comparison, all loads and impacts are presented in units of average kilowatt-hours per hour (kWh/h), abbreviated in most cases to kW, where positive impact values indicate an increase in energy use relative to the baseline, and negative impact values indicate savings. Note that these hourly kW values are easily converted to kWh through multiplication by the number of hours across the desired time period.

Aggregate Load Impacts

Event Impacts on a 106°F Weekday

Figure 28 plots the modeled baseline, non-event weekday loads, and Conservation Day loads for all 837 residential PowerStat participants on a reference weekday, with a maximum temperature of 106°F and minimum temperature of 67°F. Thus, this graph reflects the aggregated effects of all program options run simultaneously. Figure 29 shows the same results represented as impacts, where the modeled baseline loads are subtracted from 2013 weekday loads.

FIGURE 26. AVERAGE PARTICIPANT LOADS ON A 106-DEGREE WEEKDAY—ALL PROGRAMS

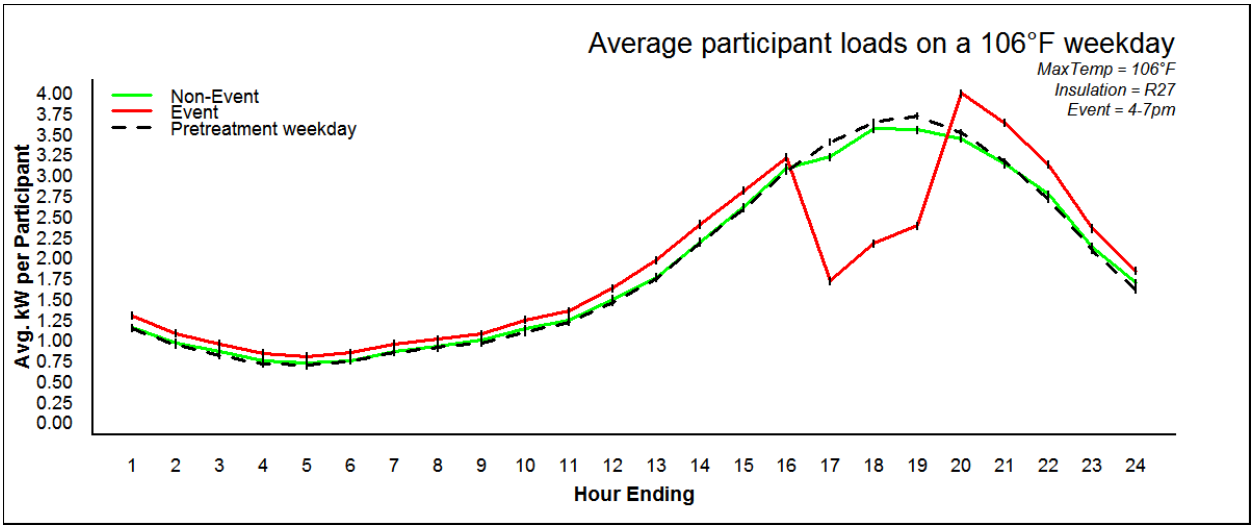


FIGURE 27. AVERAGE PARTICIPANT IMPACTS ON A 106-DEGREE WEEKDAY—ALL PROGRAMS

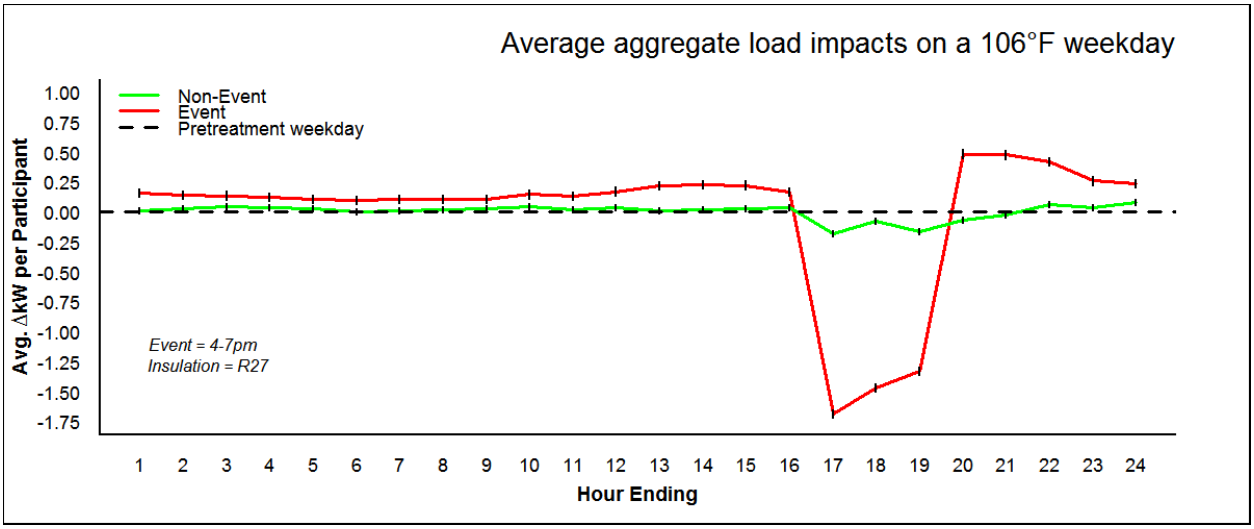


Table 17 lists the 3-hour average loads and impacts during the peak, pre-peak and post peak periods. On average, PowerStat participants saved 0.16 kW (-4.4%) during the peak hours on non-event days, with no statistically significant change in energy use in the pre-peak or post-peak periods. During Conservation Day events, peak loads were reduced by 1.45 kW (-41%), with statistically significant load increases in the pre-peak (+7.7%) and post-peak (+15%) periods.

TABLE 17. AVERAGE PARTICIPANT LOADS AND IMPACTS ON A 106-DEGREE WEEKDAY—ALL PROGRAMS

	Pre peak (hour 14-16)	Peak (hour 17-19)	Post Peak (hour20-22)
Baseline loads	2.61	3.51	3.08
Nonevent loads	2.62	3.35	3.07
Event day loads	2.81	2.06	3.53
Nonevent peak impacts	+0.018 (+0.7%)	-0.16* (-4.4%)	-0.001 (-0.03%)
Event peak impacts	+0.21* (+7.7%)	-1.45* (-41%)	+0.45* (+15%)

* Statistically significant (α = 0.05)

Event Impacts on a 100°F Weekday

Figure 28 plots the modeled baseline, non-event weekday loads, and Conservation Day loads for all 807 residential PowerStat participants on a weekday with a maximum temperature of 100°F. As such, this graph reflects the aggregated effects of all of the program options run simultaneously. Figure 29 shows the same results represented as impacts, where the modeled baseline loads are subtracted from 2013 weekday loads.

FIGURE 28. AVERAGE PARTICIPANT LOADS ON A 100-DEGREE WEEKDAY—ALL PROGRAMS

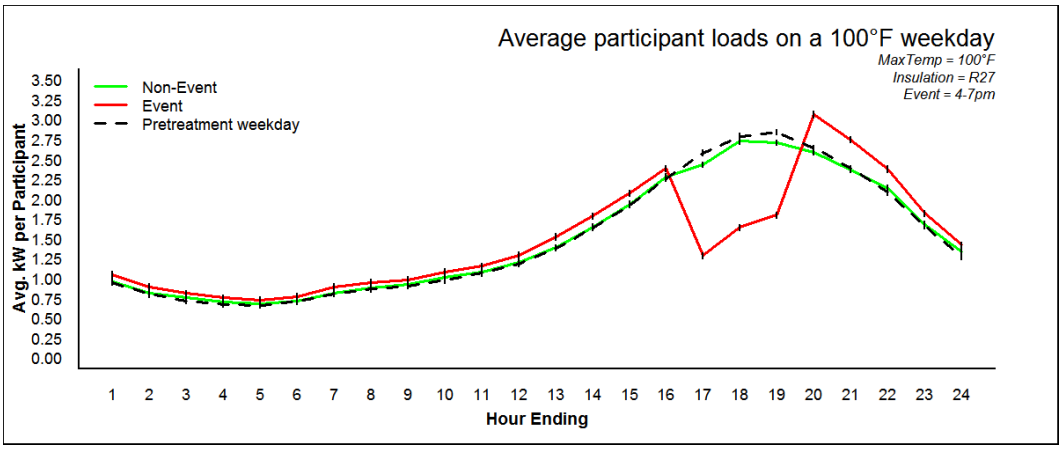


FIGURE 29. AVERAGE PARTICIPANT IMPACTS ON A 100-DEGREE WEEKDAY—ALL PROGRAMS

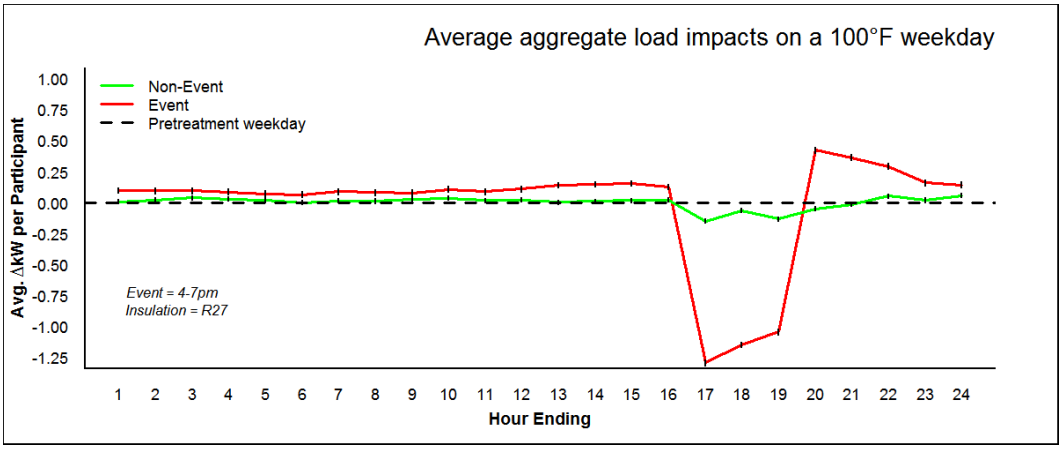


Table 18 lists the 3-hour average loads and impacts during the peak, pre-peak and post peak periods. In aggregate, PowerStat participants saved 4.3% during the peak hours on non-event days with no statistically significant change in energy use in the pre-peak or post-peak periods. On Conservation Days, peak loads are reduced by 41%, with statistically significant increases in the pre-peak (+7.2%) and post-peak (+15%) periods.

TABLE 18. AVERAGE PARTICIPANT LOADS AND IMPACTS ON A 100-DEGREE WEEKDAY—ALL PROGRAMS

	Pre peak (hour 14-16)	Peak (hour 17-19)	Post Peak (hour20-22)
Baseline loads	1.94	2.76	2.38
Nonevent loads	1.95	2.64	2.39
Event day loads	2.08	1.64	2.73
Nonevent peak impacts	0.009 (0.5%)	-0.12* (-4.3%)	-0.004 (-0.2%)
Event peak impacts	0.14* (7.2%)	-1.13* (-41%)	0.35* (15%)

* Statistically significant (α = 0.05)

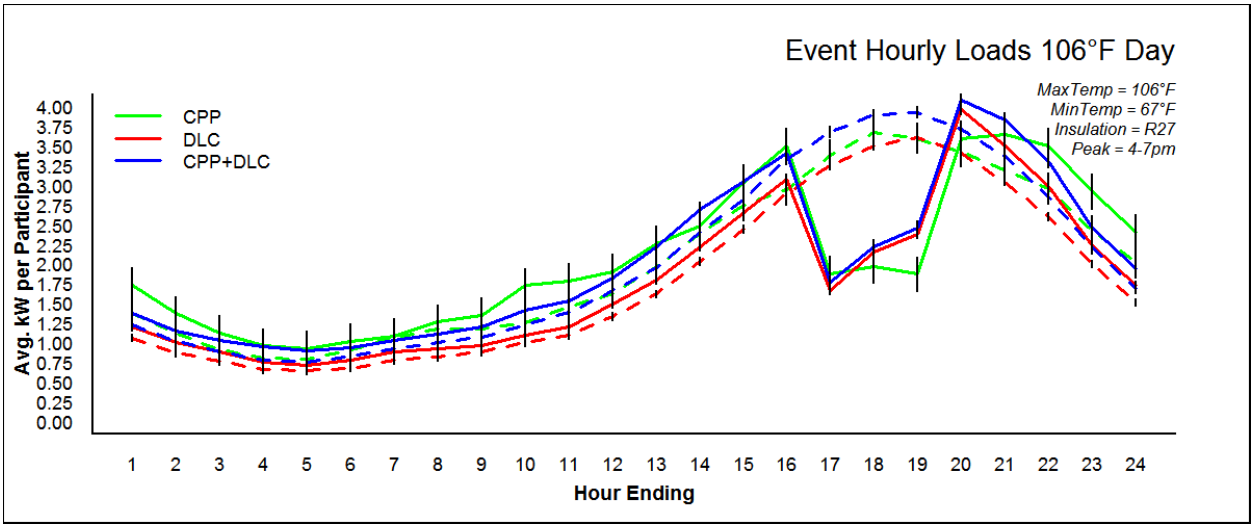
Event Day Load Impacts by Program Group

This section presents and compares the average Conservation Day loads and load impacts for each program group.

Event Impacts on a 106°F Weekday, by Program

Figure 30 illustrates the modeled baselines and Conservation Day loads for the three main program groups on an event day with a maximum temperature of 106°F. Figure 31 shows the same results represented as impacts, where the modeled baseline loads are subtracted from 2013 weekday loads. Error bars represent 95% confidence intervals for the impacts.

FIGURE 30. HOURLY EVENT DAY LOADS, BY TREATMENT GROUP



Note that in Figure 31, the peak load impacts for the two groups with utility managed thermostats (DLC and CPP+DLC) slope upwards over the 3 peak hours, indicating that the demand response resource starts off strong, but is reduced as AC units come back to life in the second and third hours of the event. In contrast, the CPP load impacts show the opposite trend, starting off at the same level as the DLC group, but then increasing in the second and third hours, perhaps as occupants initiate manual load reductions. This pattern suggests that these two program types might be used well in combination to effect the desired system load shape in real time.

FIGURE 31. HOURLY EVENT DAY IMPACTS, BY TREATMENT GROUP

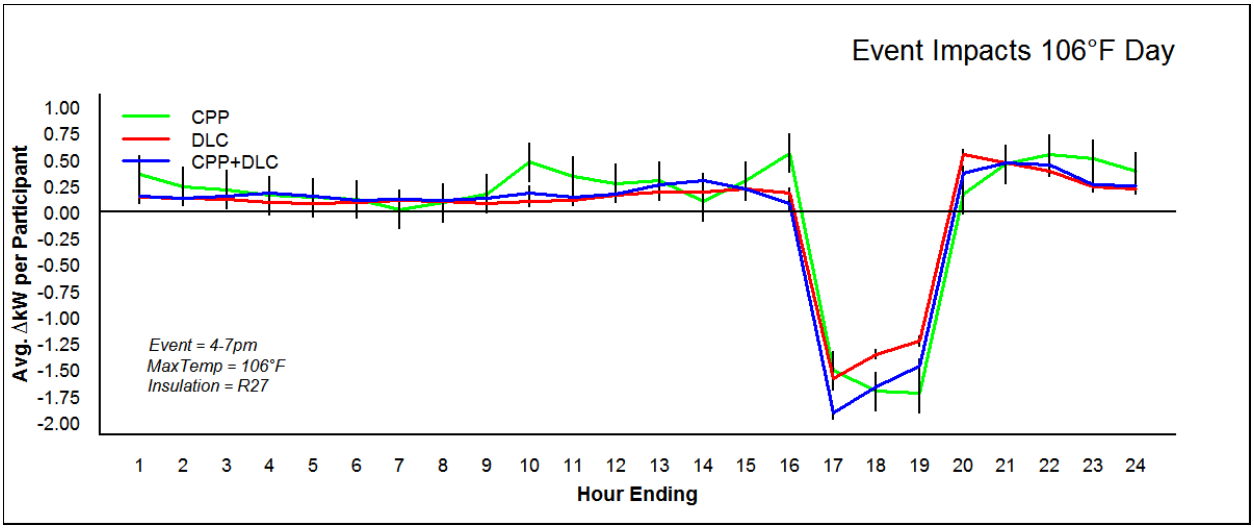


Table 19 lists the average load impacts for each of the three program options on the Conservation Days. Results indicate significant impacts in all pre-peak, peak and post-peak periods, for all program options.

TABLE 19. AVERAGE EVENT LOAD IMPACTS (KW) BY PROGRAM

	N	Event Pre-peak (hours 14-16)	Event Peak (hours 17-19)
DLC	509	+0.18* (+7.3%)	-1.32* (-39%)
CPP+DLC	291	+0.20* (+7.0%)	-1.67* (-45%)
CPP	37	+0.32* (+12%)	-1.63* (-46%)

* Statistically significant (α = 0.05)

Contrast analysis was used to compare the effects of the programs on loads during the pre-peak, peak and post-peak periods, with results provided in Table 20. Note that this table should be read by assigning each value to the first of the two groups listed in the Contrast column relative to the second of the two groups. So for example, the very first value of -0.12 in the top left cell indicates that the CPP+DLC group used an average of 0.12 kW less than did the CPP group in the pre-peak hours, and that this difference is not statistically significant, because an asterisk (*) is not present. The value of -0.35* in the center cell indicates that the CPP+DLC group used an average of 0.35 kW less than did the DLC group in the peak hours, and that the difference is statistically significant.

TABLE 20. COMPARISON OF EVENT DAY LOAD IMPACTS BY TREATMENT

Contrast	Event Pre-peak (hours 14-16)	Event Peak (hours 17-19)	Event Post-peak (hours 20-22)
'CPP+DLC' v. CPP	-0.12	-0.045	+0.006
'CPP+DLC' v. DLC	+0.015	-0.35*	-0.065
CPP v. DLC	+0.13	-0.31*	-0.071

* Statistically significant (α = 0.05)

Customers on the TOU-CPP rate—both with and without utility-managed loads—provided significantly greater load shed (-0.31 and -0.35 kW respectively) than did DLC participants, who stayed on the standard tiered rate and were paid for event response. No significant differences were detected between load impacts in the Pre-peak and Post-peak periods.

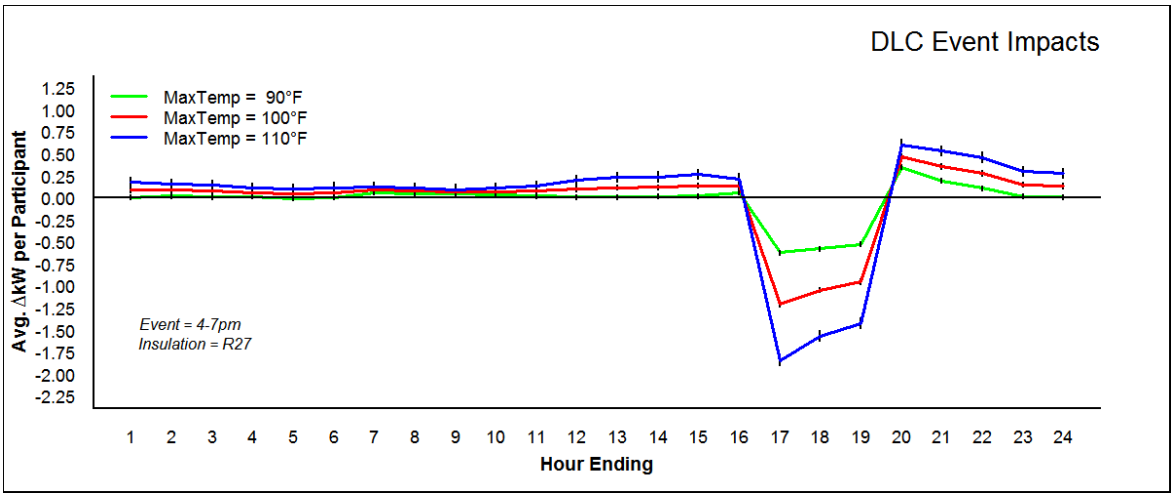
Did event impacts change with outdoor temperature?

Previous research has shown that higher outdoor temperatures result in higher demand, which translates to greater peak impacts during demand response events (e.g. Herter 2007). This section considers the effect of outdoor temperatures on hourly loads, and in particular during the pre-peak, peak, and post-peak periods.

To model these results, the mixed model for both event and non-event days was populated with three different temperature profiles, defined by maximum hourly temperatures of 90, 100, and 110 degrees. For all program groups, higher temperatures increased response to events such that each 10-degree increase in maximum daily outdoor temperature effected a 0.4 to 0.7 kW per-customer increase in load shed. Peak load impacts for the DLC group (Figure 32) start at -0.6 kW per participant at 90°F, increasing to 1.9 kW per participant at 110°F, while maintaining a 35% to 38% load drop across all temperatures. Similarly the CPP+DLC group (Figure 33) started with a -0.8 kW per participant impact at 90°F, increasing to 1.5 kW per participant at 110°F, while maintaining a 41% to 43% load drop across all temperatures. Only the CPP group (Figure 34) showed load impacts that changed *as a percentage* with temperature, starting at -0.6 kW (35%) at 90°F and increasing to 1.9 kW (46%) per participant at 110°F.

Results for 1-in-2, 1-in-5 and 1-in-10 peak days can be found in Appendix F.

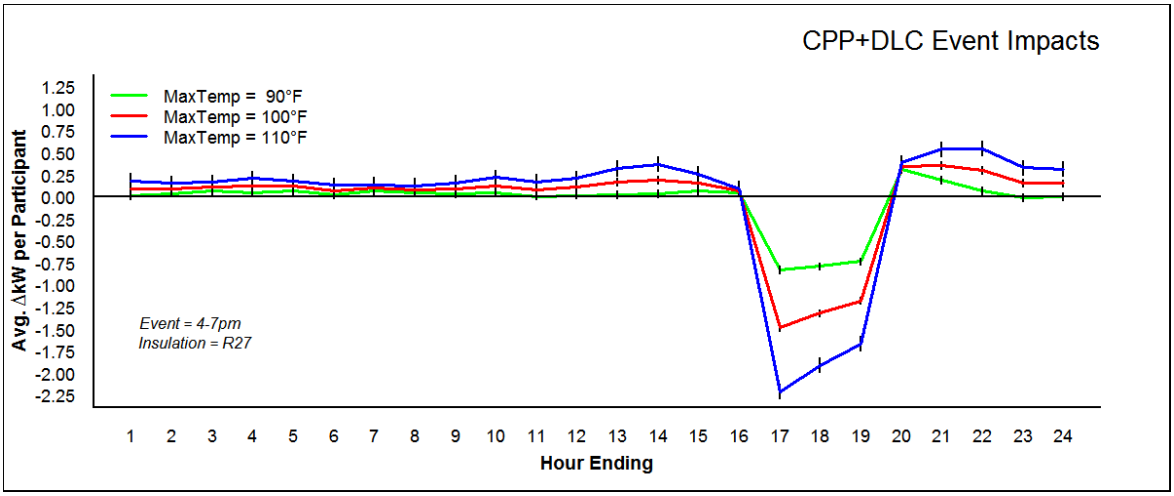
FIGURE 32. EFFECT OF OUTDOOR TEMPERATURE ON DLC IMPACTS



	N	Maximum Temperature	MaxTemp	Event Pre-peak (hours 14-16)	Event Peak (hours 17-19)	Event Post-peak (hours 20-22)
DLC	509	90°F	90	0.04 (3.4%)	-0.6 (-35%)	0.19 (13%)
DLC	509	100°F	100	0.13 (7.1%)	-1.0 (-38%)	0.36 (16%)
DLC	509	110°F	110	0.22 (6.9%)	-1.5 (-38%)	0.54 (15%)

* Statistically significant (α = 0.05)

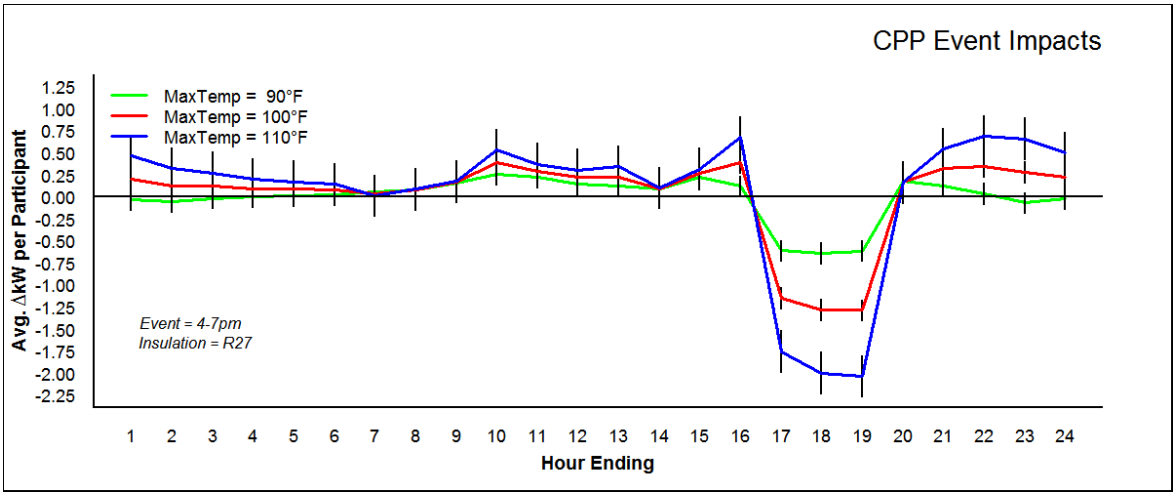
FIGURE 33. EFFECT OF OUTDOOR TEMPERATURE ON CPP+DLC IMPACTS



	N	Maximum Temperature	Event Pre-peak (hours 14-16)	Event Peak (hours 17-19)	Event Post-peak (hours 20-22)
CPP+DLC	291	90°F	0.051* (3.8%)	-0.8* (-41%)	0.17* (10%)
CPP+DLC	291	100°F	0.14* (6.5%)	-1.3* (-43%)	0.31* (12%)
CPP+DLC	291	110°F	0.24* (6.7%)	-1.9* (-43%)	0.47* (12%)

* Statistically significant (α = 0.05)

FIGURE 34. EFFECT OF OUTDOOR TEMPERATURE ON CPP IMPACTS



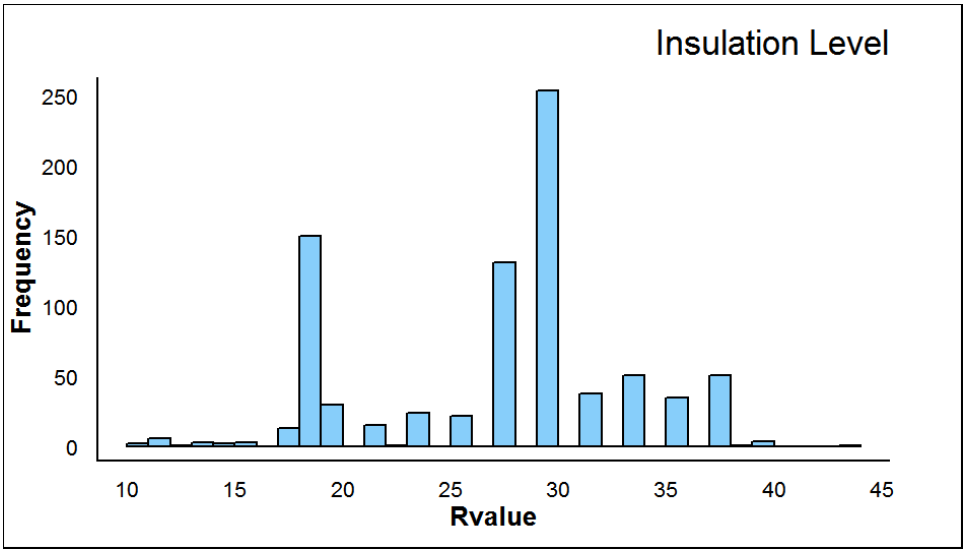
	N	Maximum Temperature	Event Pre-peak (hours 14-16)	Event Peak (hours 17-19)	Event Post-peak (hours 20-22)
CPP	37	90°F	0.15* (12%)	-0.6* (-35%)	0.11 (6.9%)
CPP	37	100°F	0.25* (12%)	-1.2* (-44%)	0.28* (11%)
CPP	37	110°F	0.36* (11%)	-1.9* (-46%)	0.47* (12%)

* Statistically significant (α = 0.05)

Did event impacts change with insulation level?

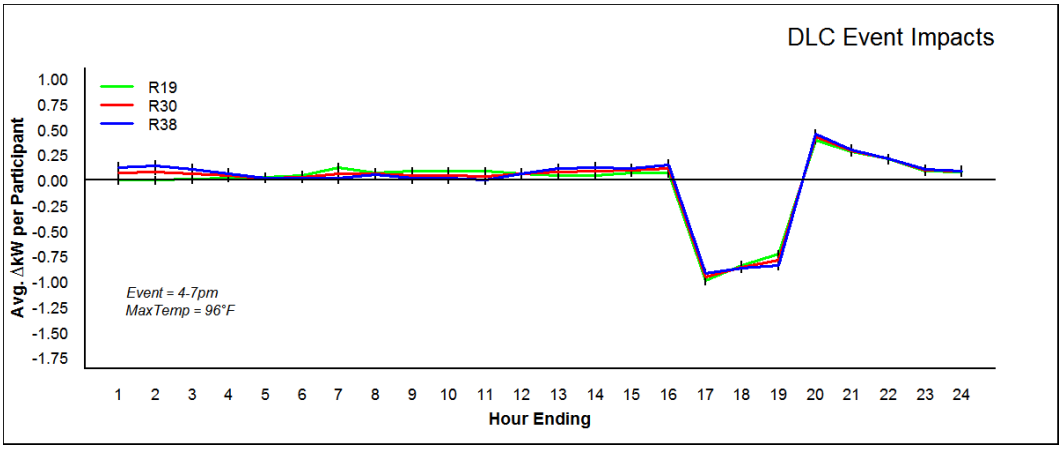
Well-insulated buildings slow the heat transfer between the interior and exterior of the building. Theoretically then, one might posit that offset strategies might have greater impacts in homes with higher levels of insulation. To test this hypothesis, ceiling insulation R-values were observed from each of the sites visited for thermostat installation. The values collected ranged from R10 to R44, with a mean value of R27. Figure 35 shows the distribution of ceiling R-values for all 2013 PowerStat participants.

FIGURE 35. DISTRIBUTION OF CEILING R-VALUES



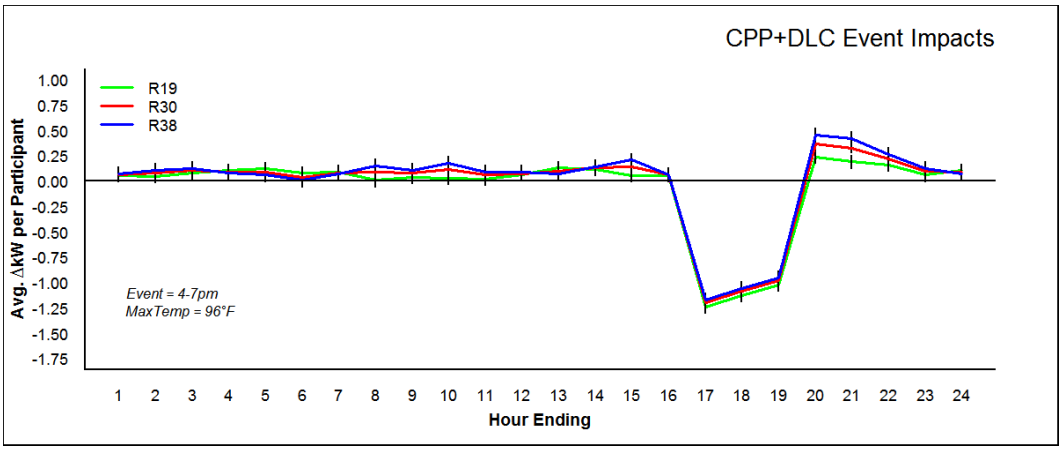
Using the mixed model described previously, hourly impacts by treatment were compared at different insulation levels. The results indicate that insulation levels did not affect load shed or rebound for the DLC customers as shown in Figure 36, and did not affect load shed for CPP+DLC customers as shown in Figure 37; however, rebound effects for CPP+DLC customers with higher insulation levels were significantly lower as shown in Figure 38. The CPP group showed significant differences in impacts between insulation levels, however, given the small sample size (37) these results, while statistically significant, may not be representative of the population.

FIGURE 36. INSULATION EFFECTS FOR DLC



Contrast	Event Pre-peak (hours 14-16)	Event Peak (hours 17-19)	Event Post-peak (hours 20-22)
R19 vs. R30	-0.04	0.02	-0.01
R19 vs. R38	-0.06	0.03	-0.01
R38 vs. R30	0.03	-0.01	0.01

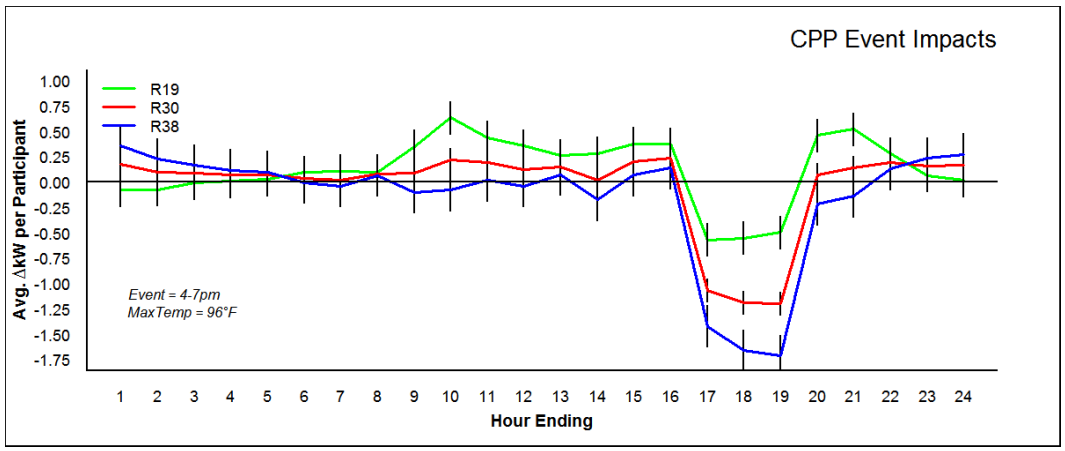
FIGURE 37. INSULATION EFFECTS FOR CPP+DLC



Contrast	Event Pre-peak (hours 14-16)	Event Peak (hours 17-19)	Event Post-peak (hours 20-22)
R19-R30	-0.04	-0.04	-0.10*
R19-R38	-0.07	-0.07	-0.18*
R38-R30	0.03	0.03	0.08*

* Statistically significant (α = 0.05)

FIGURE 38. INSULATION EFFECTS FOR CPP



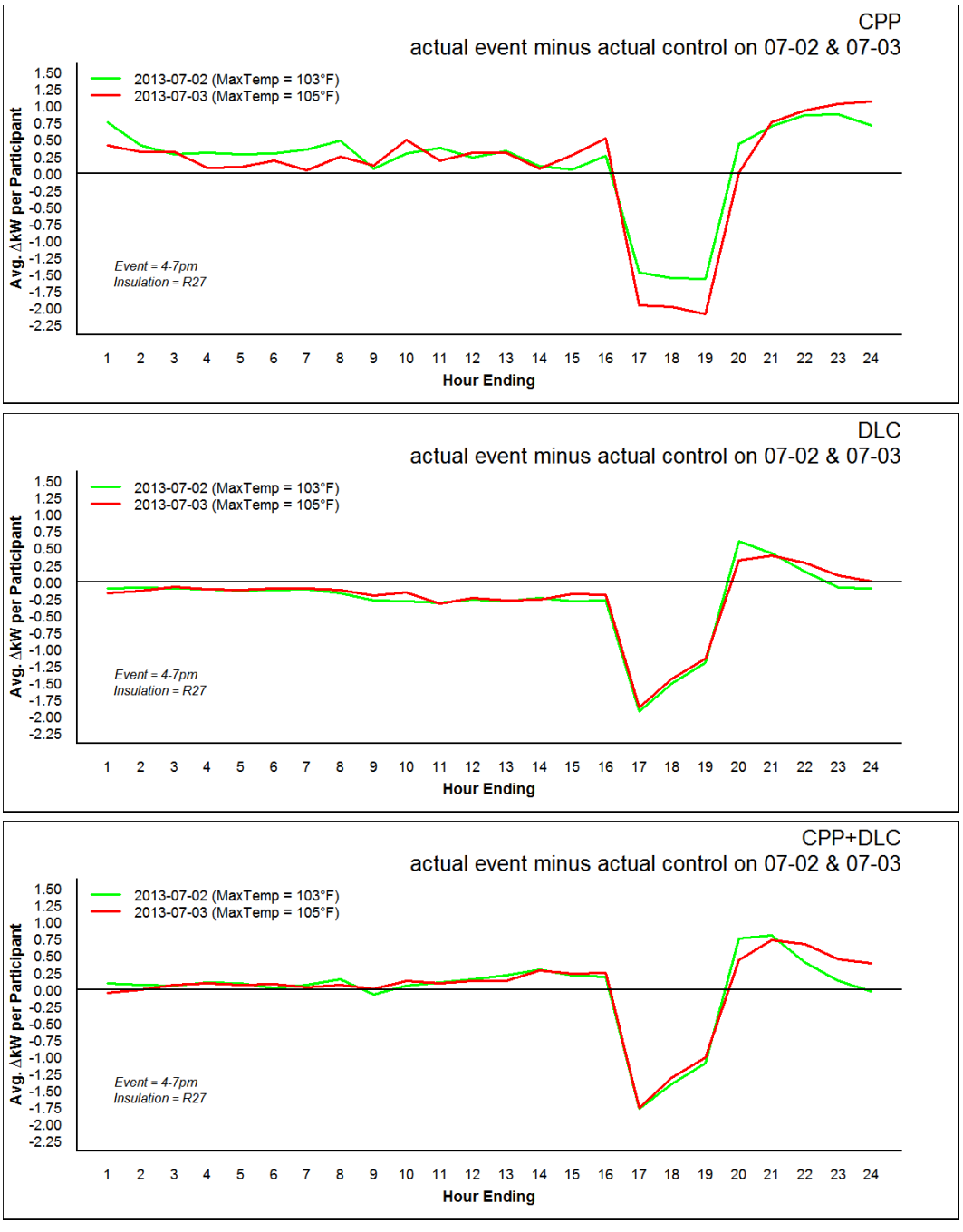
Contrast	Event Pre-peak (hours 14-16)	Event Peak (hours 17-19)	Event Post-peak (hours 20-22)
R19-R30	0.21*	0.62*	0.27*
R19-R38	0.37*	1.10*	0.47*
R38-R30	-0.15*	-0.45*	-0.20*

* Statistically significant (α = 0.05)

Did event impacts change on sequential event days?

On the second of two sequential event days, called on July 2 and July 3, the CPP program shows an increased load shed, while the DLC and CPP+DLC groups show no change in response as shown in Figure 39.

FIGURE 39. SEQUENTIAL EVENT DAYS, BY PROGRAM



Was comfort correlated with event impacts?

Table 21 shows the correlations between customer and event specific mean peak impacts and comfort ratings, by program option. As expected, lower comfort ratings were correlated with higher peak impacts in all three programs. These correlations were not significant for the CPP group, however, this could be attributed to the small sample size, since just 20 of the 37 participants in the CPP group responded to one or more post-event comfort survey questions. Thus, one must be cautious drawing any conclusions about this result—especially given that the two treatments with larger sample sizes did show significant correlations.

TABLE 21. IMPACTS AND COMFORT CORRELATIONS, BY PROGRAM

Program	N	Participants Responding	Total Responses	Impact-Comfort Correlation
DLC	509	333	705	-0.33*
CPP+DLC	291	188	438	-0.29*
CPP	37	20	50	-0.23

* Statistically significant (α = 0.05)

Effect of Limiting Opt-outs to 1 per Summer

This section estimates how limiting opt outs to just one per summer might change the participant demand response during events. The main uncertainty in this analysis is how many customers would participate if they knew from the beginning (i.e. via the recruitment letter) that they would have only one opt out per summer. We assume that any customer with multiple opt outs in the summer of 2013 would not have participated if they had been limited to one opt out. It is possible that some of these would have participated anyway, but there is also a strong possibility that some with zero or one opt out would not have participated had they been given this limit. Since neither of these uncertainties can be quantified, we complete the analysis under the assumption that they will partially cancel each other out. For future studies of this nature, the research team might include a survey question asking participants whether they would participate under a 1-opt-out scenario.

Table 22 shows the loads and load impacts for the DLC and CPP+DLC participants after excluding the 78 participants who opted out more than once. Average participant

load impacts are not significantly different under the two scenarios for either DLC (p=0.8374) or CPP+DLC (p=0.7864), leaving total program impacts substantially lower due to the smaller number of participants.

TABLE 22. COMPARISON OF EVENT IMPACTS WITH LIMITED AND UNLIMITED OPT OUTS, 106° F DAY

Opt outs	N	DLC Peak Impacts (hours 17-19)	CPP+DLC Peak Impacts (hours 17-19)	Total Impacts (kW)
Unlimited (from)	837	-1.32* (-39%)	-1.67* (-45%)	1158
Limited (1 per summer)	759	-1.35* (-39%)	-1.71* (-45%)	1068

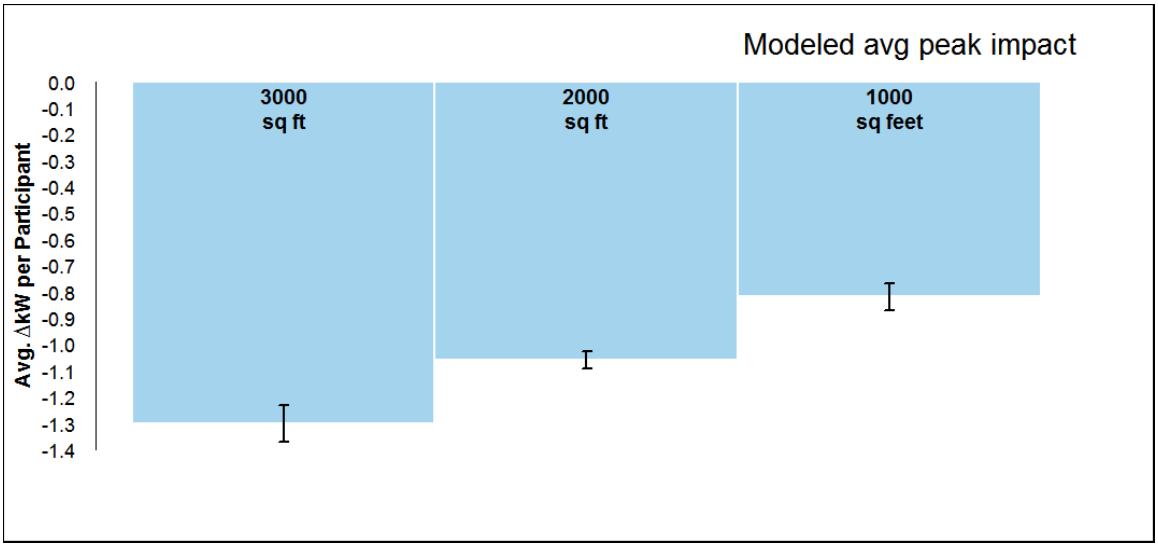
* Statistically significant (α = 0.05)

Based on this analysis, limiting DLC program opt outs to 1 per summer is likely to be counterproductive. There was no significant change in average participant load impacts when customers with multiple opt outs were excluded from the analysis. Worse, the smaller number of participants resulted in an overall 7% *reduction* in the demand response resource.

Event Day Load Impacts by Customer Characteristics

Customers in larger homes had significantly larger load impacts on event days (Figure 40). For the 420 responses collected in the pre-summer survey, the correlation between home size in square feet and load impact is statistically significant, with a Pearson's r of -0.12.

FIGURE 40. EVENT SAVINGS BY SQUARE FOOTAGE OF HOME



Similarly, Figure 41 shows the impacts for homes with two thermostats were significantly greater than impacts for homes with one thermostat.

FIGURE 41. EVENT SAVINGS BY NUMBER OF THERMOSTATS

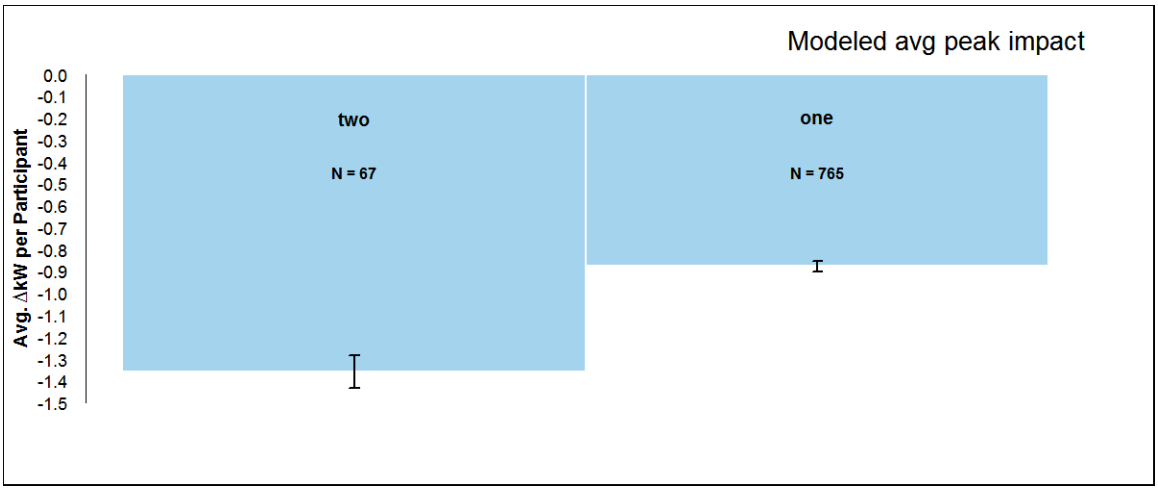


Figure 42 shows the event impacts for Elk Grove were significantly lower than event impacts for Citrus Heights, Antelope, Fair Oaks, Carmichael, and Rancho Cordova. Event impacts for Sacramento were significantly lower than event impacts for Citrus Heights and Fair Oaks.

FIGURE 42. EVENT SAVINGS BY CITY

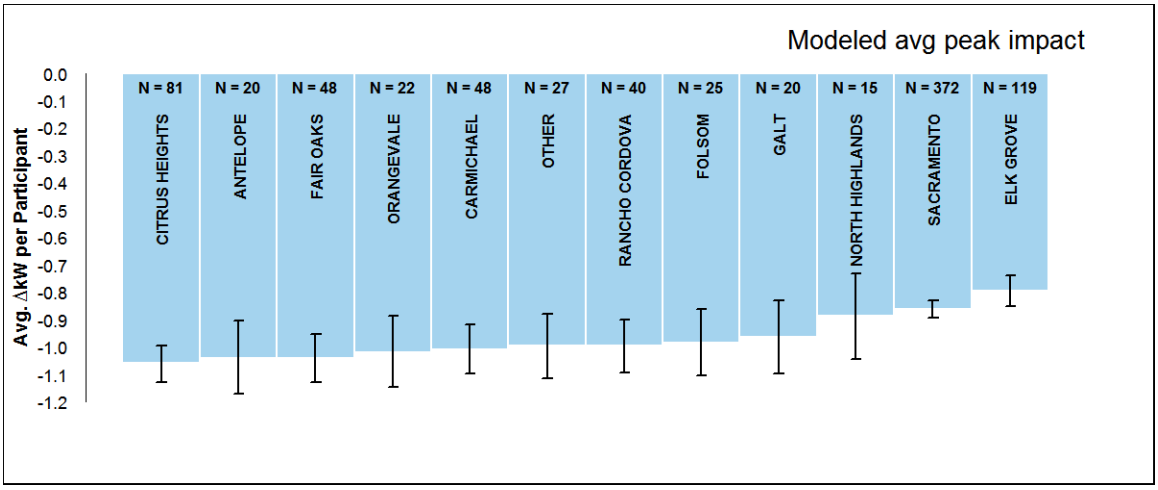


Figure 43 shows the event impacts for customers who chose to receive event notification by SMS and Email (SMS+Email), or by SMS, phone, and email (SMS+Phone+Email) were significantly higher than the impacts for customers who chose to receive event notification by email, phone, or email and phone (Phone+Email).

FIGURE 43. EVENT SAVINGS BY NOTIFICATION

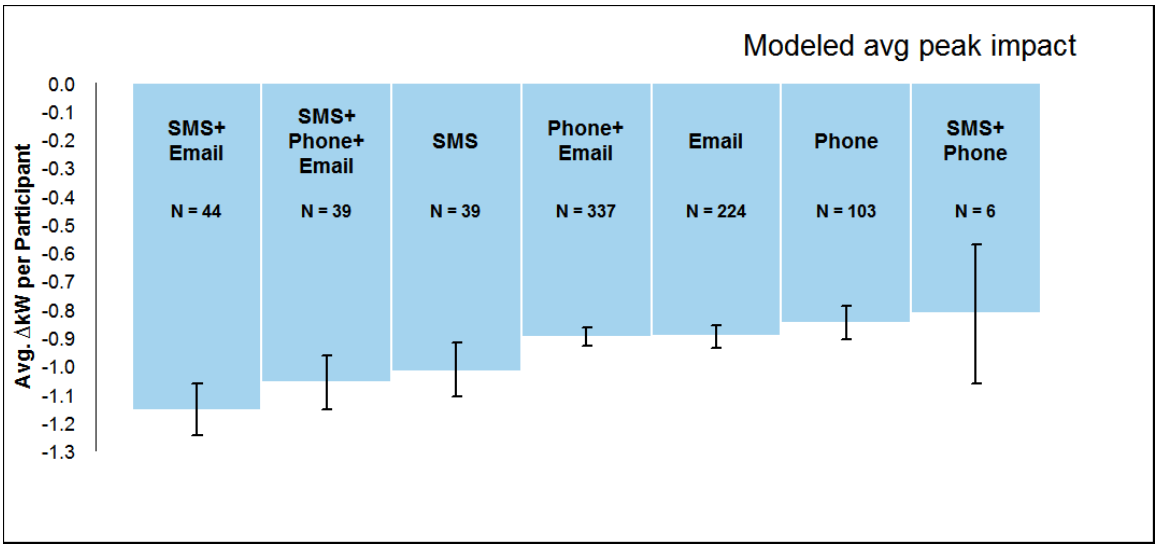


Figure 44 shows on average, event impacts for homes with Lennox HVAC units were significantly lower than impacts for homes with Trane, Day & Night, York, Bryant, Payne, Rheem, or Carrier units. Homes with Goodman units had significantly lower impacts than did homes with Trane, Day & Night, or York units. Trane units showed significantly higher impacts than units in the “Other” category.

FIGURE 44. EVENT SAVINGS BY AC UNIT MAKE

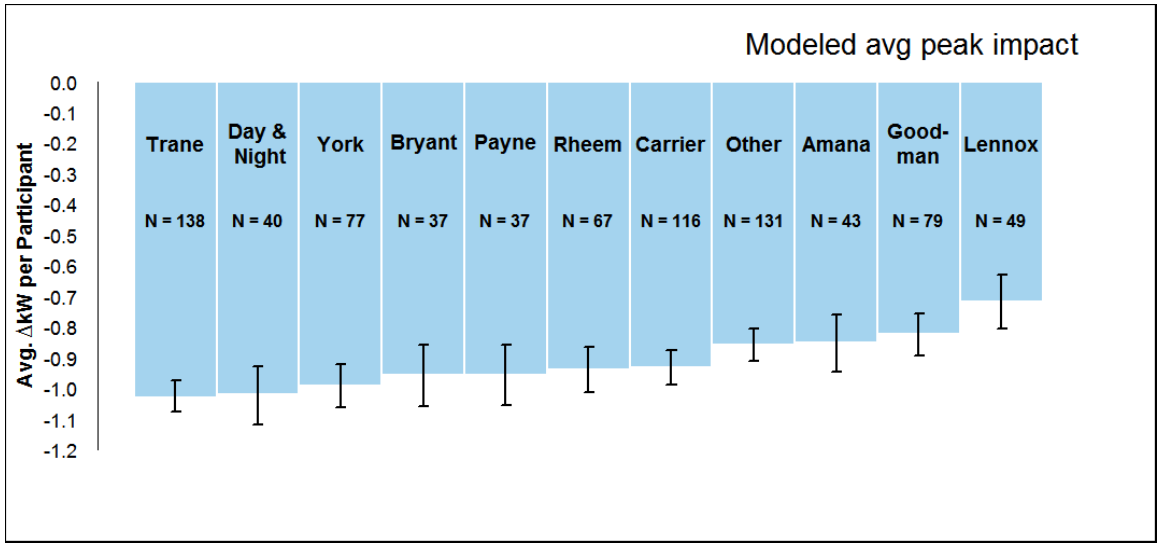
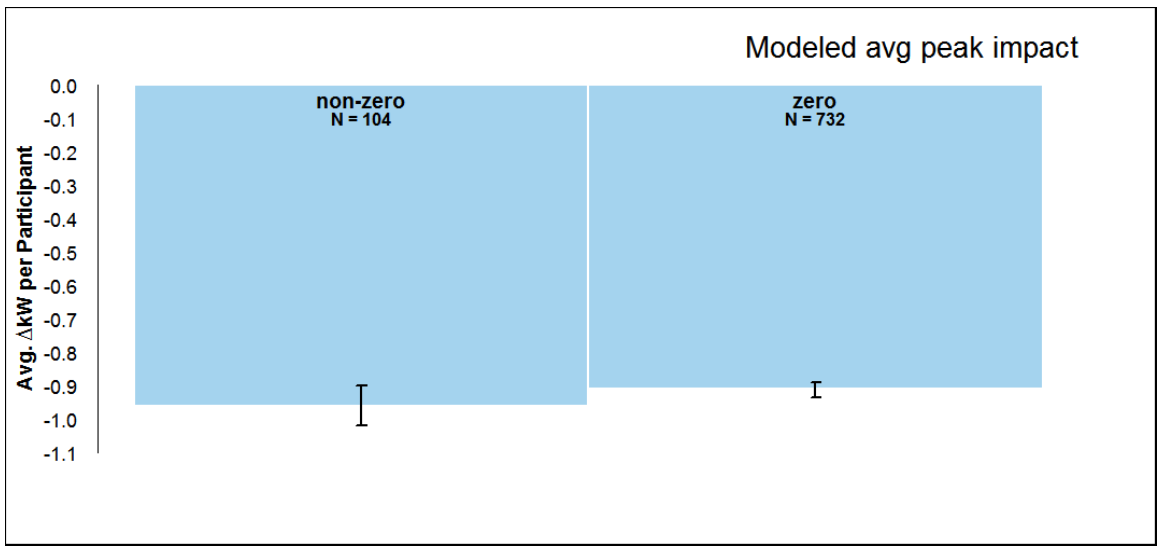


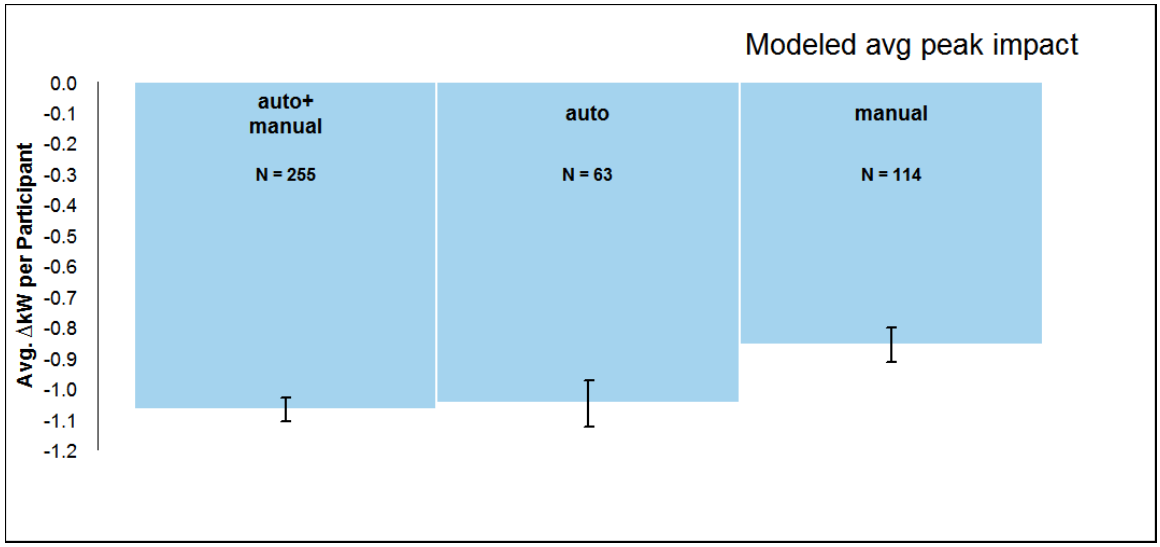
Figure 45 shows that the need to install the auxiliary switch ire from the air-conditioning unit to power the thermostat was not significantly related to event impacts.

FIGURE 45. EVENT SAVINGS BY AUXILIARY SWITCH



In Figure 46, customers who said that they manually adjust their regular thermostat schedule (manual) had significantly lower impacts than those who automated daily schedules (auto), or who occasionally adjusted automated schedules (auto+manual).

FIGURE 46. EVENT SAVINGS BY THERMOSTAT OPERATION



In Figure 47, homes with just one occupant had significantly smaller event savings than did homes with more than one occupant.

FIGURE 47. EVENT SAVINGS BY NUMBER OF OCCUPANTS

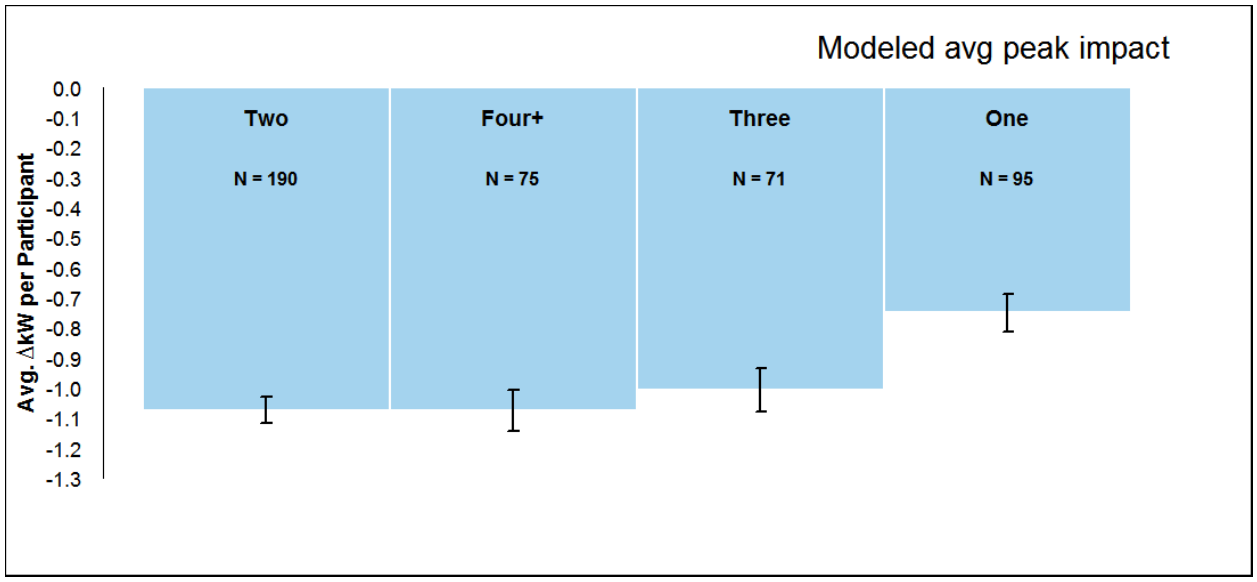
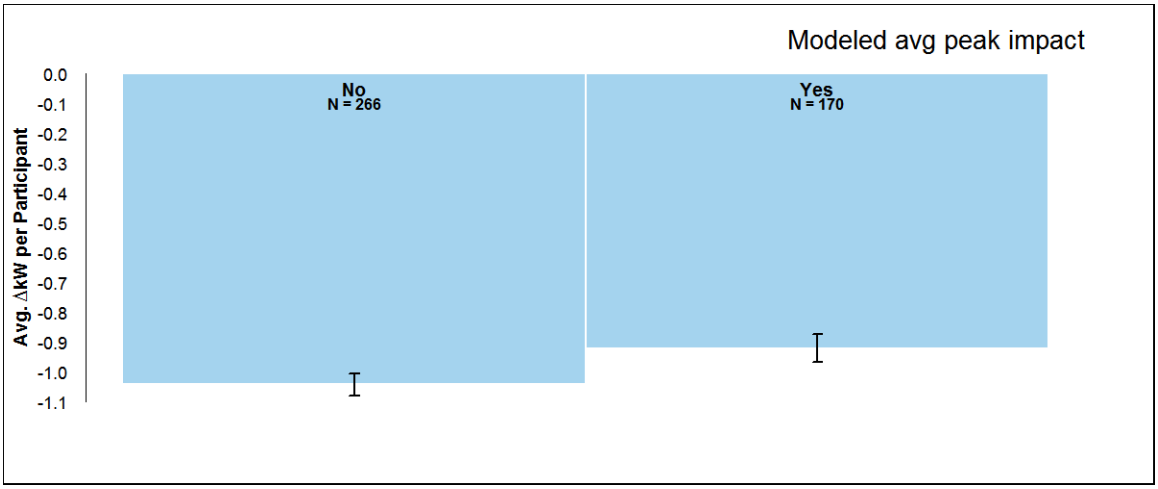


Figure 48 shows on average, homes with at least one occupant over 65 years of age had significantly lower impacts than homes without occupants over 65.

FIGURE 48. EVENT SAVINGS BY PRESENCE OF ONE OR MORE OCCUPANTS OLDER THAN 65



Non-event Weekday Load impacts

Although demand response during the twelve Conservation Day events was the main focus of this study, load impacts outside the twelve events are also of interest. In particular, the TOU rate present in both the CPP and CPP+DLC groups might be expected to reduce loads during the 4-7 pm peak period and increase loads in the pre-peak and post-peak hours.

The load impacts for each program group on non-event weekdays during the summer of 2013 are plotted in Figure 49 and listed in Table 23. Being non-event days, these impacts are fully the results of customer behavior or customer-programmed automation, since SMUD did not send automation signals to the smart thermostats on these days. As expected, the two program groups on the TOU-CPP rate reduced load significantly during the weekday peak in response to the higher peak rate, while the DLC group showed no statistically significant change from their energy use patterns of the prior year.

FIGURE 49. AVERAGE HOURLY IMPACTS ON NON-EVENT SUMMER WEEKDAYS, BY PROGRAM GROUP

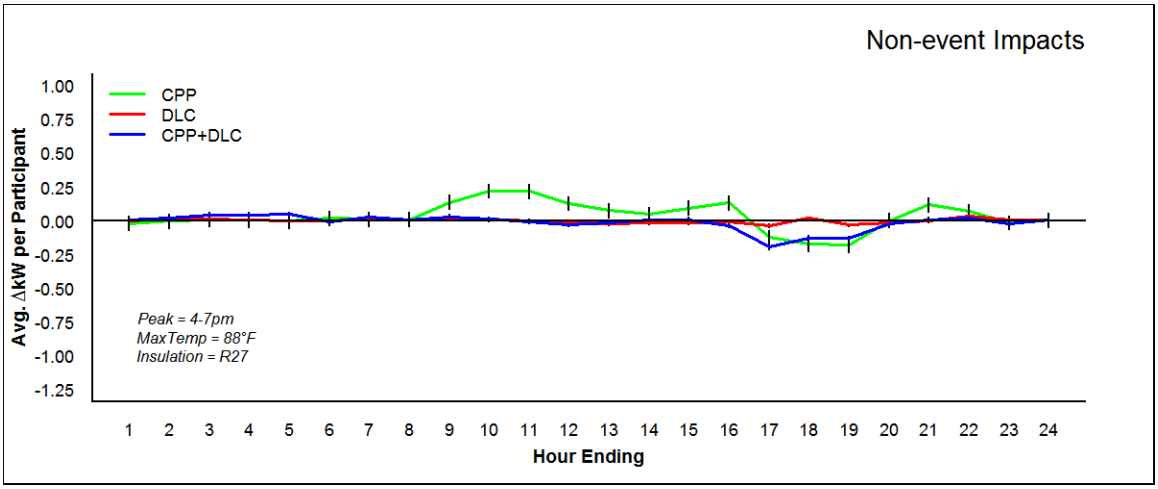


TABLE 23. AVERAGE PEAK LOAD IMPACTS ON NON-EVENT SUMMER WEEKDAYS, BY PROGRAM GROUP

	N	Pre-peak (hours 14-16)	Peak (hours 17-19)	Post-peak (hours 20-22)
DLC	509	-0.018 (-1.7%)	-0.00 (-0.0%)	0.014 (1.0%)
CPP+DLC	291	-0.014 (-1.1%)	-0.14* (-7.9%)	0.005 (0.3%)
CPP	37	0.097* (7.6%)	-0.14* (-8.9%)	0.068* (4.4%)

* Statistically significant (alpha = 0.05)

Contrasts between these impacts (Table 24) indicate significantly greater load shed during the peak hours for the CPP and CPP+DLC groups compared to the DLC group. In addition, the CPP group had greater pre-peak load increases than did the other two groups, and greater post-peak rebound than did the CPP-DLC group.

TABLE 24. COMPARISON OF LOAD IMPACTS BY TREATMENT (NON-EVENT)

	Pre-peak (hours 14-16)	Peak (hours 17-19)	Post-peak (hours 20-22)
DLC-CPP	-0.11*	0.14*	-0.055
'CPP+DLC'-CPP	-0.11*	-0.0011	-0.064*
'CPP+DLC'-DLC	0.0036	-0.14*	-0.0089

* Statistically significant (alpha = 0.05)

Summer Energy Impacts

Figure 50 shows the hourly impacts for all 122 days in the summer of 2013, including event days, non-event weekdays, weekends and holidays. On average, hourly summer loads resemble non-event weekday loads, with visible pre-peak load increases for the CPP group, and load reductions during peak for both the CPP and CPP+DLC groups. Overall, summer energy use changed very little, but increased slightly—by 3.6% and 1.1% for the CPP and DLC groups, respectively (Table 25). In all three cases, these impacts differed significantly between groups (Table 26).

FIGURE 50. AVERAGE SUMMER 2013 DAY

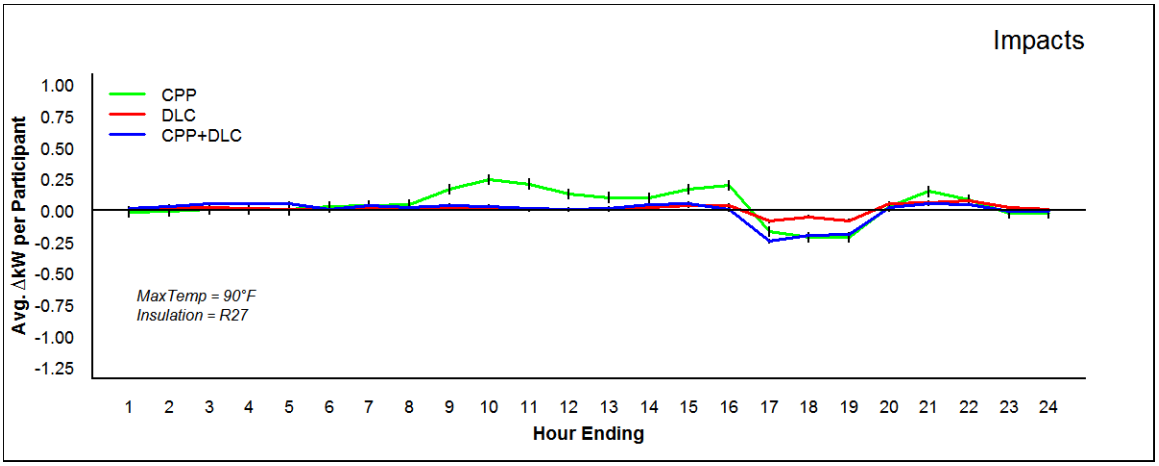


TABLE 25. AVERAGE SUMMER ENERGY IMPACTS, BY GROUP

	N	Total (hours 1-24)
DLC	509	0.012* (1.1%)
CPP+DLC	291	-0.0024 (-0.19%)
CPP	37	0.044* (3.6%)

* Statistically significant (alpha = 0.05)

TABLE 26. COMPARISON OF SUMMER ENERGY IMPACTS BETWEEN GROUPS

	Total (hours 1-24)
DLC-CPP	-0.032*
'CPP+DLC'-CPP	-0.046*
'CPP+DLC'-DLC	-0.014*

* Statistically significant (alpha = 0.05)

Residential Bill Impacts

Residential participants in the 2013 PowerStat pilot were given the choice between being charged for electricity according to the standard tiered rate (the DLC group) or according to a time varying TOU-CPP rate (the CPP and CPP+DLC groups). This section estimates and compares the average bill impacts for customers on these two rates and also between the DLC, CPP, and CPP+DLC groups.

Summer and monthly bills were calculated as the product of hourly loads estimates for 2012 and 2013, corrected for weather effects, and the respective rates for each customer in each year. On average, those on the TOU-CPP rate saved about 50% more than those choosing to stay on the standard tiered rate (Figure 51).

FIGURE 51. HISTOGRAM OF SUMMER BILL IMPACTS INCLUDING INCENTIVE PAYMENTS, BY RATE

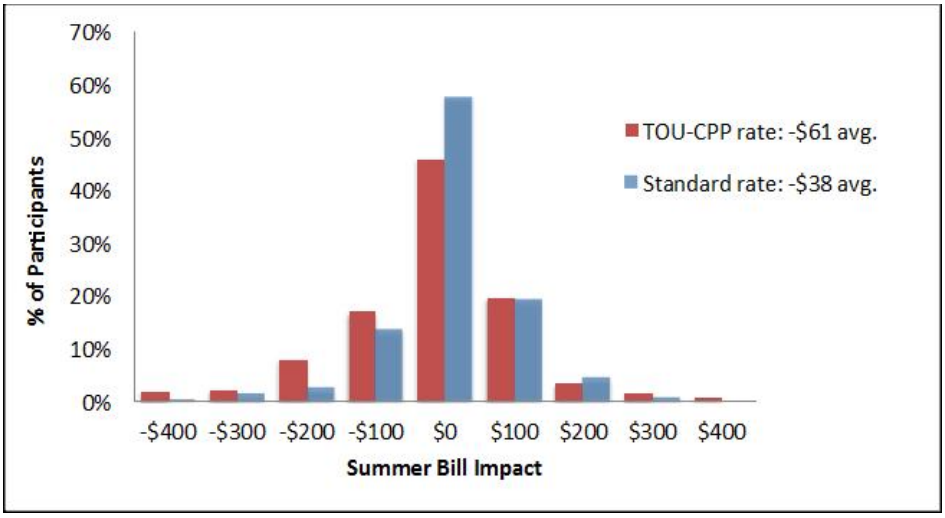


Table 27 summarizes the PowerStat participants' average monthly bill impacts for the summer of 2013 by program group, including electricity costs and DLC payments.

TABLE 27. AVERAGE MONTHLY BILL IMPACTS, BY GROUP

Subgroup	N	Electricity Cost Impact	Avg. DLC payment	Actual Monthly Bill Impact
DLC	509	+$0.82	-$10.23	-$9.41
CPP+DLC	291	-$15.44	--	-$15.44
CPP	37	-$13.47	--	-$13.47

Because the DLC group increased energy use and was on a rate that did not reward peak load shifting, their electricity costs increased slightly relative to the previous year. When payments for peak events are included in the total bill impact calculation, however, average DLC participant bill impacts become negative, indicating an average overall benefit relative to the prior year.

The two groups on the TOU-CPP rate reduced their electricity costs by shifting loads out of the higher cost peak period into the lower cost off-peak period, but were not paid directly for contributions to events. Overall, the two groups on the TOU-CPP rate saved significantly more money on their summer bills than did the DLC group on the standard rate.

Incentive Structures

Table 28 compares the actual payments to DLC subgroup customers to the estimated benefits these same customers would have received under a TOU-CPP rate. When customers in the DLC2 program participate in the event they are credited $2. DLC3 customers are credited $3 and DLC4 customer are credited $4. The actual DLC payments take into consideration participants that opted out or overrode the event.

Assuming that the TOU-CPP rate provides a relatively accurate estimate of cost to the utility, the difference between the DLC payment and the hypothetical TOU-CPP benefit, shown in the last column of Table 28, is the amount that DLC customers were overpaid for their contribution to event peak loads.

TABLE 28. MONTHLY DLC PAYMENTS VS. HYPOTHETICAL TOU-CPP BENEFITS, SUMMER 2013

Program	N	Event Offset	Incentive per Event	Actual Avg. DLC Payment	Hypothetical TOU-CPP benefit*	Monthly DLC Overpayment
DLC2	57	2°F	$2	$5.56	$5.53	$0.03
DLC3	99	3°F	$3	$8.64	$5.55	$3.09
DLC4	353	4°F	$4	$11.44	$8.11	$3.33

* Values calculated as Σ(hourly loads)x(standard rate)– Σ(hourly loads)x(TOU-CPP rate)

Based on this analysis, the incentive level of $2 per event is appropriate for the 2°F offset subgroup, however, both the 3°F and 4°F offset subgroup incentive levels are too high, at $3 and $4 per event respectively, with the 4°F offset incentive level being the most overpriced. More appropriate incentive levels for these groups would be $2 for a 3°F event offset and $3 for a 4°F event offset; however, this would call into question the need for both 2°F and 3°F event offset subgroups at $2 per event. Some potential solutions include offering 3°F at $2.50, or removing one of the two groups entirely.

Lessons Learned

This project was very complex and involved coordinating with many different internal departments and outside vendors to implement the study. As a result, there were a lot of lessons learned to share.
The lessons learned from this experience focused on the following areas:

- Design
- Process
- Market Research
- Marketing
- Technology
- Installations
- Event Messaging
- Event Management
- Training
- Planning
- Customer Service
- Load Reduction Forecasts

Design

Observation: The study design was complicated from the customer point of view. **Recommendations:** Think about these studies from the customer perspective and integrate additional time for researching customer choices. Make use of focus groups with the goal of developing less complicated and user-friendly programs ahead of sending any marketing material to customers.

Observation: Consider the number of options presented to the customer at the time of recruitment. Too many program offerings may be confusing for the average customer. **Recommendation:** In a study were many choices are offered it's imperative to spend significant upfront time explaining to the customer the differences in choices and their associated benefits.

Observation: Does allowing the "Pre Opt-Out" feature offer any real value to the utility or the customer. Customers have the ability to "Pre Opt-Out" of a single event or

forever. If they elect foreover, they will not be included in any future Conservation day events.
Recommendation: Reevaluate allowing whether "pre opt-out" is an option for future programs. Analysis should take into consideration primarily the value to the customer.

Observation: The business requirements were not fully flushed out due to time constraints to implement the project, lack of resources, and new technology.
Recommendation: Incorporate longer lead time before a program begins to allow full vetting of the business requirements by everyone involved and make sure to identify and define roles and responsibilities.

Processes

Enrollment

Observation: Customers were enrolled in the demand response management system programs with an in-house, automated workflow. After the sign up (entry of customer name, option selected, and notification preference), a service notification was generated for the thermostat installation. Customers were essentially enrolled in a program without having confirmation of a successful device installation. As a result, many customers, after realizing they were ineligible, had to be unenrolled. Two main issues developed: the creation of extra work due to the large enrollment numbers and communication issues between the installer, SMUD operations, and the billing department, who was responsible for enrolling/unenrolling customers in programs. These issues led to a strain on current staff and the need to recruit additional staff.
Recommendation: Revisit the automated enrollment workflow to simplify enrollment processes. Possible process modifications include defining what a successful is, sending customer information to the installer first and having them schedule appointments no more than a week out, and/or expanding the phone screen at the time of appointment setting in order to identify ineligibles. Once appointments are set, Billing can then conduct enrollments.

Observation: The service notification closure process is cumbersome with SAP and required to many manual inputs and mouse clicks. As a result, a group of service notifications were not closed fully resulting in the group not being enrolled in their respective demand response programs.
Recommendation: Simplify processes through the use of automation and technology. Develop reports and checks and balances in order to verify each process is completed fully.

Billing

Observation: Customers on the TOU-CPP rate that requested termination from the study had to wait until their next billing cycle to be put back on their standard rate.
Recommendation: Investigate possible modifications to billing system that would allow customers to be put back on pre-program rate as immediately as possible.

Exceptions

Observation: Managing exceptions to the automated sign-up workflow became problematic and cumbersome as multiple departments became involved for various reasons such as permissions and documentation.
Recommendation: Review sign up and exceptions processes and streamline for better customer experience.

Observation: Participants that were on SMUD's Peak Corps program could not participate in PowerStat unless they were removed in the system. This was a manual process that involved also included tracking Peak Corps participants so they could be placed back on Peak Corps after the pilot ended (also a manual process).
Recommendation: Find a solution that doesn't require removing Peak Corps customers from that program, tracking them and re-enrolling them back in the program once the study concludes.

Market Research

Observation: The PowerStat sample frame overlapped with sample frames for other pilots going on concurrently. These samples were intended to be mutually exclusive. As a result, duplicate customers were found across multiple pilots.
Recommendations: A solid Q/A process should include cross checking by someone other than the person who pulled the original sample. Where applicable, samples should be pulled at the same time to avoid the possibility of "double dipping" at a later date. Set clear and robust quality checks in place to ensure duplication issues, if any, are caught early on and before the sample list goes to the mail house.

Observation: Multiple records were found in the sample. This was because the sample frame was pulled based on contract account, which could have multiple contracts under each account.

Recommendation: Create a unique ID field that combines two existing fields that will capture specific customers at specific premises. Use a unique ID/key that ensures all records in the database are unique and there are no multiple occurrences of the same customer or contract.

Observation: There were customers meeting certain criteria that were not screened out.
Recommendation: Define and approve the list of screening criteria from the entire team before the sample is pulled. Include as many representatives from different departments so as to capture all programs and rates.

Observation: A large quantity of Small Commercial customer accounts within the sample were bounced back (over one-third) due to: no such street number, insufficient address, undeliverable, or vacant. Additionally, there were many duplicated addresses.
Recommendations: Recruitment letters were mailed out to service address to ensure it reaches decision-makers and to avoid parent company receiving dozens of identical SMUD letters for multiple business locations in Sacramento area. Update commercial database regularly to ensure cleanliness of records/addresses. Allow sufficient time for mailing/recruitment effort in case sample size increases and additional mailings are needed. If sending materials to mailing address–personalize them with business address information ("this letter is with regards to your business location at such-and-such address").

Observation: Not understanding the difference between the service address and billing address contributed to solicitations going to the wrong address.
Recommendation: Have a clear understanding of the differences in the service address vs. billing address to ensure mailings are targeted to the correct location. Make sure target audience aligns with study objectives/goals.

Observation: Customer attributes for small commercial aren't conducive to appropriate sampling due to lack of appropriate SAP fields.
Recommendations: Explore other options other than direct mail to reach this segment. Investigate ways to acquire latest up to date information on small commercial customers that would be relevant the program.

Observation: The database is not set up to handle all of the criteria for each sample frame as some pilots/studies had up to 25 criteria that needed to be screened out.
Recommendations: Investigate possible upgrade of software to handle a larger load of information.

Marketing

Observation: There was a significant lack of response from the small commercial segment direct mailing campaign.
Recommendation: Alternative channels should be utilized for recruiting the Small Commercial segment. This could include using the Commercial Customer Service Representatives to recruit customers who call in to the Contact Center, adding the recruitment to an existing energy efficiency program, and/or using public pronouncements of the program. Another method would be to leverage contractors working for SMUD to implement energy efficiency measures to this market segment.

Observation: The option choices presented to the customer were not clear in the marketing/recruitment material, which resulted in biased customer enrollment in the SMUD managed options (DLC and CPP+DLC).
Recommendation: Consider the use of focus groups to test materials before they are distributed.

Observation: There was too much information on the application and agreement which made it confusing for customers. The incomplete application/agreement rate was well above what was expected (30-40%), which led to additional staffing resources needed to contact customers to complete the materials.
Recommendation: Allocate appropriate labor resources to aid in the sign-up process based primarily on the complexity of the program. Online sign up functionality should be incorporated in the longer term.

Technology

Observation: There were many touch points in the process flows regarding customer documentation, which increased the chance of steps being missed or data being entered incorrectly. One area of concern was the use of a SQL database that tracked customer information.
Recommendation: Revisit the process flows and explore areas for consolidation of touch points and the use of extra databases for specific customer data. Consider not using the SQL database if data can be found elsewhere.

Observation: Reports were available from many systems and required labor resources to go from system to system to run reports and analyze the data.

Recommendation: Allocate additional time for reporting needs and analysis. Determine which parts of the various reports have value and aggregate for analysis and troubleshooting efficiency.

Observation: The SMUD Customer Service Representatives had difficulty identifying PowerStat study customers.
Recommendation: Investigate a way for Customer Service Representatives to identify which program a customer is on from their initial interface.

Observation: Although Customer Service Representatives could identify that a customer opted out of an event, they could not view when they actually did so. This information could be valuable for the CSR when discussing opting out of an event with a customer.
Recommendation: Look at including additional details regarding customer behavior and opting out.

Observation: When updating email/phone ensure the Business Partner is updated as well. This was a manual process and added processing time.
Recommendation: When customer information in one system is updated have mirrored information in other locations update as well.

Observation: The Silver Springs Network HCM Module takes 5-6 minutes to create the event for each program and only allows the creation of one program at a time.
Recommendation: Upgrade Silver Spring Network's HCM application to a newer version that increases the performance of calling events.

Observation: The study only offered one type of thermostat to participants. This prevented us from installing more customers than if we had other technologies to offer.
Recommendation: Look into offering a suite of end use devices to the customer so as to accommodate many premises configurations and needs. Consider including load control devices such as cyclers to air conditioners.

Installations

Observation: Manual use of communication with the Field Installer, through data transfer by an EXCEL spreadsheet, was a less than ideal solution. Tracking issues developed where it was difficult to keep information up to date.

Recommendation: Find an alternative solution to communicating/sharing information with installers. Consider using an online work order management solution that can be updated in real-time and accessed by all parties at any given time.

Observation: Device management was an issue in the field when dealing with an inoperable device. If a device was provisioned through Silver Spring Networks' DR Installer application and was found to be faulty, another device had to be provisioned. Occasionally the original device was not fully or partially de-provisioned, which caused confusion in the databases.
Recommendation: There needs to be a clear process for installations and when a device is inoperative after it's been connected to the meter.

Observation: Events were called before some installations were completed. Thus, many customers were in an incomplete state of enrollment due to their billing cycle and when they were actually fully enrolled in their program.
Recommendation: Detailed schedule planning is needed in order to enroll customers before the onset of the event calling period. This will enable the proper and full enrollment of customers. If enrollment is to take place during the event calling period, a detailed process needs to be developed in order to validate each customer and where they stand in the enrollment cycle.

Observation: The thermostat installers did not always follow the copy/paste process to be used in the field, which led to input errors.
Recommendation: Consider a different process where the installers use bar code readers to enter information. In addition, incorporate quality assurance into the process to ensure data integrity.

Event Messaging

Observation: The study used a day-ahead messaging notification to participants. There may be situations when day-of messaging is necessary for future programs designs.
Recommendation: Explore how the process flows would be impacted if day-of messaging were enabled.

Observation: The SMS opt-in process to receive day ahead event notifications was cumbersome for the customer, which resulted in a lower than expected percentage successfully opting in.

Recommendation: Investigate ways to simplify the SMS opt-in process.

Observation: Allowing SMS as the only day-ahead notification was not a good choice as some messages were not sent through the third party messaging vendor.
Recommendation: Investigate a notification methodology that incorporates reliability, which may require a minimum of two types of communication. Phone was the most reliable method with email and text messaging following.

Event Management

Observation: There were challenges in coordinating Conservation Day events with the timing of other Smart Grid pilots. Some pilots required exactly twelve Conservation Day events to be called, no matter what the weather conditions were.
Recommendation: Reevaluate the methodology in which events would be called. Consider the ability to call Conservation Day events that are not linked to other pilots or studies on the same day. This should allow Conservation Day events to be called on the very hot days to ensure that air conditioners are being used.

Training

Observation: The SMUD Contact Center customer service representatives, at times were confused about the program options.
Recommendation: Initial, pre-program training should be more in-depth. Ongoing or refresher training should be an option.

Observation: There were times when labor resources were constrained and other resources were brought onto the project in short notice to help enter customer information into databases. These resources were given very little training and there was little of any quality assurance done to ensure data entry accuracy. This led to data entry errors that took additional labor hours to fix.
Recommendation: Training should be more in-depth for staff that are entering information in databases. Institute a quality check process for validation purposes of data entered.

Planning

Observation: Entire new skills were needed for this study. A lack of skills and knowledge beforehand led to plugging-in resources. This created delays in processes and troubleshooting.
Recommendation: Identify project needs ahead of time to the best of abilities and assign flexible roles in the advent situations arise that are not expected. Additionally, assign a high level role to specific resources, i.e. troubleshooting, without having to define specific tasks if they are unknown.

Customer Service

Observation: There was a lack of quick access to the customer's Application and Participation Agreement when the customer called and had questions.
Recommendation: Investigate the possibility of scanning Application/Agreement into SAP to the customer's account in order to aid the customer experience.

Load Reduction Forecasts

Observation: All the load reduction forecasts in the demand response management system used a customer baseline approach to determine the load reduction forecasts. There are a number of attributes that are configurable in the load reduction forecast tool. The forecasts and the actual load reduction were not close.
Recommendation: Run the study for another summer and explore the reasons why the predicted load reduction models are not close to the actual. Also consider using the results from the impact evaluation models to help refine the modeling in the demand response management system.

Conclusions and Recommendations

SMUD's 2013 PowerStat study studied three program options designed to reduce summer peak loads through weekday TOU rates, CPP events, customer-managed smart thermostats, and direct load control of AC units by the utility via communicating thermostats.

Customer Preferences

One of the objectives of this study was to determine customer preferences for the voluntary program options, however, problems introduced during the recruitment effort made a quantitative examination of this issue unfeasible. Because the three program options were not clearly explained in the Participation Agreement there is a strong likelihood that the choices made by customers in signing up for the study are not representative of what would have occurred in the absence of this deficiency. The resulting bias also sheds doubt on the external validity of the final load impact estimates.

For the 2014 study, it is strongly recommended that the wording in the recruitment materials, and in particular the Participation Agreement, be reviewed carefully to avoid this bias.

Load Impacts

The primary objective of the load impact evaluation was to determine how the program incentives and load management strategies affected average summer 2013 electric loads categorized into three load impact types: (a) event peak demand, (b) non-event weekday peak demand, and (c) energy use. The following sections describe the main findings and provide recommendations for future work.

Event Day Peak Impacts

In aggregate, PowerStat participants reduced the 4-7 pm peak loads significantly on 106°F Conservation Days, by an average of 1.45 kW (41%) per participant, thus achieving the goal of significant demand response. These results suggest that SMUD

consider a future expansion of all or portions of this program to meet future demand response resource needs.

Estimated load impacts were significant for all program options. The CPP and CPP+DLC groups had statistically equivalent peak load reductions at -1.63 kW (-46%) and -1.67 kW (-45%), respectively, while the DLC group shed -1.32 kW (-39%). Load increases ranging from +7% to +16% in the pre-peak and post-peak periods indicate that system operators must also consider potential system load effects in the three hours preceding and following the peak period. Since pre-peak and post-peak load impacts were not significantly different between program groups, this issue need not be taken into account should SMUD consider implementing some subset of the three options offered in this study.

For all program groups, higher outdoor temperatures increased load shed measured in kW. On a percentage basis, however, response of the DLC (35-38%) and CPP+DLC (41-43%) groups remained relatively constant as temperature increased. Only the CPP group increased response measured as a percentage of baseline, starting at 35% load reduction at 90°F and increasing to 46% load reduction at 110°F. These findings indicate that SMUD can count on a program like this to perform well even at temperatures as high as 110°F. These findings also suggest that SMUD might find it as accurate and more convenient to describe load impacts as percentage of baseline rather than as pure kW values.

Ceiling insulation level had no effect on event day load shed for the DLC and CPP+DLC groups. In the CPP group, higher ceiling insulation levels were associated with significantly higher event impacts. As elsewhere, the CPP results should be viewed with caution given the small sample size. The expanded study planned for 2014 should re-examine this issue with a larger CPP group size.

On the second of two consecutive event days, called on July 2 and 3, the DLC and CPP+DLC groups showed no significant change, while the CPP program showed *increased* load shed of 0.5 kW (25%). This finding provides evidence that, contrary to popular belief, event impacts do not diminish on the second successive event day.

Higher event impacts were correlated with lower comfort ratings in all three programs. This is an expected result of reduced air-conditioning services.

Limiting event opt outs to one per summer would not improve average participant load impacts, and would actually *diminish* the overall load impact resource because of a reduction in participation. To improve on this analysis, the 2014 PowerStat participants

might be presented with a survey question such as: "If the number of event opt outs had been limited to 1 per summer, would you still have participated?" The answers to this question can then be used to more accurately exclude participants from the analysis of load impact estimates under a 1-opt-out-limit scenario.

Non-event Day Peak Impacts

On non-event weekdays, PowerStat participants saved an average of 4.4% over the 4-7 pm peak hours, with no statistically significant change in demand during the pre-peak or post-peak periods. As expected, the two program groups on the TOU-CPP rate reduced load significantly during the weekday peak in response to the higher peak rate, while the DLC group showed no statistically significant change from their energy use patterns of the prior year. This finding suggests that SMUD consider the use of a TOU rate to reduce summer peak loads in the residential sector.

Energy Impacts

Overall, the summer energy use of PowerStat participants increased by +1.1% and +3.6% for the DLC and CPP groups, respectively, while there was no change detected in the CPP+DLC group.

Customer Characteristics

Load sheds during events were significantly greater for customers who had larger homes, had more thermostats, received event notification by SMS text messages, and used scheduled thermostat programming all or part of the time. Load sheds during events were significantly smaller for participants who lived in homes with only one occupant, lived in homes with at least one occupant over age 65, or manually adjusted their thermostat settings on a regular basis. These relationships should be considered again in the 2014 study. Future program efforts wishing to target customers likely to provide the greatest load relief on event days might consider targeting younger and middle-aged customers living in larger homes with at least two occupants.

Bill Impacts

On average, those on the TOU-CPP rate saved about 50% more than those who chose to stay on the standard rate. Of the three groups, the CPP+DLC saved the most on their electricity bills at over $15 per month, followed by the CPP group at over $13 per

month. The DLC group saved just over $9 per month including the payments for events. Marketing materials for future programs might include this information to give customers a better idea about how each option is expected affect their electricity bills.

Incentive Structures

Based on an analysis of incentives and event impacts at the subgroup level, payments for the 3°F and 4°F offset DLC subgroup incentive levels are too high, and should be lowered to $2 for a 3°F event offset and $3 for a 4°F event offset. Although the incentive payment of $2 per event is appropriate for the 2°F offset DLC subgroup, SMUD might consider offering just $1 per event to maintain pricing consistency.

Key Customer Survey Results

What were participants' general experience with the PowerStat program?
Overall, customers were generally pleased with their experiences participating in the *2013 PowerStat® Program*. During the summer season on Conservation Days, 93% of customers reported being either very (65%) or somewhat (28%) satisfied with their experience in the program to that point. At the conclusion of the program, satisfaction ratings were slightly higher, with 95% of customers being satisfied (70% very satisfied). That customers were generally pleased with the PowerStat Program was evidenced in other areas as well. Even though participants had already received their free thermostat and thus had less incentive to enroll in the program again, nearly nine-in-ten customers stated that they would definitely (64%) or probably (25%) sign up to participate in the PowerStat® Program again next summer. More than four out of five customers (88%) also indicated that—if asked by a friend about the PowerStat® program—they would recommend that they participate.

Was the Participation Agreement clear?
Customers' initial experiences with the *2013 PowerStat® Program* occurred during the enrollment process, which included responding to a mailed Participation Agreement letter in which they were asked to select among several plan options. The results of the survey indicate that many customers may have been confused about the plan options they ultimately selected.

When asked directly about the Participation Agreement letter, 41% of customers felt that the letter was very clear in describing the different plans and options, 51% indicated

it was somewhat clear, 5% stated the letter was not at all clear, and 3% were unsure. More revealing, however, is that less than half of participants (48%) could correctly identify the plan options they ultimately chose by repeating the selection process during the survey. The confusion was more prevalent with respect to the management of Conservation Day settings (customer vs. SMUD controlled) as opposed to the temperature offset chosen.

Were participants pleased with the installation process?
Once a customer had agreed to take part in the PowerStat® program, the first substantial step in participation involved the installation of the new PowerStat thermostat in the customer's home. As was the case in 2012, SMUD contracted with GoodCents in 2013 to manage the installation of the PowerStat® thermostats. Based on the responses to the Pre-Treatment Survey, GoodCents performed admirably during the installation period.

Nearly every customer surveyed (99%) indicated they were either very (91%) or somewhat (8%) satisfied with the installation of their new thermostat. With respect to specific performance dimensions during installation, all customers surveyed (100%) agreed that the work site was left clean after the installation was complete, there was no damage to their property during the installation process, and the length of time it took to install the device was reasonable. Nearly all respondents also agreed that the technician explained the basics of how to use the thermostat (99%), they were able to select an installation time that worked for their schedule (98%), the technician explained the installation process prior to starting the work (98%), and that the technician arrived on time for the appointment (97%).

Approximately 6% of all participants indicated that they contacted GoodCents regarding one or more issues related to the PowerStat program for customer service. Of these individuals, 69% indicated that their issue was fully resolved to their satisfaction, and an additional 14% indicated that it was partially resolved. Among all program participants, just 1% indicated they contacted GoodCents regarding an issue that ultimately was *not* resolved to their satisfaction.

How did participants rate the PowerStat thermostat?
The success of the pilot is based, in part, on customers' opinions of the technology employed. Ninety-one percent (91%) of participants indicated that they were satisfied with the PowerStat thermostat overall, and approximately three-quarters indicated that the PowerStat thermostat performed better than their prior thermostat. At both the outset and the conclusion of the program, participants generally gave high marks to the

PowerStat thermostat on every performance dimension tested, including the readability of the display, ability to keep their home at a comfortable temperature, appearance, the availability of technical support, helping them to save money, and overall performance. Among the minority of customers who were dissatisfied with the PowerStat thermostat, commonly mentioned complaints were that the unit is too complicated, lacks functionality, and is not user-friendly.

Which treatment strategies performed the best in keeping customers comfortable? Across the summer season, 57% of participants indicated that the temperature in their home was about right/comfortable during peak hours on Conservation Days, 39% rated it a bit too hot, 4% stated that it was much too hot, whereas less than 1% indicated it was too cool. When the results were broken down by treatment group, the most striking pattern in the data is the general *consistency* of the responses. The percentage who indicated they were comfortable ranged between 53% and 61% across all seven treatment groups, with no differences achieving statistical significance. Similarly, the temperature offset value chosen did not significantly impact participants' comfort levels among those who were treated with a set temperature increase for the entire season. For example, those who had a four degree increase expressed comfort levels that were nearly identical to those who experienced a two degree offset.

In addition to asking respondents to rate the temperature in their home using the scale noted above, all participants were also asked to rate their *personal* comfort on Conservation Days during peak hours using a variation on the Wong-Baker visual scale for measuring pain. Once again, the results were strikingly similar across all seven treatment groups. The average comfort level ranged from a low of 3.31 to a high of 3.59 across treatment groups on a 5 point scale, although these differences were not statistically significant for any treatment group combinations.

As to why the treatments did not elicit a greater range in reported comfort levels among participants, two observations are worth considering. First, participants were not assigned to treatment groups on a random basis—they were allowed to self-select their treatment. Customers who felt comfortable with higher temperatures could thus select a higher temperature offset, whereas those who were more sensitive could opt for a lower degree offset. By allowing customers to select their treatment in this way, the study design likely underestimates the actual comfort level differences between the treatment groups if respondents were assigned on a random basis. Under random assignment, customers who felt comfortable with higher temperatures would be even more likely to report being comfortable if assigned a two degree offset, whereas those who were more sensitive would be less likely to indicate they were comfortable if they happen to be assigned a four degree offset.

A second observation is that individual customers were not exposed to different treatments in 2013 as they were in the *2012 PowerStat® Pilot.* In the 2012 pilot, the same participant received different pre-cooling treatments throughout the season, which provided different experiences and a basis for comparison. In 2013, participants received the same treatment throughout the summer season and thus lacked variation in Conservation Day experiences that could have helped them to provide a more nuanced assessment of their comfort levels on specific Conservation Days.

Small Commercial

Because only twelve customers participated in the small commercial study, load impacts results are considered anecdotal and should not be used to predict future program results. Keeping this in mind, peak load impacts were statistically significant (but unlikely to be representative) for all three groups, at -15% for the CPP group, -20% for the CPP+DLC group, and -35% for the DLC group. In addition, the CPP+DLC group had a statistically significant pre-peak load increase of 0.78 kW (+11%). Load impacts in the post peak period were not significantly different.

Perhaps the most important take away from the small commercial study is that SMUD must put forth a much greater effort in implementing this portion of the study to achieve useful results. More heterogeneity makes the small commercial sector more difficult to study than the residential sector. Thus, a successful study will require more effort and more participants than the residential sector–particularly if stratified by business type. In the absence of greater effort and a larger number of participants in the 2014 study, SMUD should not use resources for the small commercial sector, but rather put off a larger and more focused effort for that sector in 2015 after the residential sector has been well studied.

Appendices

Appendix A. Program Materials

Invitation Letter

FIGURE 52. INVITATION LETTER

Sign up today and you could save on your electric bills!

Dear [Customer Name],

You're invited to participate in our Energy Insights PowerStat® Pilot. This pilot program – available to a small group of randomly selected SMUD customers – gives you an opportunity to better manage your energy use and save on your summer electric bills. Plus, you get a FREE smart thermostat, valued at $350.

About the PowerStat® Pilot

How does it work?
Choose the plan that's right for you:
The **2-3-4 Plan** allows you to earn up to a $48 credit on your summer bill. The **Optimum Off-Peak Plan** offers greater savings depending upon how you manage your summer electricity use.

Both plans include a free smart thermostat that can help you better manage your electricity use, save energy, and help the environment. At no cost to you, a SMUD contractor will install the thermostat, and it will be yours to keep.

When does the program run?
The PowerStat Pilot will run the summer of 2013, June 1 through September 30.

How do I join?
Signing up is easy. Just choose your plan and fill out and return the enclosed Application and Participation Agreement in the postage-paid envelope provided. Enrollment is limited, and qualified customers will be enrolled on a first-come, first-served basis. Send in your signed agreement today.

Where can I learn more?
The enclosed brochure provides complete program details. You can also go to **smud.org/2013PowerStat**, or call us toll-free at **1-855-253-1824**. If you decide not to participate, you don't need to do anything and nothing about your service will change.

We're committed to exploring and embracing new technologies that have the potential to benefit our community and help you save energy. This is your chance to be a part of that process. We look forward to hearing from you!

Sincerely,

Michael Daniels
Program Manager

SMUD's Energy Insights Pilot looks at a number of new technologies that will provide you with choices and control to lower your electricity usage while staying comfortable. PS-RES-A

Brochure

FIGURE 53. RESIDENTIAL RECRUITMENT BROCHURE

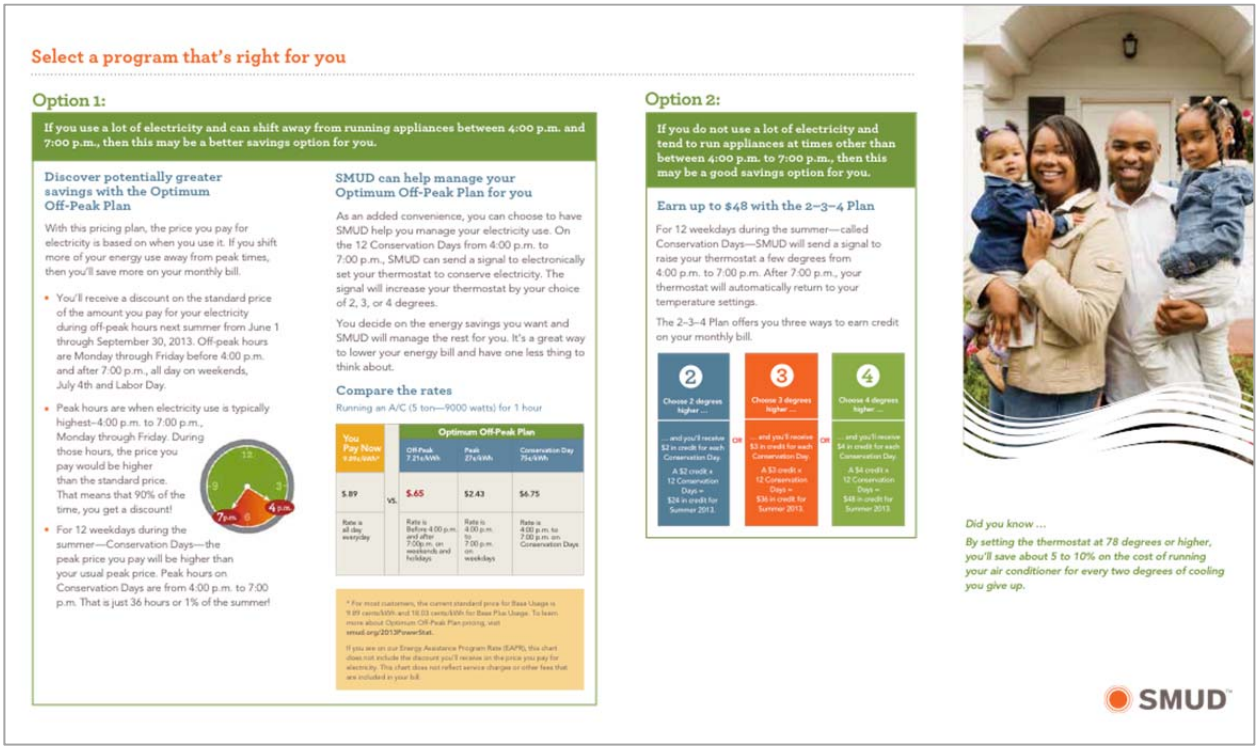


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FIGURE 54. RESIDENTIAL PARTICIPATION APPLICATION

[CONTRACT]

Sign me up for the Energy Insights PowerStat® Pilot!

Customer: _____
Customer Name

_____ _____ _____
Street Address (Premises)[1] City Zip

_____ _____
Best Telephone Number Email address[2]

[1] *Address where the Energate Thermostat(s) equipment will be installed.*

[2] *Email address will only be used to send you research surveys and other important program information.*

Eligibility Requirements

This offer is subject to availability. Agreements will be processed on a first-come, first-served basis.

You must meet all of the following participation and eligibility requirements:

- Your home is a single-family dwelling (no aprtments or mobile homes)
- You own and occupy this home (no rentals)
- You are not participating in any of the other SMUD pilot programs being offered
- You don't operate a child care or convalescent care facility in your home
- You are not planning to move out of the residence during 2013
- Your central air conditioning system(s) must be in working condition
- You have a maximum of (2) central air conditioners
- You have only one (1) thermostat for each central air conditioner
- You do not qualify if your primary system is zonal, a swamp cooler, a wall heater, a window mounted air conditioner, or a floor furnace
- You need to have a personal computer with internet access
- You are willing to participate in online surveys throughout the study period
- You complete this Application and sign the Participation Agreement in its entirely and return it in the self-addressed stamped envelope provided

Please indicate the number of thermostats in your home ❑ 1 ❑ 2

Notification Options

How would you like to be notified of the twelve (12) Conservation Days (see price description in Participation Agreement)? We'll notify you the day before each Conservation Day. Please fill in all of the ways you would like to be contacted:

❑ Telephone: (_____) _____ - _____

❑ SMS text message: (_____) _____ - _____

❑ Email: _____

(Any contact information provided will only be used for Conservation Day notifications.)

Please note that if the Telephone and/or SMS text message number you supply in this Participation Agreement above is different than the one SMUD current has on file with your account, the account phone number will be changed to the number supplied above.

Please Note: It is possible that when the SMUD representative arrives to install the thermostat(s), he or she may find that your home is ineligible for any one or all of the following reasons.

- You don't meet the requirements referenced above
- Your heating and air system isn't compatible with the Energate thermostat
- Your heating and air system isn't operating properly

PS-RES-A

Review and Sign Participation Agreement

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FIGURE 55. RESIDENTIAL PARTICIPATION AGREEMENT

SMUD's 2013 PowerStat® Pilot - Participation Agreement

This Participation Agreement ("Agreement") for SMUD's Energy Insights 2013 PowerStat Pilot ("Pilot") is entered into between the Sacramento Municipal Utility District ("SMUD"), the customer ("Customer")." The Parties agree as follows:

1. **Term.** This Agreement is effective upon the date of last execution by the Parties and shall continue until December 31, 2013, unless earlier terminated by default or by either Party with prior written notice.
2. **Scope.** This Pilot will provide select residential customers a thermostat(s) to manage energy use and costs, and help SMUD test and study new residential technologies and rates. This Pilot is part of SMUD's Department of Energy Smart Grid Investment Grant (Assistance Agreement DE-OE0000214). In exchange for Customer's participation in the Pilot (subject to the Prices in section 3), SMUD will provide an Energate Thermostat(s) and installation at no cost to Customer. As a condition of participating in the Pilot, Customer agrees to remain in the Pilot through December 31, 2013.
3. **Prices.** As described in the Customer offer letter, if Customer chooses to enroll in the Optimum Off-Peak Plan the prices are in effect June 1, 2013 through September 30, 2013 (Summer Period). For a detailed description of the rate and exact prices, please refer to the SmartSacramento® Pricing Pilot Combined Time of Use and Critical Peak Rate (Summer Season Only) on Page 3 of the R Residential Service Rate Schedule. The Rate Schedule can be found online at smud.org by clicking on the Customer service link and then Rates, Rules & Regulations link. If Customer changes his/her rate plan, rate, or billing option during the term of this Agreement, Customer may no longer participate in the Pilot.

***** *Choose ONE of the following options (A or B) by checking the box*****

A. ❑ Optimum Off Peak Rate + Energate Thermostat

YES, I want to change my rate to the Optimum Off Peak Plan rate:

Off-Peak Base Use	$0.0721 /kWh	all day on weekends and holidays + before 4 p.m. and after 7 p.m. on weekdays
Off-Peak Base Plus Use	$0.1411 /kWh	applies to off-peak use exceeding 700 kWh in a billing period for standard customers
On-Peak Use	$0.2700 /kWh	3 hours (4-7 p.m.) on normal weekdays (except for holidays)
Event Use	$0.7500 /kWh	3 hours (4-7 p.m.) on 12 Conservation Day event weekdays (except for holidays) - events are noticed one day in advance
System Infrastructure Fixed Charge	$10/month	

Prices for the following observed holidays will be the same as the weekend prices in the same month:

- Independence Day (July 4, 2013)
- Labor Day (September 2, 2013)

Customer agrees to be charged and billed for electric service at the Optimum Off Peak plan rate from June 1 through September 30, 2013.

For Customer's convenience, you have the option to have SMUD automatically raise your thermostat temperature by 2, 3, or 4 degrees during Conservation Days.

If "Yes", choose 2, 3 or 4 degrees below (If "No", please leave blank):

❑ **YES, I will allow SMUD to automatically raise my thermostat temperature up 2, 3, or 4 degrees during Conservation Days.**

This option will automatically increase the temperature set point by 2, 3, or 4 degrees from 4 p.m. to 7 p.m. during Conservation Days. Customer is allowed to override the increased temperature setpoint during any of these 12 days during the 2013 summer period.

Choose 2, 3 or 4 degrees below:

❑ 2 Degree Automatic Temperature Control

OR

❑ 3 Degree Automatic Temperature Control

OR

❑ 4 Degree Automatic Temperature Control

— OR —

B. ❑ 2, 3, 4 Plan + Energate Thermostat

YES, I want to try the new technologies, and I will allow SMUD to automatically raise my thermostat temperature 2, 3, or 4 degrees during Conservation Days. I'd like to keep my current rate.

SMUD agrees to pay Customers $2, 3, or 4 for each of the 12 Conservation Days not overridden by Customer between June and September 2013. Customer's bill will be credited each month.

Choose 2, 3 or 4 degrees below:

❑ 2 Degree Automatic Temperature Control	$2.00/Conservation Day
OR	
❑ 3 Degree Automatic Temperature Control	$3.00/Conservation Day
OR	
❑ 4 Degree Automatic Temperature Control	$4.00/Conservation Day

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4. **Surveys.** Customer agrees to participate in up to ten (10) online, telephone, or mail surveys throughout the Pilot to provide feedback on Customer's experience.
5. **Ownership of Thermostat.** Ownership of the Energate Thermostat(s) will default to Customer at the time of installation.
6. **Installation.** The Energate Thermostat(s) shall be installed at the Premises by SMUD or its contractor(s), who shall perform the work as soon as reasonably practical after execution of this Agreement. SMUD will provide Customer advance notice of installation date. All costs related to installation will be at the sole expense of SMUD. SMUD or its contractor(s) will uninstall the old thermostat(s), unless it contains mercury, until the Pilot ends. SMUD or its contractor(s) will dispose of mercury thermostats in a safe manner.
7. **Maintenance.** SMUD shall have the exclusive right to maintain the Energate Thermostat(s) and perform services during Pilot, except for services already covered by Energate's warranty. All non-warranty costs associated with maintenance will be at the sole expense of SMUD. Under no circumstances shall Customer perform maintenance or other services, or remove the Energate Thermostat(s) during the Pilot. If Customer uninstalls the Energate Thermostat(s) or performs maintenance or other services on the Energate Thermostat(s) during or after the Pilot period for any reason, neither SMUD nor Energate will be responsible for reinstalling or fixing the Energate thermostat(s) or reinstalling the old thermostat(s). After the Pilot end date of December 31, 2013, Customer will be solely responsible to maintain and service the Energate Thermostat(s).
8. **Access to Premises.** Customer grants SMUD and/or its contractor(s) the right to enter the Customer's Premises to install and maintain the Energate Thermostat(s) during the Pilot.
9. **Cost.** There is no cost to Customer for the Energate Thermostat(s), initial installation, un-installation of the old thermostat(s), maintenance, and the standard Energate warranty services.
10. **Data and Confidentiality.** SMUD and Energate will keep all customer personal information and data confidential. Data to be collected and analyzed includes hourly electricity use data, interaction data with My Account, and thermostat data.
11. **Peak Corps Participants.** Participants in the Peak Corps (Air Conditioning Load Management) program who are eligible and choose to join the Pilot will not participate in Peak Corps for the summer of 2013 (June 1 to September 31). At the completion of the Pilot, customers will be reinstated in Peak Corps on October 1, 2013.
12. **Rules and Regulations.** This agreement is subject to SMUD's Rules and Regulations, as amended from time to time.
13. **Warranty.** SMUD makes no warranties, implied or expressed, written or oral, with respect to the goods and services provided under this Agreement including, but not limited to, the warranties of merchantability and fitness for a particular purpose. Energate's limited product warranty is applicable to the Energate Thermostat. During the Pilot, SMUD will assist Customer to determine applicable Energate warranty coverage.
14. **Liability.** SMUD will not be liable, and Customer waive(s) any and all claims, for any damage, loss, expense, injury or death that result from Customer's participation in the Pilot and/or ownership and use of the Energate Thermostat(s).
15. **Notices.** All communications or notices under this Agreement shall be directed as follows:

    District: Sacramento Municipal Utility District
    Attn: Customer Solutions or 2013PowerStat@smud.org or 855-253-1824
    P.O. Box 15830, Mail Stop A203
    Sacramento, CA 95852-0830

    Customer: As provided in Customer's Application.
16. **Amendments.** SMUD reserves the right, at its sole discretion, to amend the terms of this Agreement. SMUD will notify Customer in writing of the amendment at least thirty (30) days in advance of the effective date of the amendment. The amendment will become effective as of the amendment effective date stated in the notice.
17. **Termination.** Each Party may terminate this Agreement with thirty (30) day advance written notice. If Customer terminates this Agreement before December 31, 2013, Customer keeps the Energate Thermostat(s) and Customer shall reimburse SMUD for the cost of the Energate Thermostat(s). If SMUD terminates this Agreement, Customer keeps the Energate Thermostat(s) and does not need to reimburse SMUD for the cost of the Energate Thermostat(s). **Upon termination, Customer reverts back to his/her original rate prior to participating in this Pilot.**
18. **Applicable Law.** This Agreement shall be interpreted, governed by, and construed under the laws of the State of California, as executed and to be performed wholly within the State of California.
19. **Entire Agreement.** This Agreement and Customer's Application constitute the entire understanding between the Parties as to the subject matter hereof.

Please sign here

Customer _____ SMUD _____
Signature Signature

Customer _____ SMUD _____
Print Name Date Print Name Date

SMUD

FIGURE 56. SMALL COMMERCIAL PARTICIPATION AGREEMENT

SMUD's 2013 PowerStat® Pilot - Participation Agreement

This Participation Agreement ("Agreement") for SMUD's Energy Insights 2013 PowerStat Pilot ("Pilot") is entered into between the Sacramento Municipal Utility District ("SMUD") and customer ("Customer"), and if Customer is different than the property owner, than the property owner or property manager authorized to make decisions on behalf of the property owner ("Property Owner") of the service address ("Property"), referred to in this Agreement as a "Party," collectively as "Parties." The Parties agree as follows:

1. Term. This Agreement is effective upon the date of last execution by the Parties and shall continue until December 31, 2013, unless earlier terminated by default or by either Party with prior written notice.

2. Scope. This Pilot will provide select small commercial customers a thermostat(s) to manage energy use and costs, and help SMUD test and study new technologies and rates. This Pilot is part of SMUD's Department of Energy Smart Grid Investment Grant (Assistance Agreement DE-OE0000214). In exchange for Customer's participation in the Pilot (subject to the Prices in section 4), SMUD will provide an Energate Thermostat(s) and installation at no cost to Customer. As a condition of participating in the Pilot, Customer agrees to remain in the Pilot through December 31, 2013.

3. Prices. As described in the Customer offer letter, if Customer chooses to enroll in the Optimum Off-Peak Plan the prices are in effect June 1, 2013 through September 30, 2013 (Summer Period). If Customer changes his/her rate plan, rate, or billing option during the term of this Agreement, Customer may no longer participate in the Pilot.

***** Choose ONE of the following options (A or B) by checking the box*****

A. ❑ Optimum Off Peak Rate + Energate Thermostat

YES, I want to change my rate to the Optimum Off Peak Plan rate:

Off-Peak	$0.0900 /kWh	all day on weekends and holidays + before 3 p.m. and after 6 p.m. on weekdays
On-Peak Use	$0.2837 /kWh	3 hours (3-6 p.m.) on normal weekdays (non-holidays, non-event)
Event Use	$0.7500 /kWh	3 hours (3-6 p.m.) on 12 Conservation Day event weekdays (non-holidays) - events are noticed one day in advance

Prices for the following observed holidays will be the same as the weekend prices in the same month:
- Independence Day (July 4, 2013)
- Labor Day (September 2, 2013)

Customer agrees to be charged and billed for electric service at the Optimum Off Peak plan rate from June 1 through September 30, 2013.

For Customer's convenience, you have the option to have SMUD automatically raise your thermostat temperature by 2, 3, or 4 degrees during Conservation Days.

If "Yes", choose 2, 3 or 4 degrees below (If "No", please leave blank):

❑ **YES, I will allow SMUD to automatically raise my thermostat temperature up 2, 3, or 4 degrees during Conservation Days.**
This option will automatically increase the temperature set point by 2, 3, or 4 degrees from 3 p.m. to 6 p.m. during Conservation Days. Customer is allowed to override the increased temperature setpoint during any of these 12 days during the 2013 summer period.
Choose 2, 3 or 4 degrees below:

❑ 2 Degree Automatic Temperature Control
OR
❑ 3 Degree Automatic Temperature Control
OR
❑ 4 Degree Automatic Temperature Control

— OR —

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B. ❑ 2, 3, 4 Plan + Energate Thermostat

YES, I want to try the new technologies, and I will allow SMUD to automatically raise my thermostat temperature 2, 3, or 4 degrees during Conservation Days. I'd like to keep my current rate:

SMUD agrees to pay Customers $2, 3, or 4 for each of the 12 Conservation Days between June and September 2013, and not overridden by Customer.

Off-Peak	$0.1050 /kWh
On-Peak	$0.2837 /kWh

Choose 2, 3 or 4 degrees below:

Please initial and check your preferred option.

❑ 2 Degree Automatic Temperature Control	$2.00/event	12 event days, June-September 2013
OR		
❑ 3 Degree Automatic Temperature Control	$3.00/event	12 event days, June-September 2013
OR		
❑ 4 Degree Automatic Temperature Control	$4.00/event	12 event days, June-September 2013

4. **Surveys.** Customer agrees to participate in up to ten (10) online, telephone, or mail surveys throughout the Pilot to provide feedback on Customer's experience.

5. **Ownership of Thermostat.** Ownership of the Energate Thermostat(s) will default to Customer at the time of installation. If the Property Owner chooses to transfer ownership to the Customer, when applicable, that arrangement will be made between the Property Owner and the Customer, and will not involve SMUD.

6. **Installation.** The Energate Thermostat(s) shall be installed at the Premises by SMUD or its contractor(s), who shall perform the work as soon as reasonably practical after execution of this Agreement. SMUD will provide Customer advance notice of installation date. All costs related to installation will be at the sole expense of SMUD. SMUD or its contractor(s) will uninstall the old thermostat(s) and install the Energate Thermostat(s) in the same visit. Customer shall maintain possession of the uninstalled old thermostat(s), unless it contains mercury, until the Pilot ends. SMUD or its contractor(s) will dispose of mercury thermostat in a safe manner.

7. **Maintenance.** SMUD shall have the exclusive right to maintain the Energate Thermostat(s) and perform services during Pilot, except for services already covered by Energate's warranty. All non-warranty costs associated with maintenance will be at the sole expense of SMUD. Under no circumstances shall Customer and/or Property Owner perform maintenance or other services, or remove the Energate Thermostat(s) during the Pilot. If Customer and/or Property Owner uninstalls the Energate Thermostat(s) or performs maintenance or other services on the Energate Thermostat(s) during or after the Pilot period for any reason, neither SMUD nor Energate will be responsible for reinstalling or fixing the Energate thermostat(s) or reinstalling the old thermostat(s). After the Pilot end date of December 31, 2013, Customer and/or Property Owner will be solely responsible to maintain and service the Energate Thermostat(s).

8. **Access to Premises.** Customer and/or Property Owner grants SMUD and/or its contractor(s) the right to enter the Customer's Premises to install and maintain the Energate Thermostat(s) during the Pilot.

9. **Cost.** There is no cost to Customer for the Energate Thermostat(s), initial installation, un-installation of the old thermostat(s), maintenance, and the standard Energate warranty services.

10. **Data and Confidentiality.** SMUD and Energate will keep all customer personal information and data confidential. Data to be collected and analyzed includes hourly electricity use data, interaction data with My Account, and thermostat data.

11. **Rules and Regulations.** This agreement is subject to SMUD's Rules and Regulations, as amended from time to time.

12. **Warranty.** SMUD makes no warranties, implied or expressed, written or oral, with respect to the goods and services provided under this Agreement including, but not limited to, the warranties of merchantability and fitness for a particular purpose. Energate's limited product warranty is applicable to the Energate Thermostat. During the Pilot, SMUD will assist Customer to determine applicable Energate warranty coverage. However, after the end of the Pilot on December 31, 2013, the Customer will be solely responsible for contacting Energate for any warranty or support issues. The Customer will be solely responsible to maintain and work with Energate directly for ongoing support and maintenance after the Pilot ends.

SMUD

13. **Liability.** SMUD will not be liable, and Customer and/or Property Owner waive(s) any and all claims, for any damage, loss, expense, injury or death that result from Customer and/or Property Owner ownership and use of the Energate Thermostat(s).

14. **Notices.** All communications or notices under this Agreement shall be directed as follows:

District: Sacramento Municipal Utility District
Attn: Customer Solutions or 2013PowerStat@smud.org or 855-253-1824
P.O. Box 15830, Mail Stop A203
Sacramento, CA 95852-0830

Customer: As provided in Customer's Application.

15. **Amendments.** SMUD reserves the right, at its sole discretion, to amend the terms of this Agreement. SMUD will notify Customer in writing of the amendment at least thirty (30) days in advance of the effective date of the amendment. The amendment will become effective as of the amendment effective date stated in the notice.

16. **Termination.** Each Party may terminate this Agreement with thirty (30) day advance written notice. If Customer terminates this Agreement before December 31, 2013, Customer keeps the Energate Thermostat(s) and Customer shall reimburse SMUD for the cost of the Energate Thermostat(s). If SMUD terminates this Agreement, Customer keeps the Energate Thermostat(s) and does not need to reimburse SMUD for the cost of the Energate Thermostat(s). Upon termination, Customer reverts back to his/her original rate in effect prior to participating in this Pilot.

17. **Applicable Law.** This Agreement shall be interpreted, governed by, and construed under the laws of the State of California, as executed and to be performed wholly within the State of California.

18. **Property Owner Waiver.** Property Owner, if different than the Customer, grants permission to have the Energate thermostat(s) installed at the Property at no charge to the Customer or the Property Owner. Property Owner authorizes SMUD or its contractor access to the Property as necessary to install and/or service the Energate thermostat(s). SMUD will not be party to any disputes between the Customer and the Property Owner regarding ownership and control of the Energate thermostat(s).

19. **Entire Agreement.** This Agreement and Customer's Application constitute the entire understanding between the Parties as to the subject matter hereof.

Please sign here

Customer _____ (Signature) SMUD _____ (Signature)

Customer _____ (Print Name) _____ (Date) SMUD _____ (Print Name) _____ (Date)

Property Owner (if different than Customer) _____ (Signature)

_____ (Print Name) _____ (Date)

FIGURE 57. INSTALLER CHECKLIST

Pre-Installation

- Confirm customer of record is home prior to entering
- Hand customer their Welcome Kit
- Pre-Test HVAC System operability and compatibility
    - If declined, thoroughly document reason

Data Collection

- Air Conditioner Make/Model #
- R-value (estimate, if needed)

Provisioning of Device

- DRI Tool
- Send **SECURE** Email to 2013powerstat@smud.org
    - Copy and paste in body: MAC ADDRESS and ACCOUNT #
    - Subject Line = "**[Secure]** Device Information for Successful Install"

Educating the Customer

- Explain basic functionality of thermostat
- Contact Information
    - Technical (GoodCents Toll Free **1-866-380-6052**)
    - Program (SMUD Toll Free **1-855-253-1824**)
- Magnet
- Setting Schedules
- "Leave" Setting (80 degrees) by default
- Opt-Outs
    - Device
        - Temporary Hold
        - Permanent Hold
    - By Phone
- For A/C Automation Option Participants
    - Conservation Screen
    - Price Display
        - Calibration Price = $.0001
        - Conservation Day CPP Price = $.75 (12 during summer)

For Technicians: Issues/Escalations

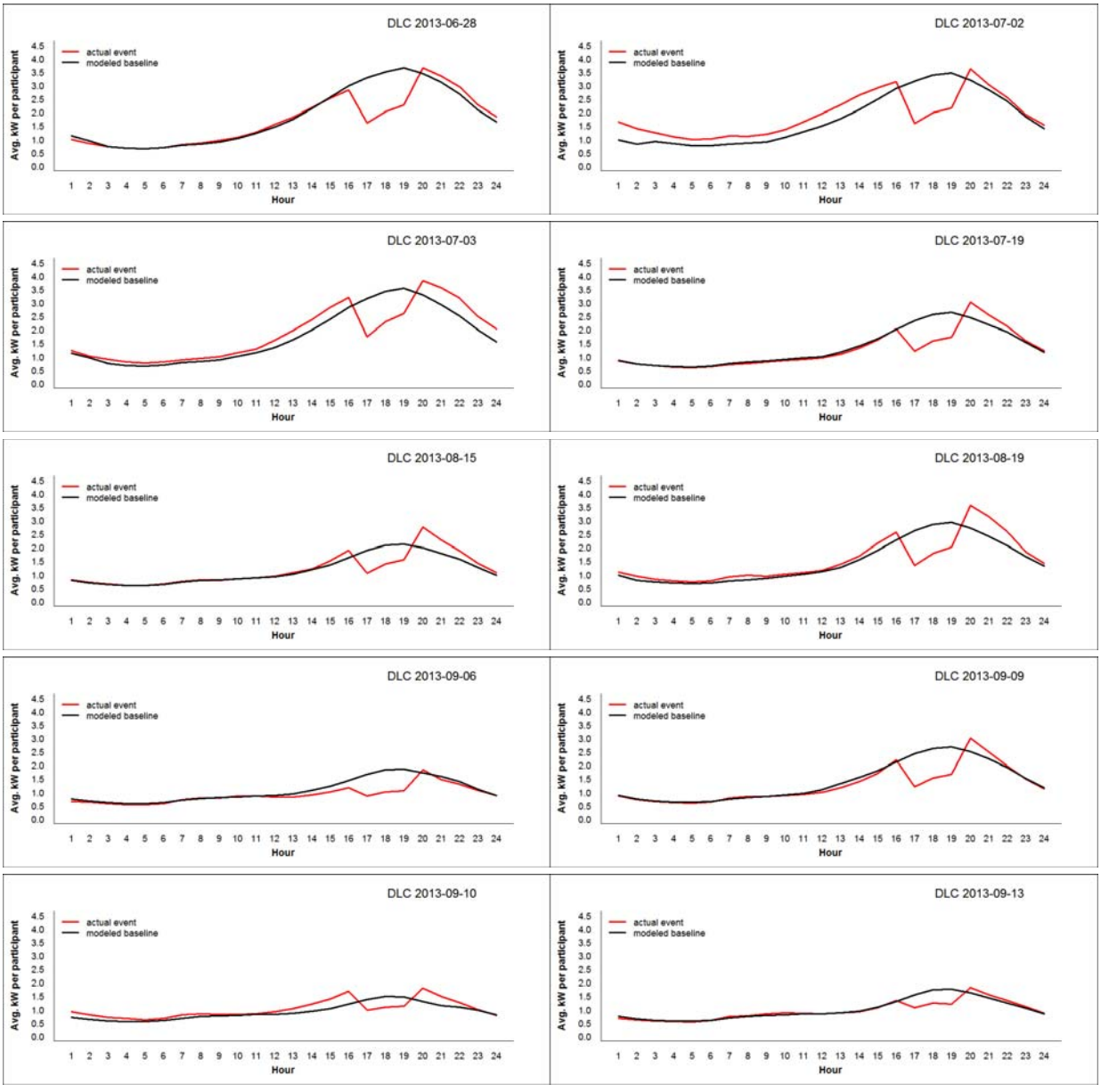
- ***Connectivity (HCM):***
    - Customer Solutions: (916) 732-7000
- ***Urgent Customer Issues:***
    - 1st Call: Gene Pinasco: (916) 732-6720 (Business Days)

2nd Call: Michael Daniels: (408) 464-6232 (all other hours)

Appendix B. Observed residential loads on event days

The following figures plot the observed hourly load values for each of the twelve event days called in 2013. Each plot also includes a modeled baseline, adjusted for the temperature profile of that particular day.

FIGURE 58. OBSERVED HOURLY LOADS ON EVENT DAYS, RESIDENTIAL DLC



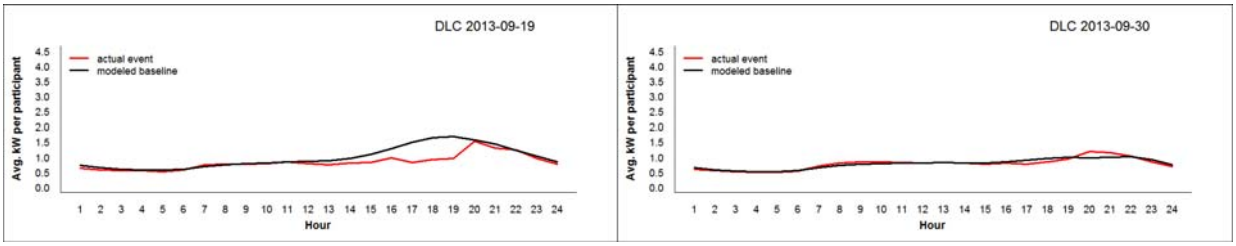
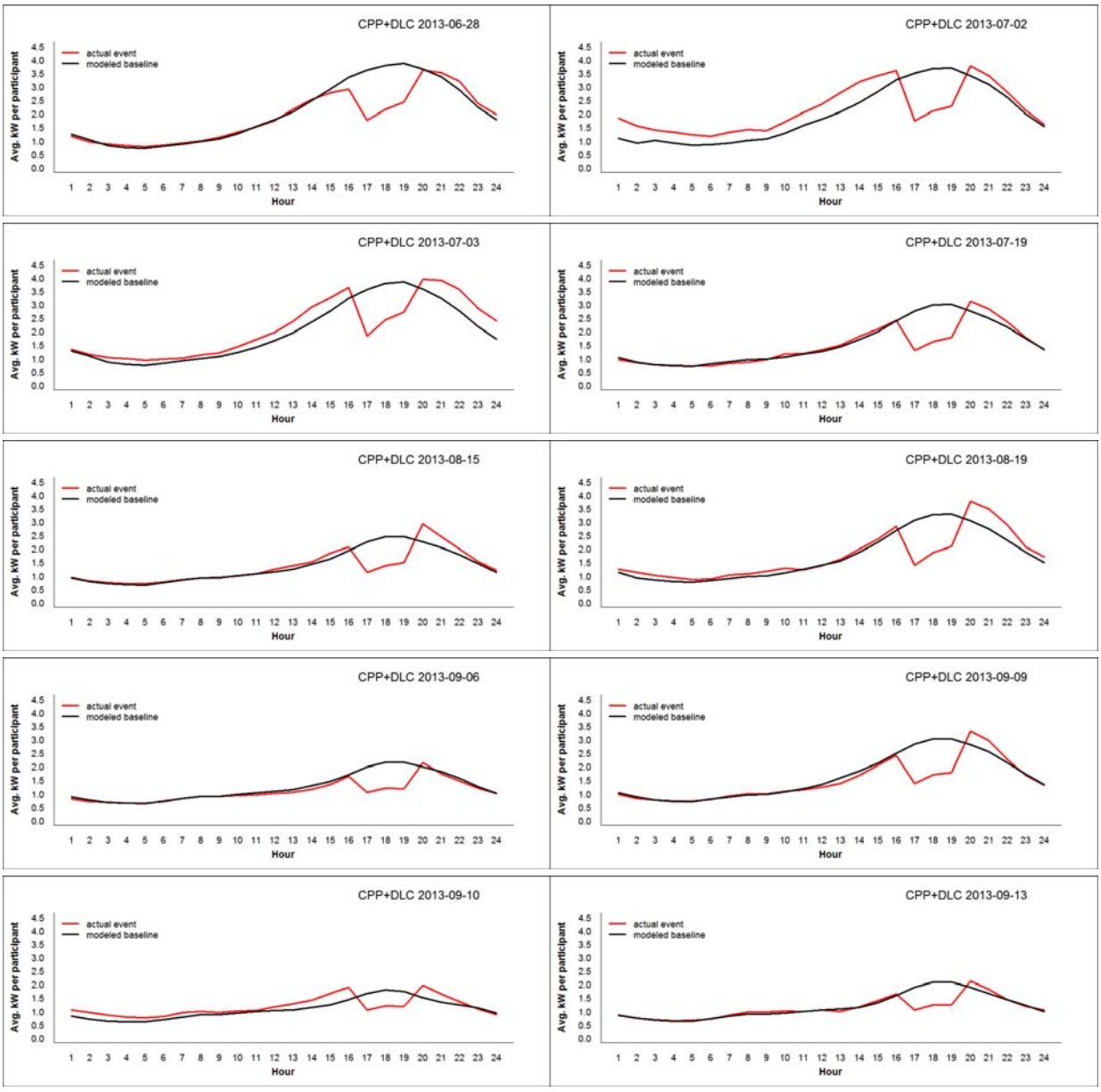


FIGURE 59. OBSERVED HOURLY LOADS ON EVENT DAYS, RESIDENTIAL CPP+DLC



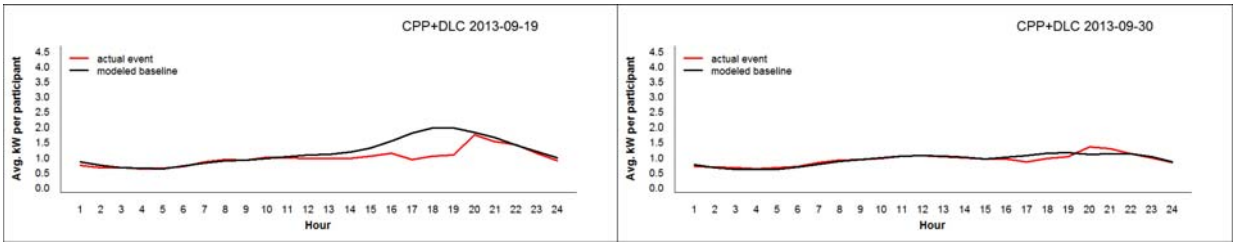
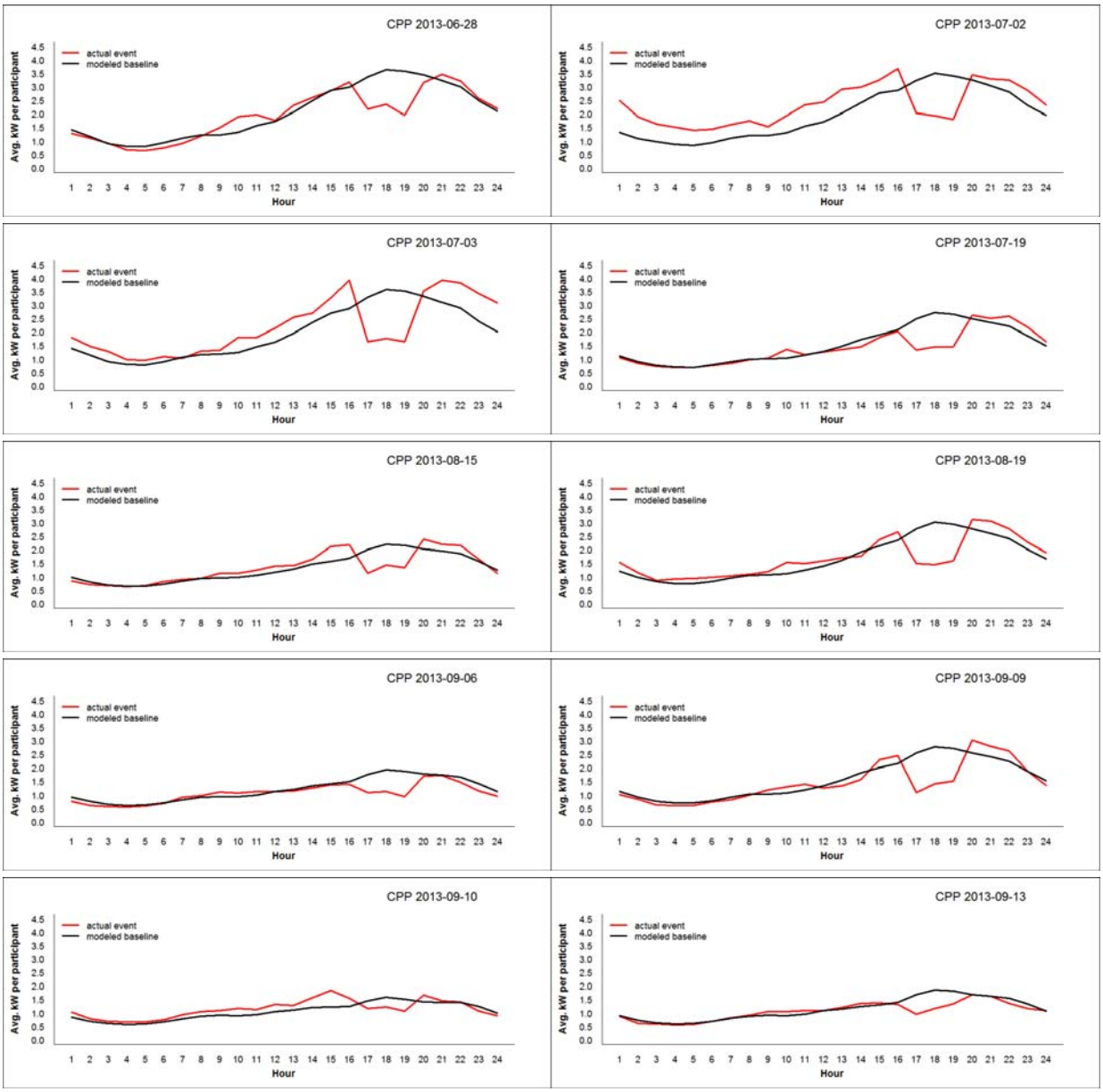
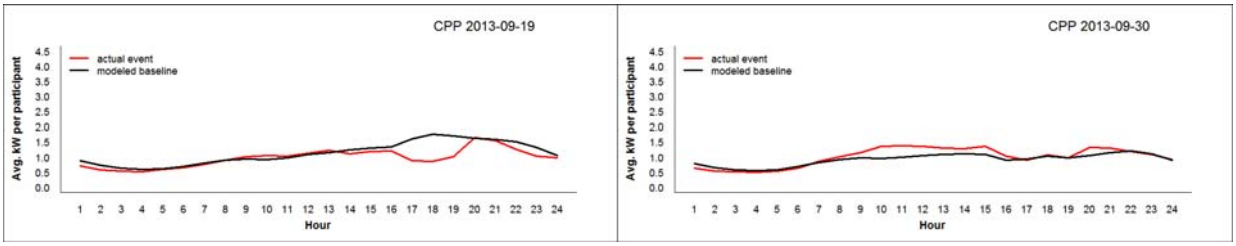


FIGURE 60. OBSERVED HOURLY LOADS ON EVENT DAYS, RESIDENTIAL CPP





Appendix C. Load Models

This section lists each of the equations used to calculate the results provided in this report. For all models, the following definitions apply.

kw_{ijk}: kilowatt load for customer i on day j at hour k
$hour_{ijk}$: categorical variables (1-24) indicating the hour of the day, where hour 1 spans the period from midnight to 1:00 a.m. and hour 24 spans the period from 11:00 p.m. to midnight
CDH_{ijk}: cooling degree hour on day j at hour k
$MaxTemp_{ij}$: maximum temperature on day j
CDD_{ij}: cooling degree day calculated as sum of 24 CDH values on day j
$DayType$: categorical variables indicating day type (event, nonevent, pretreatment weekday)
$Treat\_Event$: categorical variables for treatment and event
$Treat\_Year$: categorical variables for treatment and year
$Month$: categorical variable indicating month
$Year$: categorical variables indicating year (2012, 2013)
r_i: random effects for customer $\sim N(0, \varphi_1)$
r_{ij}: random effects for day $\sim N(0, \varphi_2)$
ε_{ijk}: error terms $\sim N(0, \delta^2 I)$

Hourly Weekday Loads

All days except weekends and holidays are in the model.

$$kw_{ijk} = \beta_{(hour)ijk} hour_{ijk} + \beta_{(CDH)ijk} CDH_{ijk} + \beta_{(MaxTemp)ij} MaxTemp_{ij} + \beta_{(CDD)ij} CDD_{ij} + \beta_{(hour*CDD^2)ijk} hour_{ijk} * CDD^2 + \beta_{(hour*MaxTemp^2*DayType)ijk} hour_{ijk} * MaxTemp^2 * DayType + r_i + r_{ij} + \varepsilon_{ijk}$$

3-hour Impact Comparisons

All days except weekends and holidays are in the model.

$$kw_{ijk} = \beta_{(hour)ijk} hour_{ijk} + \beta_{(CDH)ijk} CDH_{ijk} + \beta_{(MaxTemp)ij} MaxTemp_{ij} + \beta_{(CDD)ij} CDD_{ij} + \beta_{(hour*CDD^2)ijk} hour_{ijk} * CDD^2 + \beta_{(hour*MaxTemp^2*Treat\_Event)ijk} hour_{ijk} * MaxTemp^2 * Treat\_Event + r_i + r_{ij} + \varepsilon_{ijk}$$

Overall Energy Impacts

All days including weekends and holidays are in the model

$$kw_{ijk} = \beta_{(hour)ijk}hour_{ijk} + \beta_{(CDH)ijk}CDH_{ijk} + \beta_{(MaxTemp)ij}MaxTemp_{ij} + \beta_{(hour*Treat\_Year)ijk}hour_{ijk} * Treat\_Year + r_i + r_{ij} + \varepsilon_{ijk}$$

TOU-CPP Rate Bill Impacts

All days in 2013 are included in the model

$$kw_{jk} = \beta_{(hour)jk}hour_{jk} + \beta_{(CDH)jk}CDH_{jk} + \beta_{(Month)jk}Month + \beta_{(MaxTemp)jk}MaxTemp_{jk} + \beta_{(hour*year)jk}hour_{jk} * DayType + \varepsilon_{jk}$$

Standard Rate Bill Impacts

All days in 2012 and 2013 are included in the model

$$kw_{jk} = \beta_{(hour)jk}hour_{jk} + \beta_{(CDH)jk}CDH_{jk} + \beta_{(Month)jk}Month + \beta_{(MaxTemp)jk}MaxTemp_{jk} + \beta_{(hour*year)jk}hour_{jk} * Year + \varepsilon_{jk}$$

Appendix D. Average Event Impacts

Figure 61 illustrates the modeled baselines and average Conservation Day loads for the three main program groups in the residential PowerStat study. Figure 62 shows the same results represented as impacts, where the modeled baseline loads are subtracted from 2013 weekday loads. Error bars represent 95% confidence intervals for the impacts.

FIGURE 61. HOURLY EVENT DAY LOADS, BY TREATMENT GROUP

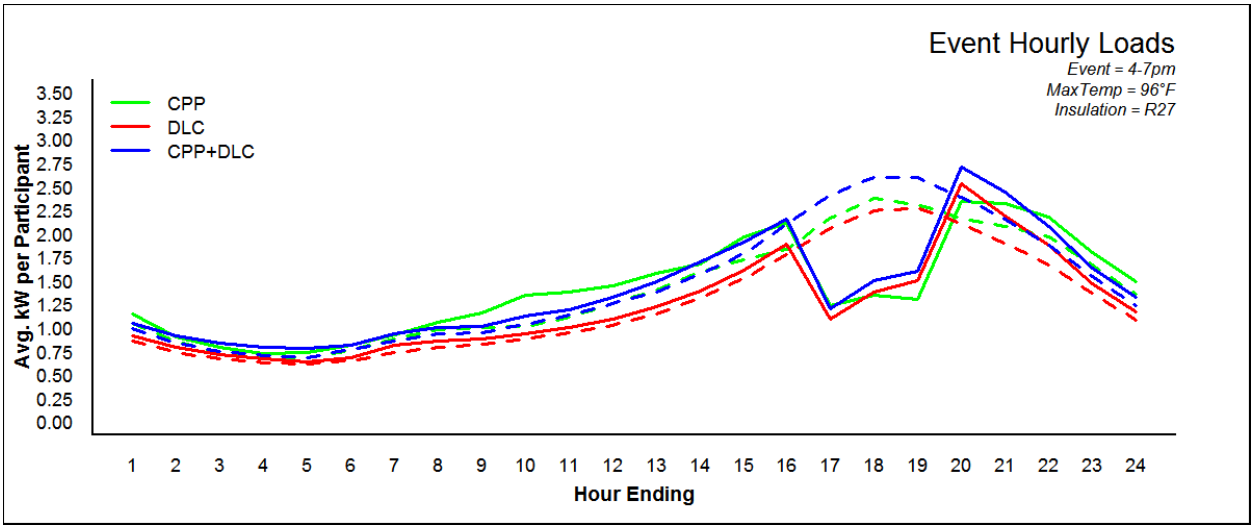


FIGURE 62. HOURLY EVENT DAY IMPACTS, BY TREATMENT GROUP

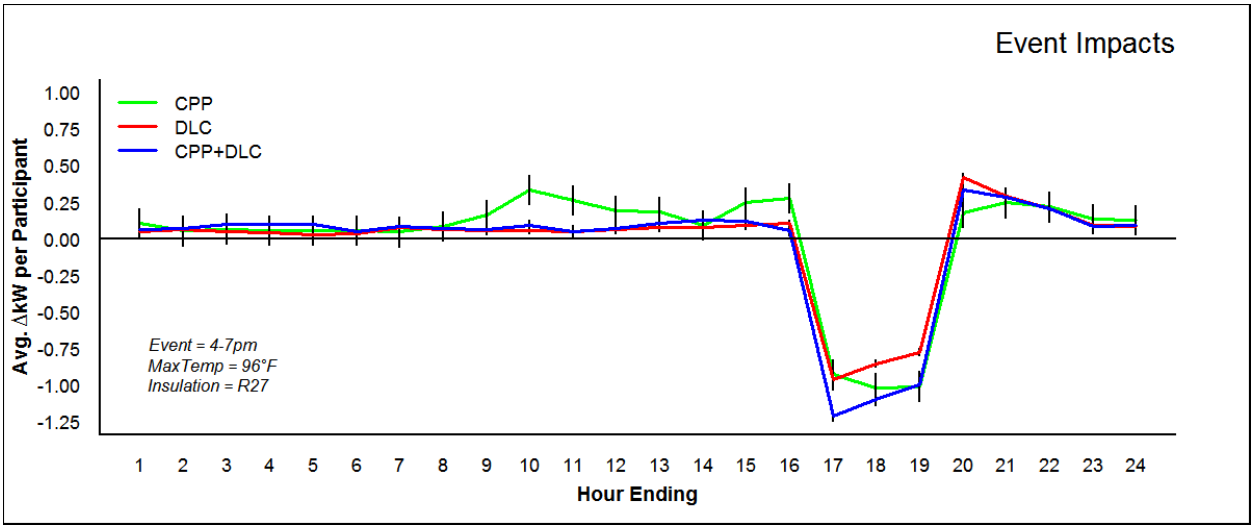


Table 29. Average Event Day Load Impacts (kW) by Program lists the average load impacts for each of the three treatments on 2013 Conservation Days. Negative kW

values indicate the average hourly savings relative to the baseline. In all 3-hour periods, the program options had significant effects, showing energy reductions ranging from 37% to 43% in the peak periods, and energy increases ranging from 5.5% to 15% in the pre-peak and post-peak periods.

TABLE 29. AVERAGE EVENT DAY LOAD IMPACTS (KW) BY PROGRAM

Group	N	Event Pre-peak (hours 14-16)	Event Peak (hours 17-19)	Event Post-peak (hours 20-22)
DLC	509	+0.09* (+5.8%)	-0.83* (-37%)	+0.29* (+15%)
CPP+DLC	291	+0.10* (+5.5%)	-1.1* (-43%)	+0.25* (+11%)
CPP	37	+0.21* (+12%)	-0.96* (-42%)	+0.21* (+10%)

* Statistically significant (α = 0.05)

Contrast analysis was used to compare the effects of the programs on loads during the three daily periods described above. Results indicate the following statistically significant results (Table 30):

- In the Pre-peak hours, CPP loads increased more than did DLC loads.
- In the Peak hours, CPP+DLC load reductions were greatest, followed by CPP, and then DLC.
- There were no significant differences in the Post-peak load impacts.

TABLE 30. COMPARISON OF EVENT DAY LOAD IMPACTS BY TREATMENT

Contrast	Event Pre-peak (hours 14-16)	Event Peak (hours 17-19)	Event Post-peak (hours 20-22)
DLC v. CPP	-0.12*	+0.13*	+0.079
'CPP+DLC' v. CPP	-0.10	-0.13*	+0.038
'CPP+DLC' v. DLC	+0.014	-0.26*	-0.041

* Statistically significant (α = 0.05)

Of the three program groups, the customers on the TOU-CPP rate with utility-managed loads (CPP+DLC) provided the greatest absolute load drop on 2013 event days. On a percentage basis, however, those on the TOU-CPP rate who managed their own thermostats (CPP) provided a 42% load shed—nearly identical to the 43% load shed of

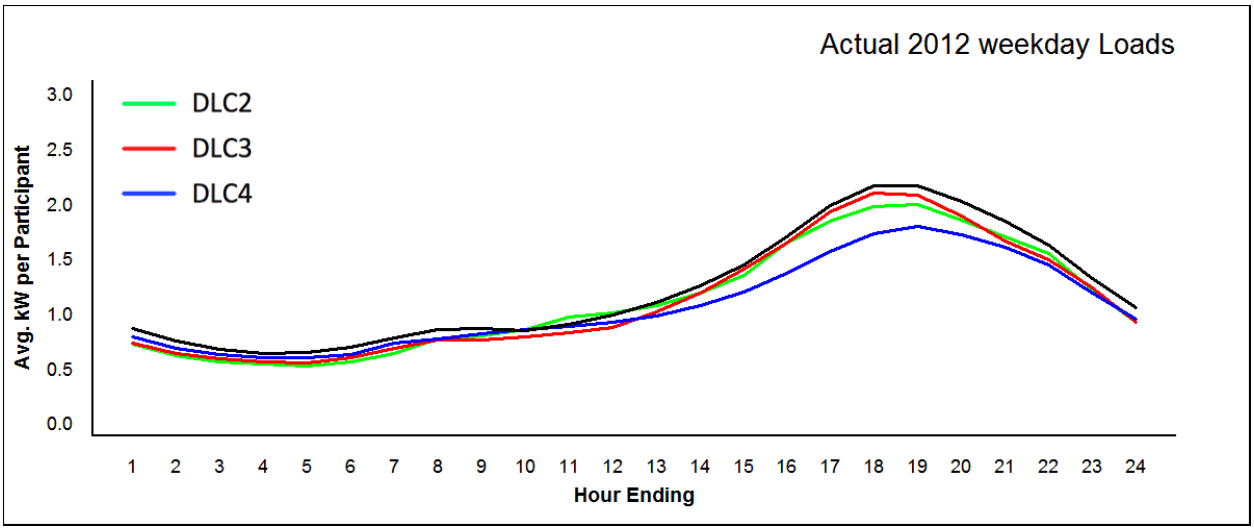
the CPP+DLC group. Participants who stayed on the standard tiered rate and were paid for event response (DLC) showed the smallest load shed during events at 37%.

Appendix E. Impacts for residential 2-3-4 subgroups

This section presents the loads and impacts for the DLC and CPP+DLC program groups, with comparisons between the impacts for the three Conservation Day peak offsets of 2, 3 or 4 degrees.

DLC Program

FIGURE 63. AVERAGE PRETREATMENT LOADS, DLC



CONSERVATION DAY EVENTS, DLC

FIGURE 64. AVERAGE EVENT LOAD IMPACTS, DLC

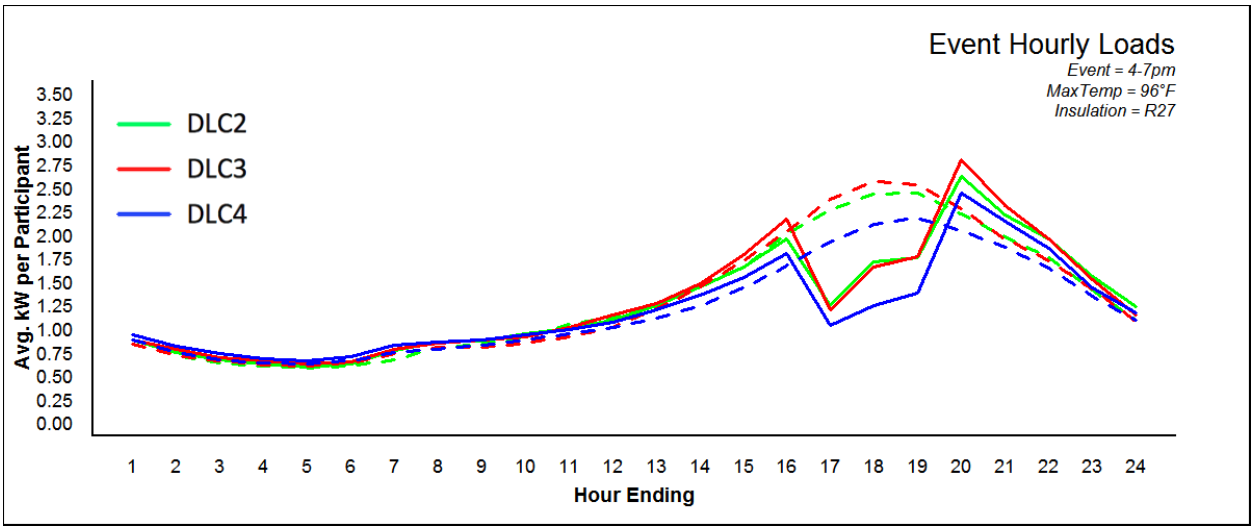


FIGURE 65. AVERAGE EVENT LOAD IMPACTS

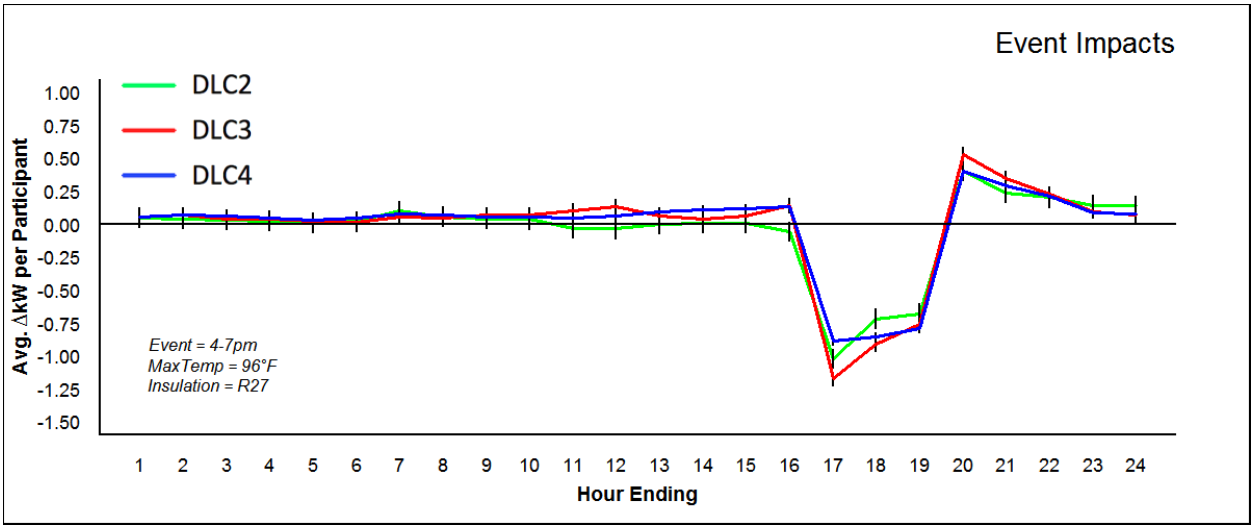


TABLE 31. AVERAGE EVENT LOAD IMPACTS

	N	Event Pre-peak (hours 14-16)	Event Peak (hours 17-19)	Event Post-peak (hours 20-22)
DLC2	57	-0.04 (-2.5%)	-0.82* (-34%)	+0.21* (+10%)
DLC3	99	+0.07* (+4.0%)	-0.96* (-38%)	+0.33* (+16%)
DLC4	353	+0.13* (+9.0%)	-0.80* (-38%)	+0.29* (+15%)

* Statistically significant (α = 0.05)

TABLE 32. COMPARISON OF EVENT LOAD IMPACTS BY TREATMENT

	Event Pre-peak (hours 14-16)	Event Peak (hours 17-19)	Event Post-peak (hours 20-22)
DLC3-DLC2	+0.11*	-0.14*	+0.12*
DLC4-DLC2	+0.17*	+0.02	+0.09*
DLC4-DLC3	+0.06	+0.16*	-0.04

* Statistically significant (α = 0.05)

NONEVENT SUMMER WEEKDAYS, DLC

TABLE 33. AVERAGE NONEVENT LOAD IMPACTS

	N	Pre-peak (hours 14-16)	Peak (hours 17-19)	Post-peak (hours 20-22)
DLC2	57	-0.03 (-2.5%)	-0.01 (-0.4%)	+0.004 (+0.3%)
DLC3	99	-0.05* (-3.9%)	-0.02 (-1.3%)	+0.013 (+0.9%)
DLC4	353	-0.01 (-0.7%)	+0.01 (+0.6%)	+0.011 (+0.8%)

* Statistically significant (α = 0.05)

TABLE 34. COMPARISON OF NONEVENT LOAD IMPACTS BY TREATMENT

	Nonevent Pre-peak (hours 14-16)	Nonevent Peak (hours 17-19)	Nonevent Post-peak (hours 20-22)
DLC3-DLC2	-0.019	-0.017	+0.010
DLC4-DLC2	+0.021	+0.014	+0.008
DLC4-DLC3	+0.040*	+0.031	-0.002

* Statistically significant (α = 0.05)

Overall summer energy impacts, DLC

Table 35. Average Load Impacts (Modeled)

	N	Total (hours 1-24)
DLC2	57	-0.0053 (-0.5%)
DLC3	99	-0.0045 (-0.4%)
DLC4	353	+0.018* (+1.7%)

* Statistically significant (α = 0.05)

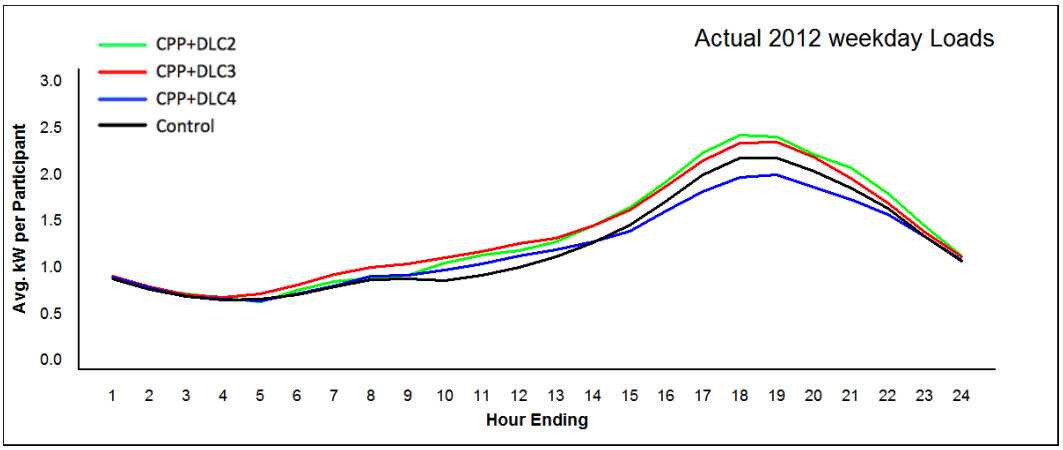
Table 36. Comparison of Load Impacts by Treatment

	Total (hours 1-24)
DLC3-DLC2	+0.001
DLC4-DLC2	+0.023*
DLC4-DLC3	+0.022*

* Statistically significant (α = 0.05)

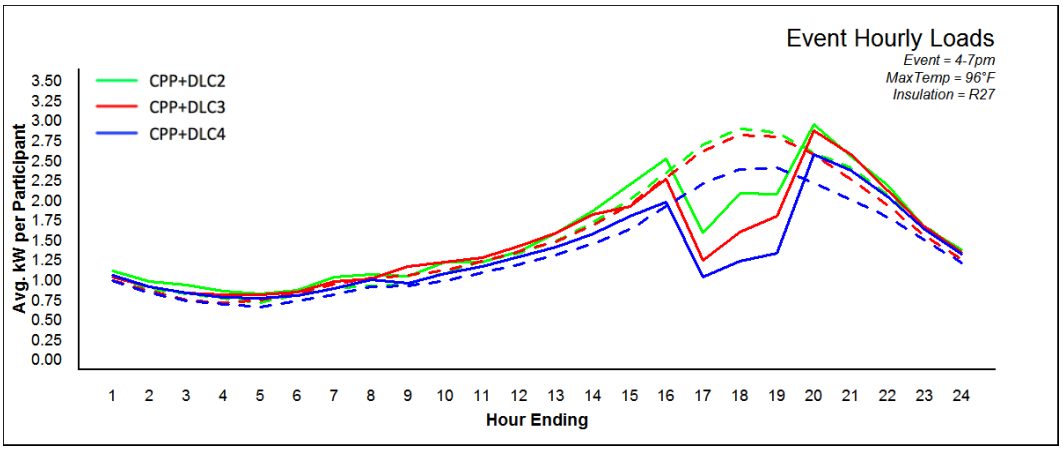
CPP+DLC Program

FIGURE 66. ACTUAL 2012 WEEKDAY LOADS



CONSERVATION DAY EVENTS, CPP+DLC

FIGURE 67. EVENT HOURLY LOADS



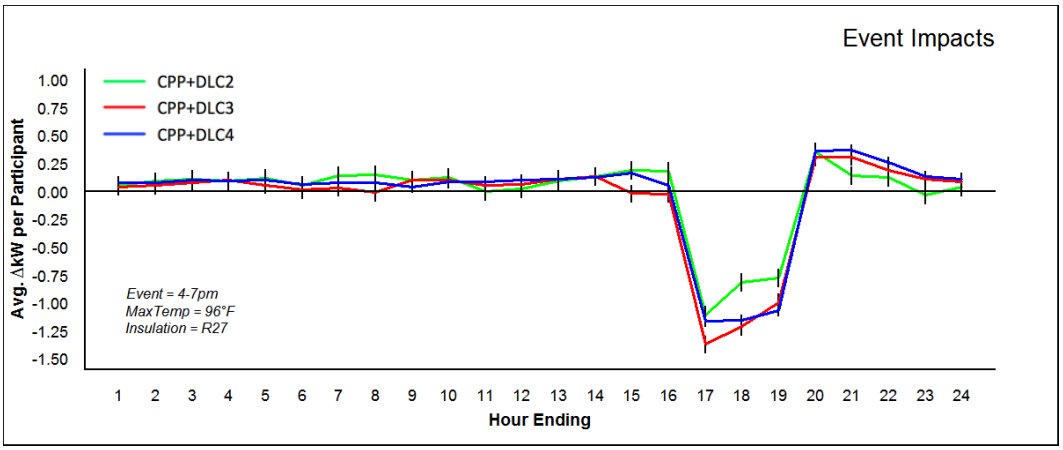


TABLE 37. AVERAGE LOAD IMPACTS (EVENT)

	N	Pre-peak (hours 14-16)	Peak (hours 17-19)	Post-peak (hours 20-22)
CPP+DLC2	65	0.15* (7.6%)	-0.90* (-32%)	0.16* (6.7%)
CPP+DLC3	70	0.06 (2.9%)	-1.2* (-43%)	0.23* (10%)
CPP+DLC4	156	0.11* (6.6%)	-1.1* (-46%)	0.33* (16%)

* Statistically significant (α = 0.05)

TABLE 38. COMPARISON OF LOAD IMPACT BY TREATMENT (EVENT)

	Pre-peak (hours 14-16)	Peak (hours 17-19)	Post-peak (hours 20-22)
CPP+DLC3–CPP+DLC2	-0.090	-0.28*	0.075
CPP+DLC4–CPP+DLC2	-0.035	-0.18*	0.18*
CPP+DLC4–CPP+DLC3	0.055	0.10	0.10

* Statistically significant (α = 0.05)

NONEVENT SUMMER WEEKDAYS, CPP+DLC

TABLE 39. AVERGE LOAD IMPACTS (NON-EVENT)

	N	Nonevent Pre-peak (hours 14-16)	Nonevent Peak (hours 17-19)	Nonevent Post-peak (hours 20-22)
CPP+DLC2	65	-0.016 (-1.2%)	-0.13* (-6.5%)	-0.021 (-1.2%)
CPP+DLC3	70	0.019 (1.4%)	-0.11* (-5.7%)	0.002 (0.1%)
CPP+DLC4	156	-0.009 (-0.7%)	-0.14* (-8.6%)	0.025 (1.7%)

* Statistically significant (α = 0.05)

TABLE 40. COMPARISON OF LOAD IMPACTS BY TREATMENT (NON-EVENT)

	Nonevent Pre-peak (hours 14-16)	Nonevent Peak (hours 17-19)	Nonevent Post-peak (hours 20-22)
CPP+DLC3–CPP+DLC2	0.035	0.011	0.023
CPP+DLC4–CPP+DLC2	0.007	-0.016	0.046
CPP+DLC4–CPP+DLC3	-0.028	-0.027	0.023

* Statistically significant (α = 0.05)

OVERALL SUMMER ENERGY IMPACTS, CPP+DLC

TABLE 41. AVERAGE LOAD IMPACTS (OVERALL)

	N	Total (hours 1-24)
CPP+DLC2	65	-0.011 (-0.83%)
CPP+DLC3	70	-0.002 (-0.18%)
CPP+DLC4	156	0.005 (0.39%)

* Statistically significant (α = 0.05)

TABLE 42. COMPARISON OF LOAD IMPACTS BY TREATMENT

	Total (hours 1-24)
CPP+DLC3–CPP+DLC2	0.009
CPP+DLC4–CPP+DLC2	0.016
CPP+DLC4–CPP+DLC3	0.007

* Statistically significant (α = 0.05)

Bill Impacts by Subgroup

Also listed are the *perceived* bill impacts collected by the post-summer survey and analyzed by True North Research (2013).

TABLE 43. AVERAGE ACTUAL AND PERCEIVED MONTHLY BILL IMPACTS, BY SUBGROUP

Subgroup	N	Electricity Cost Impact	Avg. DLC payment	Actual Monthly Bill Impact	Perceived Monthly Bill Impact*	Perceived Savings Inflation
DLC2°	57	-$0.72	-$5.56	-$6.28	-$11.61	38%
DLC3°	99	-$0.69	-$8.64	-$9.33	-$16.16	42%
DLC4°	353	$1.50	-$11.44	-$9.94	-$20.09	268%
CPP+DLC2°	65	-$14.99	--	-$14.99	-$33.44	123%
CPP+DLC3°	70	-$16.53	--	-$16.53	-$33.00	100%
CPP+DLC4°	156	-$15.14	--	-$15.14	-$35.24	133%
CPP	37	-$13.47	--	-$13.47	-$47.64	254%

* Perceived monthly bill impacts from survey analysis by True North Research, 2013.

Appendix F. 1-in-2, 1-in-5, and 1-in-10 Event days

This section present the loads and load impacts for each program group on different temperature days defined by SMUD as follows:

1-in-2. The hottest day in a typical summer: maximum 106°F, minimum 67°F.

1-in-5. The hottest day in 5 years: maximum 108°F, minimum 69°F.

1-in-10. The hottest day in 10 years. maximum 110°F, minimum 71°F.

A seen previously, loads and impact are both larger on hotter days across all program groups.

FIGURE 68. 1-IN-2, 1-IN-5, AND 1-IN-10 HOURLY LOADS FOR DLC EVENTS

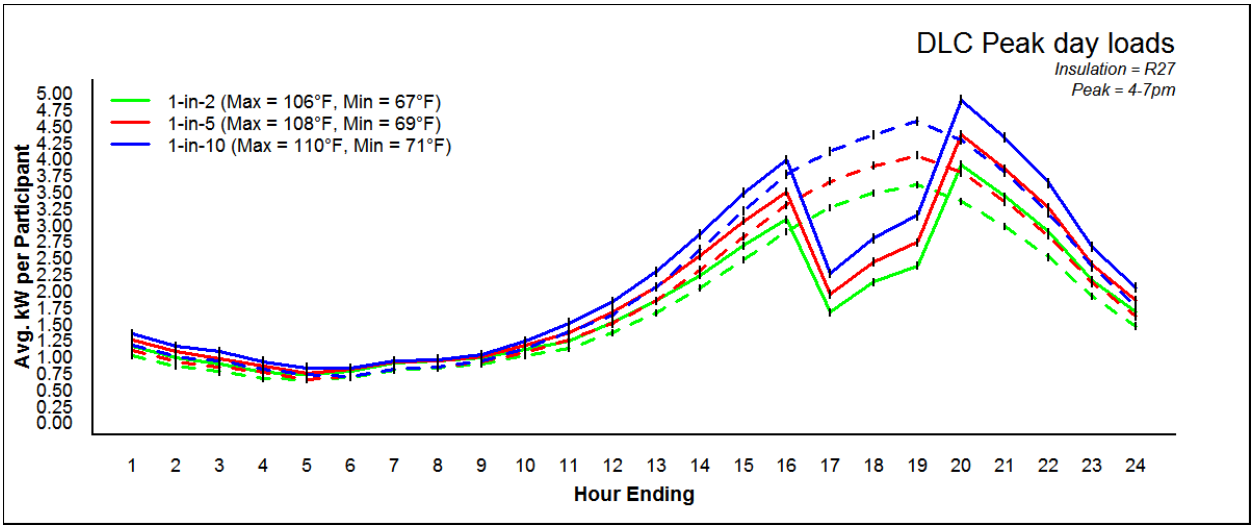


TABLE 44. 1-IN-2, 1-IN-5, AND 1-IN-10 PEAK IMPACTS FOR DLC EVENTS

Group	Peak Day Type	MaxTemp	Pre-peak (hours 14-16)	Peak (hours 17-19)	Post-peak (hours 20-22)
DLC	1-in-2	106	0.18	-1.3	0.47
DLC	1-in-5	108	0.20	-1.4	0.50
DLC	1-in-10	110	0.22	-1.5	0.54

TABLE 45. 1-IN-2, 1-IN-5, AND 1-IN-10 HOURLY IMPACTS FOR DLC EVENTS

Hour	1-in-2	1-in-5	1-in-10
hour1	0.14	0.16	0.18
hour2	0.13	0.14	0.16
hour3	0.12	0.13	0.15
hour4	0.09	0.10	0.11
hour5	0.07	0.09	0.10
hour6	0.09	0.10	0.12
hour7	0.11	0.12	0.12
hour8	0.10	0.11	0.11
hour9	0.08	0.09	0.09
hour10	0.10	0.10	0.11
hour11	0.11	0.12	0.13
hour12	0.16	0.18	0.20
hour13	0.18	0.21	0.23
hour14	0.19	0.21	0.24
hour15	0.22	0.24	0.27
hour16	0.18	0.20	0.22
hour17	-1.58	-1.71	-1.85
hour18	-1.35	-1.46	-1.57
hour19	-1.23	-1.32	-1.42
hour20	0.55	0.57	0.60

Hour	1-in-2	1-in-5	1-in-10
hour21	0.46	0.50	0.54
hour22	0.38	0.42	0.46
hour23	0.24	0.27	0.30
hour24	0.22	0.25	0.28

FIGURE 69. 1-IN-2, 1-IN-5, AND 1-IN-10 HOURLY LOADS FOR CPP+DLC EVENTS

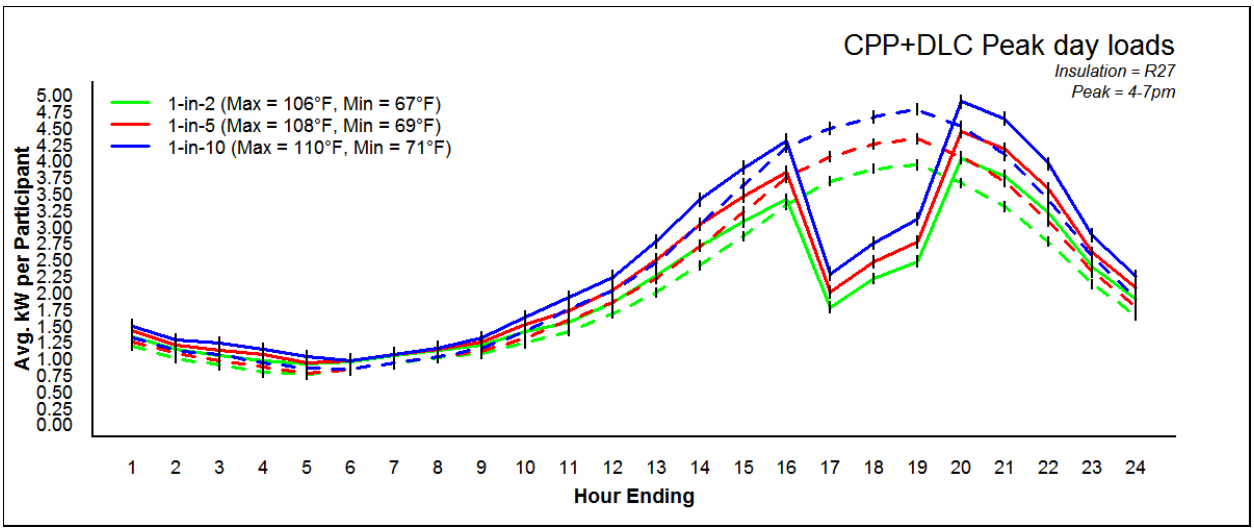


TABLE 46. 1-IN-2, 1-IN-5, AND 1-IN-10 PEAK IMPACTS FOR CPP+DLC EVENTS

Treatment	Peak Day Type	MaxTemp	N	Pre-peak (hours 14-16)	Peak (hours 17-19)	Post-peak (hours 20-22)
CPP+DLC	1-in-2	106	291	0.20	-1.7	0.40
CPP+DLC	1-in-5	108	291	0.22	-1.8	0.43
CPP+DLC	1-in-10	110	291	0.24	-1.9	0.47

TABLE 47. 1-IN-2, 1-IN-5, AND 1-IN-10 HOURLY IMPACTS FOR CPP+DLC EVENTS

Hour	1-in-2	1-in-5	1-in-10
hour1	0.14	0.16	0.18
hour2	0.13	0.14	0.15
hour3	0.14	0.15	0.16
hour4	0.17	0.19	0.21
hour5	0.15	0.16	0.17
hour6	0.11	0.12	0.13
hour7	0.12	0.13	0.13
hour8	0.11	0.12	0.13
hour9	0.13	0.14	0.16
hour10	0.18	0.20	0.22
hour11	0.13	0.15	0.17
hour12	0.17	0.19	0.21
hour13	0.26	0.29	0.32
hour14	0.30	0.33	0.37
hour15	0.22	0.24	0.26
hour16	0.08	0.08	0.09
hour17	-1.91	-2.06	-2.21
hour18	-1.67	-1.79	-1.91
hour19	-1.47	-1.57	-1.67
hour20	0.37	0.38	0.38

Hour	1-in-2	1-in-5	1-in-10
hour21	0.46	0.50	0.54
hour22	0.44	0.49	0.55
hour23	0.26	0.29	0.33
hour24	0.25	0.28	0.31

FIGURE 70. 1-IN-2, 1-IN-5, AND 1-IN-10 HOURLY LOADS FOR CPP EVENTS

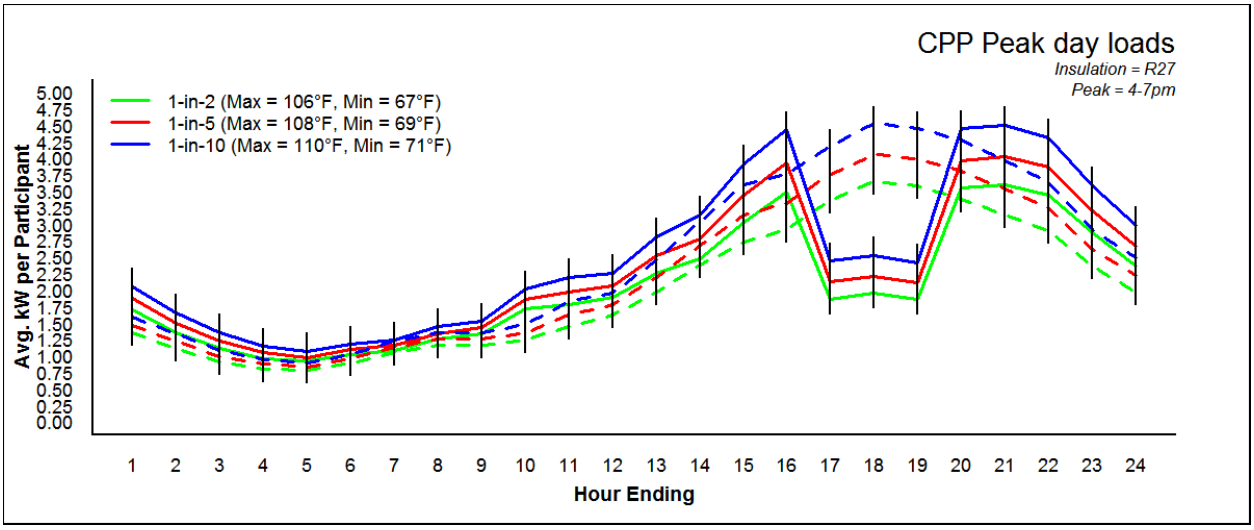


TABLE 48. 1-IN-2, 1-IN-5, AND 1-IN-10 PEAK IMPACTS FOR CPP EVENTS

Treatment	Peak Day Type	MaxTemp	N	Pre-peak (hours 14-16)	Peak (hours 17-19)	Post-peak (hours 20-22)
CPP	1-in-2	106	37	0.32	-1.6	0.40
CPP	1-in-5	108	37	0.34	-1.8	0.43
CPP	1-in-10	110	37	0.36	-1.9	0.47

TABLE 49. 1-IN-2, 1-IN-5, AND 1-IN-10 HOURLY IMPACTS FOR CPP EVENTS

Hour	1-in-2	1-in-5	1-in-10
hour1	0.36	0.41	0.46
hour2	0.24	0.28	0.32
hour3	0.21	0.24	0.27
hour4	0.15	0.18	0.20
hour5	0.14	0.15	0.17
hour6	0.12	0.13	0.15
hour7	0.02	0.02	0.01
hour8	0.08	0.08	0.09
hour9	0.17	0.17	0.17
hour10	0.47	0.50	0.53
hour11	0.34	0.35	0.37
hour12	0.27	0.29	0.30
hour13	0.30	0.32	0.34
hour14	0.10	0.10	0.10
hour15	0.30	0.31	0.32
hour16	0.56	0.62	0.68
hour17	-1.51	-1.63	-1.75
hour18	-1.70	-1.85	-2.00
hour19	-1.73	-1.88	-2.03
hour20	0.17	0.17	0.16
hour21	0.45	0.50	0.54

Hour	1-in-2	1-in-5	1-in-10
hour22	0.55	0.62	0.69
hour23	0.50	0.58	0.66
hour24	0.39	0.44	0.50

Appendix G. Small Commercial Study

The PowerStat study was originally designed to test the effects of dynamic pricing and load control in both the residential and small commercial sectors. One of the main differences in study design was the timing of the peak period, which for commercial customers started at 3:00 p.m. and ended at 6:00 p.m. Table 50 shows the rate options available to small commercial PowerStat participants.

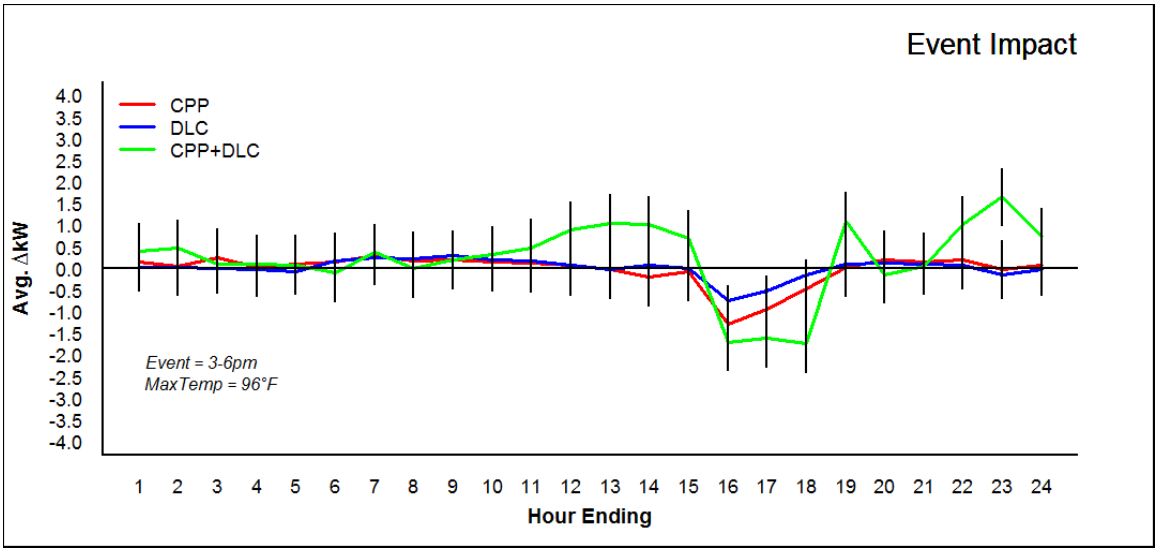
TABLE 50. SMALL COMMERCIAL RATE OPTIONS: STANDARD AND TOU-CPP RATES (SUMMER)

Period Name	Period Timing	Standard Rate—Non-Demand Metered *($/kWh)*	TOU-CPP Rate *($/kWh)*	% of Summer Hours
Event	3:00–6:00 p.m.	$ 0.2837	$ 0.7500	1%
On-peak	3:00–6:00 p.m. Non-holiday weekdays	$ 0.2837	$ 0.2837	8%
Off-peak	All other hours	$ 0.1050	$ 0.0900	91%

Small Commercial Load Impacts by Program

Figure 71plots the average event impacts for the small commercial program groups. Keep in mind that the extremely small sample sizes—just 12 customers in total—essentially relegate these results to being considered anecdotal. They are presented here for the sake of thoroughness in data reporting, but should not in any way be used to predict future program results.

FIGURE 71. COMMERCIAL EVENT DAY LOAD IMPACTS, BY PROGRAM



Statistical analysis indicates that the peak load impacts are significant for all three groups (Table 51). In addition, the CPP+DLC group exhibits a statistically significant pre-peak load increase.

TABLE 51. COMMERCIAL EVENT DAY LOAD IMPACTS, BY PROGRAM

Group	N	Event Pre-peak (hours 13-15)	Event Peak (hours 16-18)	Event Post-peak (hours 19-21)
DLC	8	-0.075 (-2.1%)	-0.51* (-15%)	0.044 (1.5%)
CPP+DLC	2	0.78* (11%)	-1.8* (-20%)	0.048 (0.49%)
CPP	2	-0.29 (-11%)	-1.0* (-35%)	0.001 (0.14%)

* Statistically significant (α = 0.05)

Contrast analysis indicates that pre-peak and peak event impacts for the CPP+DLC group were significantly different from the CPP and DLC groups.

TABLE 52. CONTRASTS BETWEEN COMMERCIAL EVENT DAY LOAD IMPACTS

Contrast	Event Pre-peak (hours 13-15)	Event Peak (hours 16-18)	Event Post-peak (hours 19-21)
DLC-CPP	0.21	0.53	0.0430
'CPP+DLC'-CPP	1.10*	-0.80*	0.0470
'CPP+DLC'-DLC	0.85*	-1.30*	0.0038

* Statistically significant (α = 0.05)

Small Commercial Load Impacts by Customer

MODEL

$$kw_{jk} =$$
$$\beta_{(hour)jk} hour_{jk} + \beta_{(CDH)jk} CDH_{jk} + \beta_{(MaxTemp)jk} MaxTemp_{jk} +$$
$$\beta_{(MaxTemp*hour*DayType)jk} MaxTemp_{jk} * hour_{jk} * DayType + r_j + \varepsilon_{jk}$$

kw_{jk}: kilowatt load on day j at hour k
$hour_{jk}$: categorical variables (1-24) indicating the hour of the day, where hour 1 spans the period from midnight to 1:00 a.m. and hour 24 spans the period from 11:00 p.m. to midnight
CDH_{jk}: cooling degree hour on day j at hour k
$MaxTemp_{jk}$: maximum temperature on day j
$DayType$: categorical variable for Day Type with 2 levels (event, nonevent)
r_j: random effects for day $\sim N(0, \varphi_2)$, assumed to be independent for different j
ε_{jk}: error terms $\sim N(0, \delta^2 I)$, assumed to be independent for different j and to be independent of random effects

* All Summer 2013 days except weekends and holidays are in the modelTable 53 shows the results of the model for each customer in the small commercial PowerStat study. Of the 12 customers, 8 exhibited statistically significant load reductions during the peak hours on the 12 Conservation days. Most of this effort can be contributed to load shifting rather than load reduction, since only 2 of these customers also reduced overall energy use on those days.

TABLE 53. COMMERCIAL LOAD IMPACTS, BY CUSTOMER

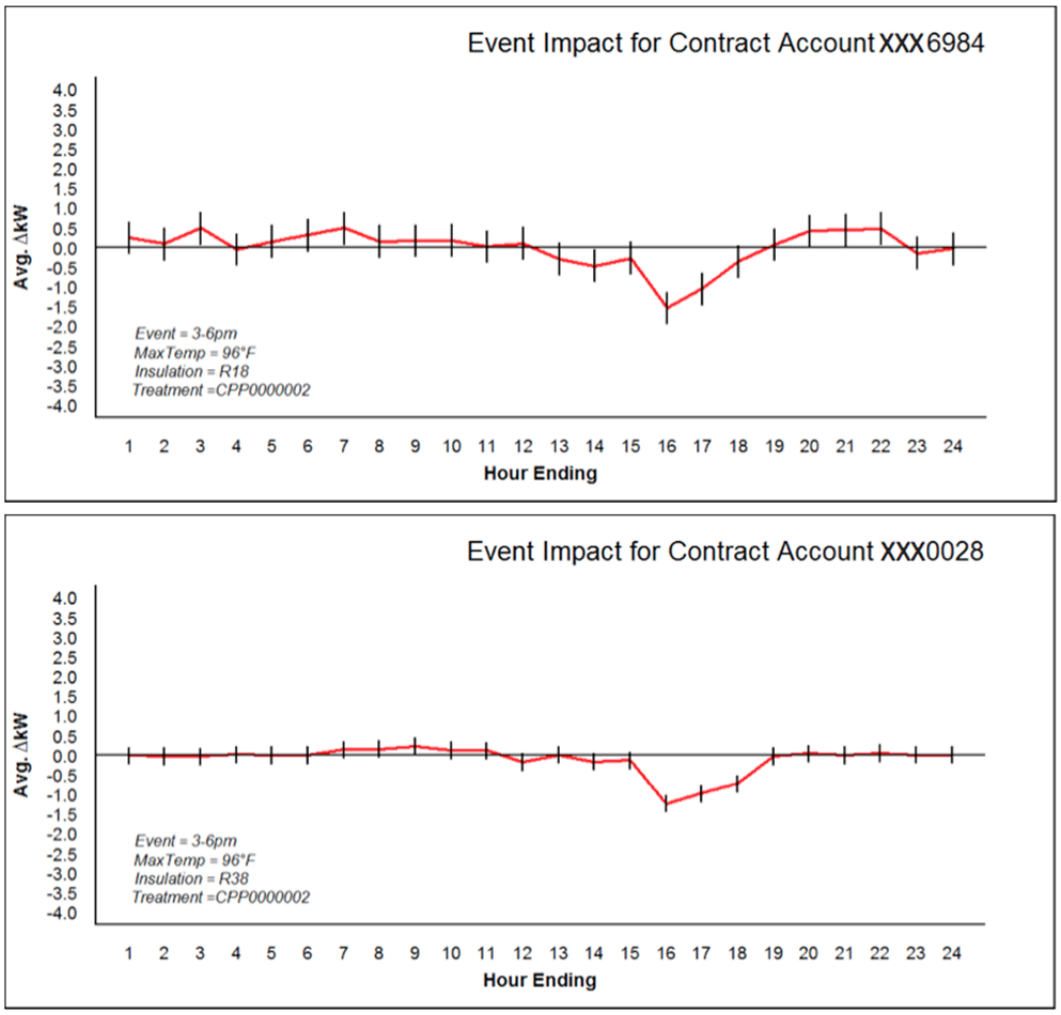
Contract Account	Program	R-value	Event Pre-peak (hours 13-15)	Event Peak (hours 16-18)	Event Post-peak (hours 19-21)	Event Other (hours 1-12,22-24)	Event Total (hours 1-24)
XXXX984	CPP	18	-0.34* (-9.7%)	-0.98* (-27%)	+0.30* (+45%)	+0.17* (+42%)	-0.02 (-1.5%)
XXXX028	CPP	38	-0.10 (-5.3%)	-0.98* (-47%)	+0.003 (+1.4%)	+0.04 (+9.3%)	-0.11* (-14%)
XXX880	DLC-2	24	-0.03 (-2.4%)	-0.16* (-35%)	+0.03 (+20%)	+0.02 (+4.4%)	-0.005 (-1%)

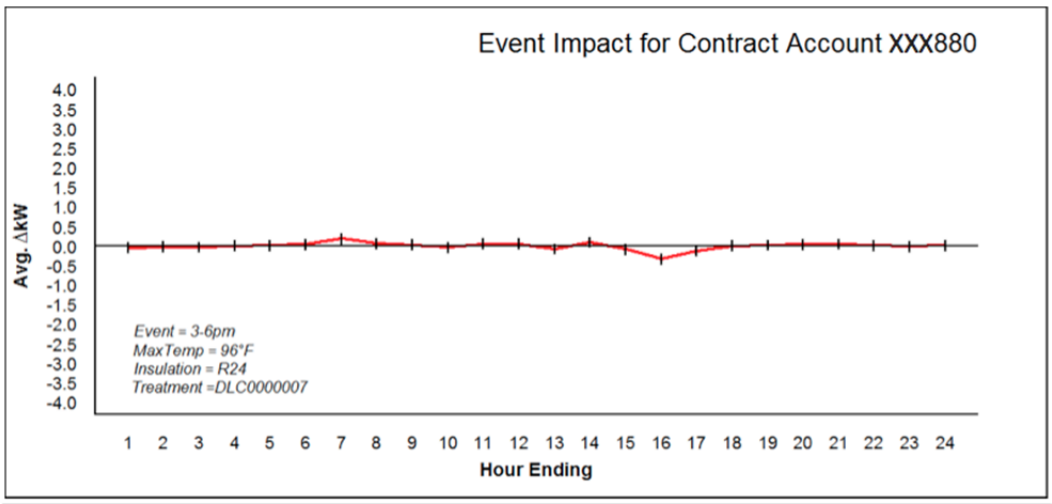
Contract Account	Program	R-value	Event Pre-peak (hours 13-15)	Event Peak (hours 16-18)	Event Post-peak (hours 19-21)	Event Other (hours 1-12,22-24)	Event Total (hours 1-24)
XXXX780	DLC-2	19	-0.70* (-13%)	-1.2* (-19%)	-0.33* (-6.6%)	-0.14 (-8.4%)	-0.37* (-12%)
XX157	DLC-4	19	-0.10 (-1.1%)	-0.36 (-4.1%)	+0.3 (+3.6%)	+0.27 (+4.6%)	+0.15 (+2.2%)
XXXX869	DLC-4	19	+0.002 (+0.5%)	+0.001 (+0.2%)	+0.001 (+0.1%)	+0.002 (+0.41%)	+0.002 (+0.4%)
XXXX467	DLC-4	30	+0.16 (+11%)	+0.51 (+43%)	+0.85* (+40%)	+0.07 (+4.8%)	+0.23 (+15%)
XXX354	DLC-4	19	-0.61 (-6.2%)	-2.5* (-28%)	-0.65 (-14%)	+0.34 (+10%)	-0.25 (-5.1%)
XXX724	DLC-4	19	-0.10 (-4.2%)	-1.2* (-47%)	+0.45* (+18%)	+0.10* (+6%)	-0.04 (-2.2%)
XXX719	DLC-4	19	-0.004 (-2.8%)	-0.03 (-21%)	+0.03 (+12%)	-0.02 (-5.4%)	-0.02 (-4.8%)
XXXX377	CPP+DLC4	30	+1.10* (+30%)	-2.0* (-32%)	+0.39 (+5.2%)	+0.66 (+31%)	+0.34 (+9.7%)
XXX899	CPP+DLC4	24	+0.14 (+1.3%)	-1.7* (-14%)	+0.58* (+5.2%)	+0.13 (+1.9%)	-0.05 (-0.6%)

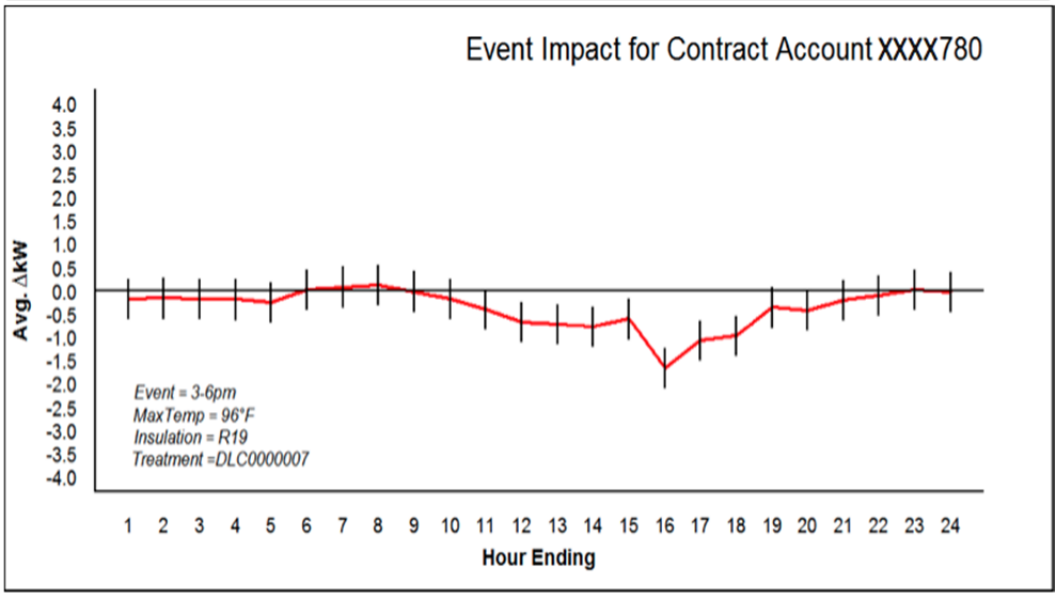
* Statistically significant (α = 0.05)

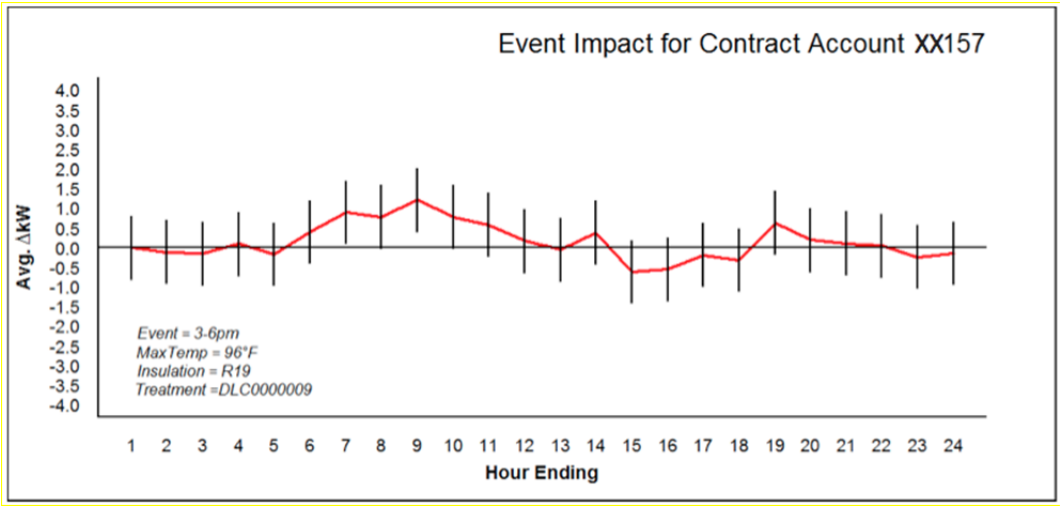
The following section provides graphs of load impacts for each small commercial customer.

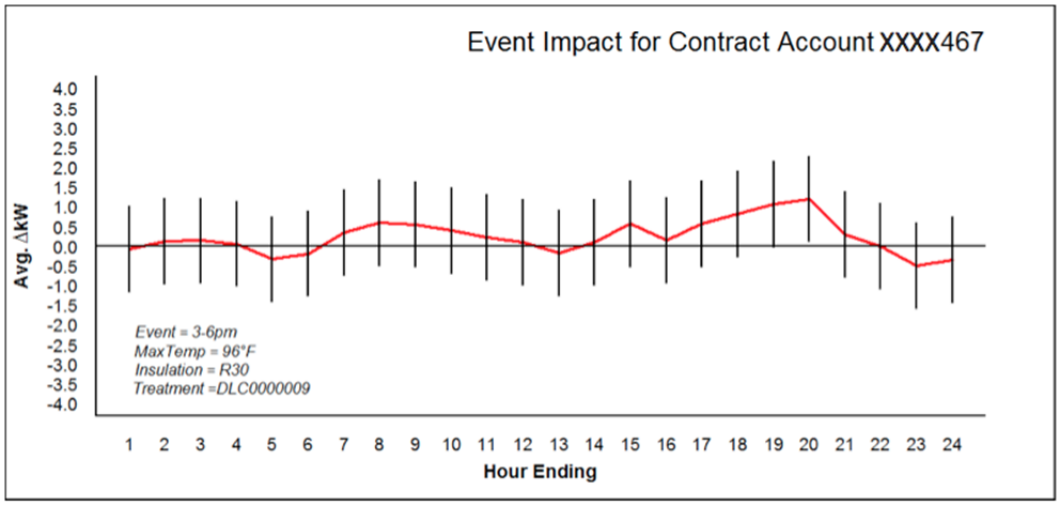
FIGURE 72. EVENT IMPACTS

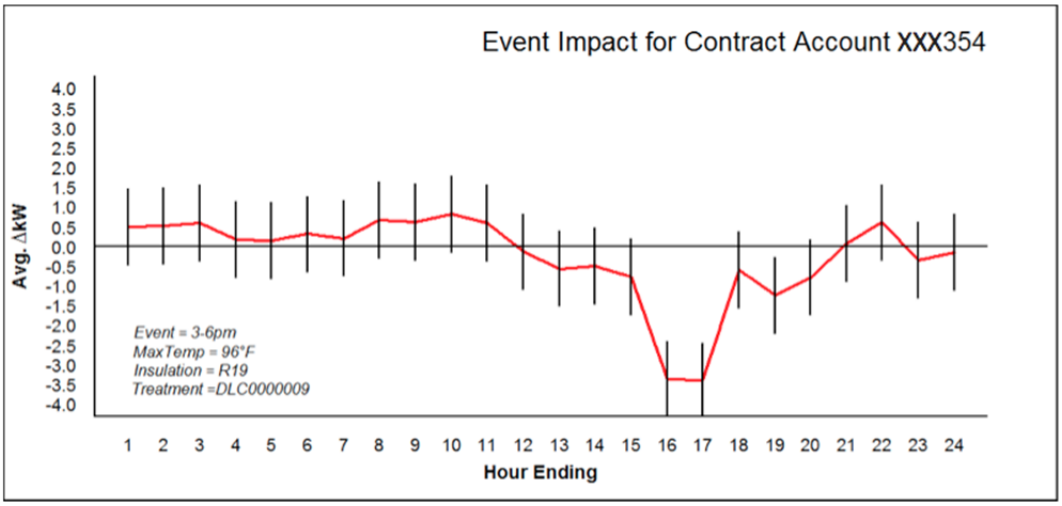


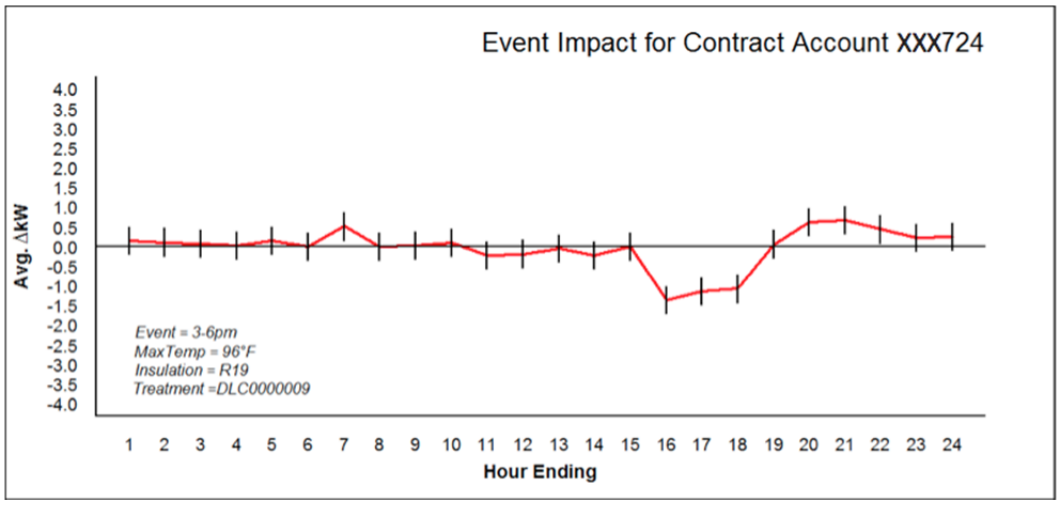


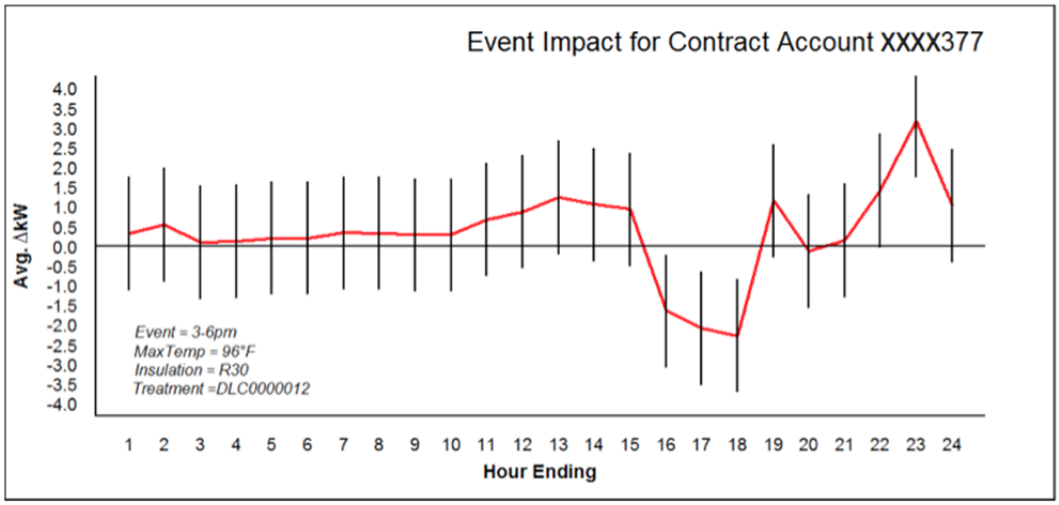


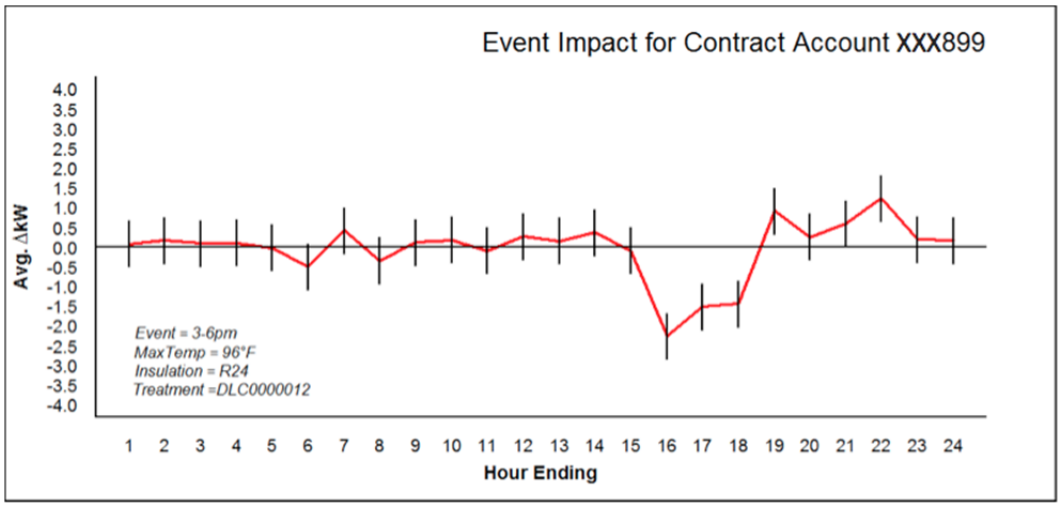


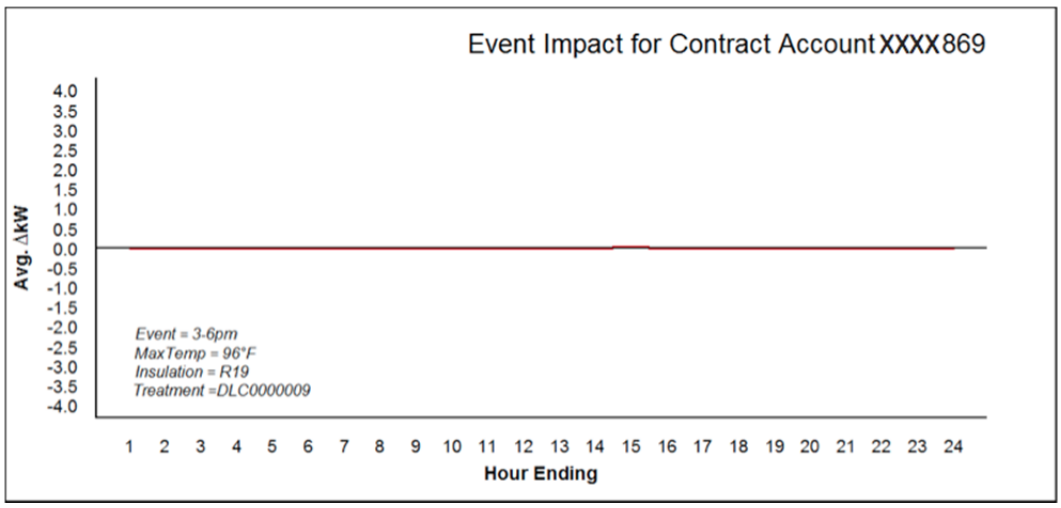


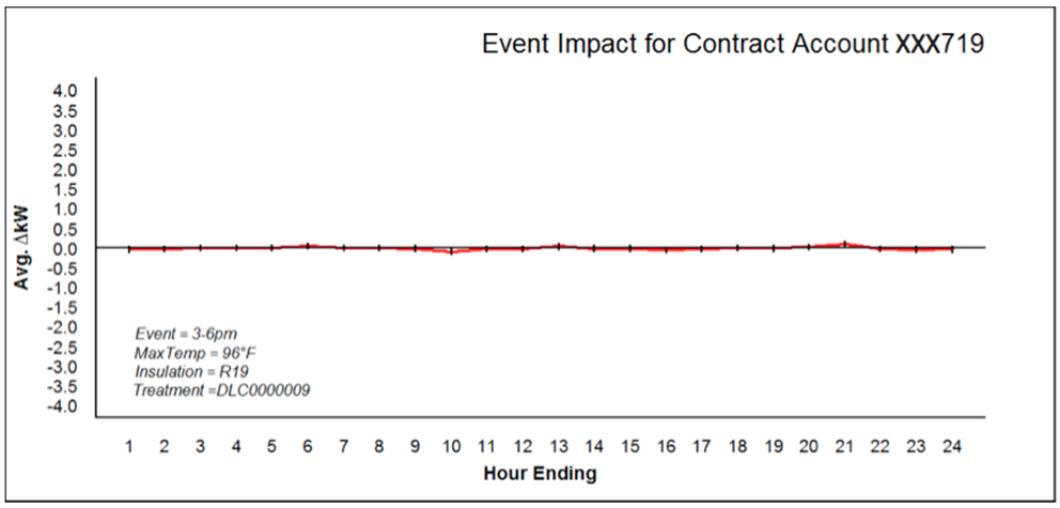












Appendix H. True North Research Report

2013 PowerStat® Program Customer Experience Report

PREPARED FOR THE
SACRAMENTO MUNICIPAL UTILITY DISTRICT

DECEMBER 10 , 2013

TRUENORTH RESEARCH
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ENCINITAS CA 92024
760.632.9900 WWW.TN-RESEARCH.COM

SMUD®

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INTRODUCTION

The Sacramento Municipal Utility District (SMUD) provides reliable electricity service at competitive rates to all of Sacramento County and a small portion of Placer County. As the sixth largest publicly owned utility in the country, SMUD is known for its innovative energy programs, high customer satisfaction, and commitment to being a leader in promoting community benefits. To this end, SMUD regularly conducts primary market research studies to profile customer needs, develop and refine programs that meet these needs, as well as measure customer awareness, opinions, behaviors and satisfaction as they pertain to SMUD and the services it offers.

BACKGROUND The present study is one of numerous pilot studies underway as part of SMUD's SmartSacramento® initiative, a comprehensive customer-centered smart grid system that enables and encourages customers to take an active, informed role in their energy use. Initiated in 2009 and continuing through 2014, the SmartSacramento® project includes Advanced Metering Infrastructure (AMI), distribution automation, demand response, customer applications such as web access to energy usage and analyses, dynamic pricing options, enhanced cyber security, and various partner projects.

Specifically, the *2013 PowerStat® Program* is designed to measure the peak period load reduction that can be achieved by adjusting air conditioner (AC) temperature settings during peak hours on hot days. Whereas the 2012 pilot utilized several pre-cooling strategies combined with SMUD control of residential participant's thermostats on PowerStat® event days, the 2013 program was different in a number of key respects. In addition to having a larger participant group (873 total) and incorporating both residential and small commercial customers, the *2013 PowerStat® Program* explores the impact that different levels of utility and participant control over their thermostat and incentives have on energy use and participants' experiences with the program. Within the residential and commercial markets, respectively, participants opted in to one of three treatment groups:

Group 1 *Customers with a price-based/TOU-CPP rate maintained control of their thermostat offset temperature throughout the season, and could adjust the offset from 1 to 5 degrees at any time on a Conservation Day—as well as opt-out of a specific event day.*

Group 2 *Customers with a price-based/TOU-CPP rate selected their temperature offset during enrollment (2, 3, or 4 degrees) and SMUD remotely adjusted their thermostat settings on Conservation Days accordingly. Although they had the option to opt-out of specific event days, they could not adjust their offset temperature.*

Group 3 *Customers with a standard rate structure selected their temperature offset during enrollment (2, 3 or 4 degrees) and received a corresponding credit of $2, $3 or $4 per Conservation Day in which they did not opt-out. SMUD remotely adjusted their thermostat settings on Conservation Days accordingly.*

In addition to quantifying the peak period energy use reduction achieved by the program among participating households and businesses, SMUD was interested in evaluating the impacts of the program on customers' experiences, their comfort level, and relevant attitudes about the program and SMUD. Whereas SMUD commissioned Herter Energy Research Solutions to conduct the load impact analysis, True North Research was selected to assist in designing and implementing

a series of surveys to capture customers' opinions and experiences at different stages of the program.

METHODOLOGY True North worked with SMUD to design three different surveys to be administered to customers at various stages of the program. Customers received email invitations (and reminder emails when necessary) to participate in the surveys through a secure, password-protected website hosted by True North. Customers who did not participate online in response to email reminders also received telephone calls for the purpose of conducting interviews via telephone. Each participant received a unique personal identification number (PIN) which was used to track their participation in the surveys and link their responses across all surveys in the final database. A summary of the three surveys and related interviewing protocols follows. Note that the survey questions and language were appropriately tailored to residential and commercial customers, respectively.

TABLE 1 SURVEY DATES, COMPLETED SURVEYS & RESPONSE RATES[1]

	Date(s)	Completed Surveys	Response Rate
Pre-Treatment Survey	May 31 to Jul 2	449	72%
Interim Survey (Conservation Days)	Jul 2	366	60%
	Jul 19	134	55%
	Aug 15	296	50%
	Aug 19	79	27%
	Sep 6	258	39%
	Sep 10	63	15%
	Sep 30	265	52%
Post-Treatment Survey	Oct 11 to Nov 14	531	63%

Pre-Treatment Survey The Pre-Treatment survey (see *Pre-Treatment Survey Questionnaire: Residential* on page 61 and *Pre-Treatment Survey Questionnaire: Commercial* on page 71) was administered at the onset of the study, following the installation of the PowerStat® thermostat. The survey included questions about customers' reasons for participating in the program and expectations of the program, as well as evaluative questions regarding the enrollment process, the thermostat installation process, initial impressions of the thermostat, and overall opinions about SMUD. A total of 449 customers completed the Pre-Treatment survey between August 1 and August 9, 2012.

Interim Survey The Interim survey (see *Interim Survey Questionnaire: Residential* on page 79 and *Interim Survey Questionnaire: Commercial* on page 85) was administered after each of seven Conservation Days. Customers received an email notification from SMUD the day prior to each Conservation Day, and surveys were conducted within the three days following each event to promote accurate recall. To avoid respondent fatigue, the first six events were grouped into three consecutive two-event waves. All participants received an invitation to complete an Interim survey on the *first* Conservation Day of each wave. Only those who ultimately did not complete a survey on the first event were invited to participate in a survey for the *second* event of each wave. The Interim survey included questions regarding Conservation Day awareness, behaviors, com-

1. Because additional customers were added to the study after Conservation Days had occurred, the total number of interviews shown in the table does not exhibit a consistent relationship with the response rate.

fort level of the respondent during peak hours, and opinions regarding the PowerStat program. In total, 1,461 Interim Surveys were completed during the season.

Post-Treatment Survey The Post-Treatment survey (see *Post-Treatment Survey Questionnaire: Residential* on page 88 and *Post-Treatment Survey Questionnaire: Commercial* on page 99) was administered at the completion of the study. Using question wording that was purposely tracked from the Pre-Treatment survey in select cases, the Post-Treatment survey measured satisfaction and perceptions of SMUD, the PowerStat® program, the PowerStat® thermostat, and experiences with SMUD and GoodCents customer service. For customers in Group 1 who maintained control of their temperature offset, the Post-Treatment survey also included questions about their typical Conservation Day settings. The survey was completed by 531 customers between October 11 and November 14, 2013.

ORGANIZATION OF REPORT

This report is designed to meet the needs of readers who prefer a summary of the findings as well as those who are interested in the details of the results. For those who seek an overview of the findings, the sections titled *Just the Facts* and *Conclusions* are for you. They provide a summary of the most important factual findings of the survey in bullet-point format and a discussion of their implications. For the interested reader, this section is followed by a detailed question-by-question discussion of the results from the surveys by topic area across each of the three surveys, which includes figures summarizing all of the primary topics tested (see *Table of Contents*). And, for the truly ambitious reader, the three questionnaires designed and administered for the study are contained at the back of this report.

NOTE ON SMALL COMMERCIAL SAMPLE

The sample of commercial customers that participated in the *2013 PowerStat® Program* was smaller than originally anticipated. With just 15 commercial customers total in the study and fewer completing any single survey, the results of the commercial surveys should not be considered statistically reliable. For that reason, the body of this report focuses exclusively on residential customers. The commercial survey results are confined to the topline summaries (see *Pre-Treatment Survey Questionnaire: Commercial* on page 71, *Interim Survey Questionnaire: Commercial* on page 85 and *Post-Treatment Survey Questionnaire: Commercial* on page 99 for a summary of the commercial survey results).

ACKNOWLEDGEMENTS

True North thanks Anya Suneson, Craig Sherman, and Michael Daniels at SMUD, as well as Karen Herter of Herter Energy Research Solutions, for contributing their valuable input during the design stage of this study. Their collective experience and insights improved the overall quality of the research presented here.

DISCLAIMER

The statements and conclusions in this report are those of the authors (Dr. Timothy McLarney and Richard Sarles) at True North Research, Inc. and not necessarily those of SMUD. Any errors and omissions are the responsibility of the authors.

ABOUT TRUE NORTH

True North is a full-service survey research firm that is dedicated to providing public agencies with a clear understanding of the opinions, perceptions, priorities and concerns of their constituents and customers. Through designing and implementing scientific surveys, focus groups and one-on-one interviews, as well as expert interpretation of the findings, True North helps its clients to move with confidence when making strategic decisions in a variety

of areas—such as planning, program development and evaluation, performance management, organizational development, establishing fiscal priorities, and developing effective public outreach campaigns. During their careers, Dr. McLarney (President) and Mr. Sarles (Principal Researcher) have designed and conducted over 800 survey research studies for public agencies—including more than 300 studies for California municipalities and special districts.

JUST THE FACTS

The following is an outline of the main factual findings from the study. For the reader's convenience, we have organized the findings according to the section titles used in the body of this report. Thus, to learn more about a particular finding, simply turn to the appropriate report section.

PROGRAM PARTICIPATION & SATISFACTION

- The most commonly mentioned reason for participating in the *2013 PowerStat® Program* was the desire to save money/reduce their energy bill, mentioned by 56% of respondents, followed by conserve energy/reduce electricity use (31%), and receive a free state-of-the-art thermostat/new technology (19%). No other single reasons were mentioned by at least 5% of respondents.
- At the onset of the program, at least nine-in-ten customers who provided an opinion said they expected to learn how to save money (97%) by participating in the program, help protect the environment (91%), learn how to better conserve electricity (91%), and use less energy (93%), whereas 89% expected to have more control over their electricity bill and 86% anticipated being able to keep their home at a comfortable temperature.
- At the completion of the program, 94% of customers who provided an opinion said the program had saved them money, 92% felt they had helped protect the environment, 90% improved their knowledge about ways to reduce their household's electricity use, 94% said they had reduced the amount of electricity their household uses, and 90% said the program gave them more control over their electricity bill.
- Its also worth noting that 89% of respondents reported at the conclusion of the program that their experiences during the program motivated them to change their electricity-use habits.
- Customers were asked to rate their overall experience with the PowerStat® program after each Conservation Day (Interim Surveys) and at the end of the study (Post-Treatment Survey). Overall, 95% of customers surveyed indicated they were satisfied with their experience participating in the PowerStat® program at its completion, with 70% offering that they were *very* satisfied. Satisfaction levels were slightly lower on Conservation Days, with 93% being either very (65%) or somewhat (28%) satisfied.
- Overall, 16% of customers had suggestions for improving the program. The most common suggestions centered on better communication about the program and Conservation Days (40%), followed by improved thermostat control options (19%), improved user interface for the thermostat (17%), and selecting more appropriate Conservation Days (7%).
- More than nine-in-ten customers indicated that participating in the PowerStat® program resulted in a reduction to their electricity bill. The average reported savings was $24.56 per typical summer month among program participants.
- When customers were asked if they would recommend that a friend participate in the PowerStat® program, 88% of respondents answered in the affirmative, 8% were unsure, and only 4% said no.
- Nearly nine-in-ten customers said they definitely (64%) or probably (25%) would sign up to participate in the PowerStat® program again next summer.
- When asked to indicate the temperature increase they would select for Conservation Days next summer, half (50%) of customers indicated that they would select the highest temperature increase (4 degree), 18% preferred a three degree increase, 17% opted for a two degree increase, whereas 15% were unsure or preferred to not answer the question.

- As to how the automatic temperature increase is managed on Conservation Days next summer, most customers (57%) preferred that they agree to a specific temperature increase amount at the outset of the season that remains constant and can not be changed. Less than one-third (30%) of customers stated that they preferred to maintain control over the automatic temperature increase for Conservation Days and thereby have the ability to change it when they desire. An additional 12% were unsure or preferred to not answer the question.
- Approximately half of customers (51%) indicated that it would also be acceptable if SMUD were instead to send notices on the same day as a Conservation Day, whereas 43% indicated that same-day-notification was unacceptable and 6% were unsure or unwilling to answer the question.

ENROLLMENT & PLAN SELECTION

- Overall, 41% of customers felt the Participation Agreement letter was very clear in describing the different plans and options, 51% indicated it was somewhat clear, 5% stated the letter was not at all clear, and 3% were unsure.
- When presented with the options, less than half (48%) of participants could correctly recall their actual plan including the temperature offset requested.
- When asked to identify the main reason why they selected a particular plan, 54% were motivated to maximize their cost savings, 15% wanted SMUD to automatically control the temperature increase, 10% desired to retain control over their temperature increase, 6% wanted a guaranteed payment per event, 2% wanted to make sure that no one else in their household would over-ride thermostat settings on a Conservation Day, whereas 7% offered a different reason and 6% were unsure.

INSTALLATION PROCESS

- All customers surveyed (100%) agreed that the work site was left clean after the installation was complete, there was no damage to their property during the installation process, and the length of time it took to install the device was reasonable.
- Nearly all respondents also agreed that the technician explained the basics of how to use the thermostat (99%), they were able to select an installation time that worked for their schedule (98%), the technician explained the installation process prior to starting the work (98%), and that the technician arrived on time for the appointment (97%).
- Consistent with the high levels of agreement found with specific statements about the installation process, nearly every customer (99%) surveyed indicated that, overall, they were either very (91%) or somewhat (8%) satisfied with the installation of their new thermostat.
- Ninety-five percent (95%) of customers who retained control of their Conservation Day settings (Group 1) indicated that the technician explained the Conservation Day settings to them during installation.
- Although half (50%) of participants in Group 1 did not recall the specific setting they chose during installation, 30% indicated that they selected Max Savings, 10% chose Balanced, 5% selected Comfort, whereas 5% chose Savings.
- Overall, 50% of customers in Group 1 indicated that they were well-informed about the temperature degree increase associated with each Conservation Setting, 25% felt somewhat informed, 20% were slightly informed, whereas 5% stated that they were not at all informed.

THERMOSTAT USE & RATINGS

- When asked to rate their overall satisfaction with the new thermostat, 91% of customers surveyed at the onset of the study (Pre-Treatment) were either very (62%) or somewhat (29%) satisfied. When asked again later in the program, overall satisfaction was a bit higher (94%), with 66% of customers indicating they were very satisfied and 28% saying they were somewhat satisfied.
- Participants who were *dissatisfied* with their new thermostat were provided the opportunity to describe the specific reasons why they were dissatisfied in an open-ended manner. Although the specific reasons varied, a common theme for many is that the unit is too complicated, lacks functionality, and is not user-friendly.
- The highest rated attributes of the PowerStat® thermostat included the readability of the display (97% excellent or good Pre-Treatment and 95% excellent or good Post-Treatment), overall performance (97% and 91%), ability to keep their home at a comfortable temperature (96% and 93%), appearance (96% and 92%), the availability of technical support (95% and 88%), and helping the participant to save money (93% Post-Treatment only).
- Customers assigned somewhat lower ratings to the clarity of the thermostat operation manual (85% excellent or good Pre-Treatment and 81% excellent or good Post-Treatment) and the thermostat's ease of use (86% and 82%).
- During the Pre-Treatment Survey, approximately three-quarters of respondents felt the PowerStat® thermostat was much (54%) or somewhat (23%) better than their prior thermostat, and another 12% said it was about the same.
- The findings were similarly favorable in the Post-Treatment Survey, with 54% of respondents stating that the PowerStat® thermostat was much better than their prior thermostat, 23% saying it was somewhat better, and 17% indicating it was about the same.
- More than half (61%) of respondents in the Post-Treatment Survey indicated that it was *very* easy to maintain their home at a comfortable temperature with the PowerStat® thermostat, and an additional 32% stated it was *somewhat* easy. Approximately 5% of customers found it difficult to maintain a comfortable temperature in their home with the new thermostat, whereas 2% were unsure.

CUSTOMER SERVICE

- At least 95% of customers who provided an opinion agreed with the statements: *SMUD clearly explained the goals of the program* (96% Pre-Treatment and 97% Post-Treatment), *SMUD clearly explained what I was expected to do during the program* (97% and 97%), *I was satisfied with how SMUD answered my questions* (97% and 99%), and *The information SMUD made available was informative and helpful* (96% and 98%).
- Overall, 12% of customers indicated that they contacted SMUD, and another 6% stated that they contacted GoodCents during the program.
- Among customers who contacted SMUD, 68% said their issues were resolved to their satisfaction and another 12% said their issues were partially resolved.
- Among customers who contacted GoodCents, 69% indicated that their issues were resolved to their satisfaction and an additional 14% said they were partially resolved.
- Approximately 1% of participants had reason to contact GoodCents regarding an issue that ultimately was not resolved. The corresponding figure for customers who contacted SMUD was 2%.

- The 16% of customers who contacted SMUD and/or GoodCents were asked to describe the issue or issues that prompted their contact. Common issues included the thermostat not working properly (29%), seeking assistance with programming time or temperature settings (24%), general questions about the program (12%), and problems with the thermostat display (10%).

CONSERVATION DAY BEHAVIOR & OPINIONS

- Members of Treatment Group 1 who retained control over their temperature offset on Conservation Days were quite mixed in their choice of Conservation Day settings, with 9% typically selecting Max Savings, 18% Savings, 23% Balanced, 18% Comfort, and 32% being unsure. Not a single respondent from this group indicated that they tended to use the Max Comfort setting.
- As for how often Group 1 customers made changes to their Conservation Setting during the summer, 41% reported that they never changed the setting, 14% did so once or twice, 18% changed the setting three to five times, whereas 27% adjusted the Conservation Setting at least five times during the season.
- Overall, 83% of customers affirmed that they do take actions on *normal* summer days during peak hours to reduce their household's energy use.
- When asked in an open-ended manner to describe the types of actions they take on a normal summer day to reduce their household's energy use during peak hours, the most frequently reported behaviors included turning off lights and electronics (26%), reducing or avoiding doing laundry (22%), changing thermostat settings (19%), reducing their use of air conditioning in general (13%), adjusting windows and shades (12%), washing dishes by hand (11%), and using a fan instead of air conditioning (9%).
- Approximately one-third (31%) of customers stated that they did take *additional* actions every Conservation Day during peak hours to reduce their household's electricity use, 22% indicated that they took additional actions on most Conservation Days, 11% offered that they did so but on just a few Conservation days, whereas 32% did not take additional actions on Conservation Days and 4% were unsure.
- As to what actions they took on Conservation Days in addition to their normal actions, 32% reported turning off lights and electronics, 7% left their home, 7% changed their thermostat settings, 6% reported using a fan instead of air conditioning, 6% reduced or avoided doing laundry, and 5% adjusted their windows and shades.

COMFORT LEVEL ON CONSERVATION DAYS

- Across the summer season and multiple Conservation Day episodes, 83% of participants indicated that they were aware of the most recent Conservation Day, 15% were not aware, whereas 2% were unsure.
- Across the season, an average 84% of participants surveyed indicated that they were at home for at least 30 minutes between the hours of 4PM and 7PM on the Conservation Day.
- Across the summer season, 57% indicated that the temperature in their home was about right/comfortable during peak hours on Conservation Days, 39% rated it a bit too hot, 4% stated that it was much too hot, whereas less than 1% indicated it was too cool.

- When asked to rate their personal comfort using a variation on the Wong-Baker visual scale for measuring pain, 42% of customers selected the face associated with the middle of the comfort scale, 29% selected the somewhat comfortable face, and 15% selected the very comfortable face as best representing their comfort level on the Conservation Day during peak hours. Overall, 12% of participants chose the somewhat uncomfortable face and 2% the very uncomfortable face to represent their comfort level during peak hours on the Conservation Day.

ATTITUDES ABOUT SMUD

- At the onset of the study nearly all (98%) of customers indicated they were satisfied with SMUD's efforts to provide electricity services, with more than three-quarters (78%) stating that they were *very* satisfied.
- Overall satisfaction was virtually identical at the completion of the study, with 97% indicating they were very (75%) or somewhat (22%) satisfied.
- Three-quarters (75%) of customers surveyed just after installation of their PowerStat® thermostat (Pre-Treatment Survey) indicated that their participation in the program to that point had positively impacted their opinion of SMUD, 17% said it had no impact, and the remaining 8% were unsure.
- At the completion of the program (Post-Treatment Survey), the findings were nearly identical, with 75% stating that their participation had positively impacted their opinion of SMUD, 22% said it had no impact, and only 1% felt it had a negative impact.

RATE PLAN

- When asked to select between the Optimum Off-Peak Pricing Plan and the Standard Tiered Rate Plan, nearly half (49%) of respondents could not identify which plan their household is on. The remaining respondents were rather evenly divided between those who thought their household was on the Standard Tiered Rate Plan (26%) and those who selected the Optimum Off-Peak Pricing Plan (25%).
- For the Standard Tiered Rate Plan, 41% rated their understanding of the plan as excellent or good, 20% indicated it is fair, whereas 18% confided they have a poor or very poor understanding of the plan and 20% were unsure.
- The results for the Optimum Off-Peak Pricing Plan were very similar, with 38% rating their understanding of the plan as excellent or good, 20% indicating it is fair, 22% stating they have a poor or very poor understanding of the plan, and 20% unsure.

CONCLUSIONS

As noted in the *Introduction*, this study was designed to provide SMUD with a reliable understanding of customers' experiences with the *2013 PowerStat® Program*, with a special emphasis on measuring the impacts of the program on customers' comfort levels in home when exposed to various treatments. Whereas subsequent sections of this report are devoted to conveying the detailed results of the surveys, in this section we attempt to 'see the forest through the trees' and note how the collective results of the surveys answer some of the key questions that motivated the research.

The following conclusions are based on True North's interpretations of the results, as well as the firm's experience conducting similar evaluation studies for public agencies throughout the State.

What were participants' general experiences with the PowerStat® program?

Overall, customers were generally pleased with their experiences participating in the *2013 PowerStat® Program*. During the summer season on Conservation Days, 93% of customers reported being either very (65%) or somewhat (28%) satisfied with their experience in the program to that point. At the conclusion of the program, satisfaction ratings were slightly higher, with 95% of customers being satisfied (70% very satisfied).

That customers were generally pleased with the PowerStat® Program was evidenced in other areas as well. Even though participants had already received their free thermostat and thus had less incentive to enroll in the program again, nearly nine-in-ten customers stated that they would definitely (64%) or probably (25%) sign up to participate in the PowerStat® Program again next summer. More than four out of five customers (88%) also indicated that—if asked by a friend about the PowerStat® program—they would recommend that they participate.

Was the Participation Agreement clear?

Customers' initial experiences with the *2013 PowerStat® Program* occurred during the enrollment process, which included responding to a mailed Participation Agreement letter in which they were asked to select among several plan options. The results of the survey indicate that many customers may have been confused about the plan options they ultimately selected.

When asked directly about the Participation Agreement letter, 41% of customers felt that the letter was very clear in describing the different plans and options, 51% indicated it was somewhat clear, 5% stated the letter was not at all clear, and 3% were unsure. More revealing, however, is that less than half of participants (48%) could correctly identify the plan options they ultimately chose by repeating the selection process during the survey. The confusion was more prevalent with respect to the management of Conservation Day settings (customer vs. SMUD controlled) as opposed to the temperature offset chosen.

Were participants pleased with the installation process?

Once a customer had agreed to take part in the PowerStat® program, the first substantial step in participation involved the installation of the new PowerStat® thermostat in the customer's home. As was the case in 2012, SMUD contracted with GoodCents in 2013 to manage the installation of the PowerStat® thermostats. Based on the responses to the Pre-Treatment Survey, GoodCents performed admirably during the installation period.

Nearly every customer surveyed (99%) indicated they were either very (91%) or somewhat (8%) satisfied with the installation of their new thermostat. With respect to specific performance dimensions during installation, all customers surveyed (100%) agreed that the work site was left clean after the installation was complete, there was no damage to their property during the installation process, and the length of time it took to install the device was reasonable. Nearly all respondents also agreed that the technician explained the basics of how to use the thermostat (99%), they were able to select an installation time that worked for their schedule (98%), the technician explained the installation process prior to starting the work (98%), and that the technician arrived on time for the appointment (97%).

Approximately 6% of all participants indicated that they contacted GoodCents regarding one or more issues related to the PowerStat® program for customer service. Of these individuals, 69% indicated that their issue was fully resolved to their satisfaction, and an additional 14% indicated that it was partially resolved. Among all program participants, just 1% indicated they contacted GoodCents regarding an issue that ultimately was *not* resolved to their satisfaction.

How did participants rate the PowerStat® thermostat?

The success of the pilot is based, in part, on customers' opinions of the technology employed. Ninety-one percent (91%) of participants indicated that they were satisfied with the PowerStat® thermostat overall, and approximately three-quarters indicated that the PowerStat® thermostat performed better than their prior thermostat. At both the outset and the conclusion of the program, participants generally gave high marks to the PowerStat® thermostat on every performance dimension tested, including the readability of the display, ability to keep their home at a comfortable temperature, appearance, the availability of technical support, helping them to save money, and overall performance.

Among the minority of customers who were dissatisfied with the PowerStat® thermostat, commonly mentioned complaints were that the unit is too complicated, lacks functionality, and is not user-friendly.

How did participation in the program impact opinions about SMUD?

With respect to specific customer service issues, SMUD received high marks from PowerStat® program participants. Nearly all participants (95%+) agreed that *SMUD clearly explained the goals of the program*, *SMUD clearly explained what I was expected to do during the program*, *I was satisfied with how SMUD answered my questions*, and *The information SMUD made available was informative and helpful.*

During the course of the pilot, 12% of participants reported that they contacted SMUD regarding one or more issues related to the PowerStat® program for customer service. Among customers who contacted SMUD, 68% said their issues were resolved to their satisfaction and another 12% said their issues were partially resolved. Overall, just 2% of participants contacted SMUD regarding an issue that ultimately was *not* resolved to their satisfaction.

More broadly, the findings of the surveys suggest that simply making the pilot program and free thermostat available to participants had a positive impact on most participants attitudes about SMUD, and their participation in the program after enrollment did not significantly alter their very favorable opinions of SMUD. Indeed, 98% of customers surveyed after installation but prior to a Conservation Day indicated that they were satisfied with the job SMUD is doing to provide electricity services to their household, and 75% stated that their participation in the pilot to that point had positively impacted their opinions of SMUD. These figures remained virtually unchanged at the conclusion of the pilot.

Which treatment strategies performed the best in keeping customers comfortable?

The PowerStat® program and the associated treatment strategies are being evaluated on two fronts—peak period load reduction and the impact of the program on the customer experience. Although the load reduction achievements of the program and respective treatment strategies are the subject of a separate analysis being conducted by Herter Energy Research Solutions, from the *customer experience* perspective there were no statistically significant differences between the treatment groups.

Across the summer season, 57% of participants indicated that the temperature in their home was about right/comfortable during peak hours on Conservation Days, 39% rated it a bit too hot, 4% stated that it was much too hot, whereas less than 1% indicated it was too cool. When the results were broken down by treatment group, the most striking pattern in the data is the general *consistency* of the responses. The percentage who indicated they were comfortable ranged between 53% and 61% across all seven treatment groups, with no differences achieving statistical significance. Similarly, the temperature offset value chosen did not significantly impact participants' comfort levels among those who were treated with a set temperature increase for the entire season. For exam-

ple, those who had a four degree increase expressed comfort levels that were nearly identical to those who experienced a two degree offset.

In addition to asking respondents to rate the temperature in their home using the scale noted above, all participants were also asked to rate their *personal* comfort on Conservation Days during peak hours using a variation on the Wong-Baker visual scale for measuring pain. Once again, the results were strikingly similar across all seven treatment groups. The average comfort level ranged from a low of 3.31 to a high of 3.59 across treatment groups on a 5 point scale,[2] although these differences were not statistically significant for any treatment group combinations.

As to why the treatments did not elicit a greater range in reported comfort levels among participants, two observations are worth considering. First, participants were not assigned to treatment groups on a random basis—they were allowed to self-select their treatment. Customers who felt comfortable with higher temperatures could thus select a higher temperature offset, whereas those who were more sensitive could opt for a lower degree offset. By allowing customers to select their treatment in this way, the study design likely underestimates the actual comfort level differences between the treatment groups if respondents were assigned on a random basis. Under random assignment, customers who felt comfortable with higher temperatures would be even more likely to report being comfortable if assigned a two degree offset, whereas those who were more sensitive would be less likely to indicate they were comfortable if they happen to be assigned a four degree offset.

A second observation is that individual customers were not exposed to different treatments in 2013 as they were in the *2012 PowerStat® Pilot.* In the 2012 pilot, the same participant received different pre-cooling treatments throughout the season, which provided different experiences and a basis for comparison. In 2013, participants received the same treatment throughout the summer season and thus lacked variation in Conservation Day experiences that could have helped them to provide a more nuanced assessment of their comfort levels on specific Conservation Days.

2. The scale ranged from 1 (very uncomfortable) to 5 (very comfortable).

Program Participation & Satisfaction

SMUD recruited over 850 residential customers to participate in the *2013 PowerStat® Program*. During recruitment, customers were informed about the basic objectives and protocols of the program and thus chose to participate with some knowledge and expectations of the program. In this first section of the report, we present the results of questions that pertained to their expectations when enrolling in the program and whether the program met these expectations, as well as their suggestions for how the program could be improved.

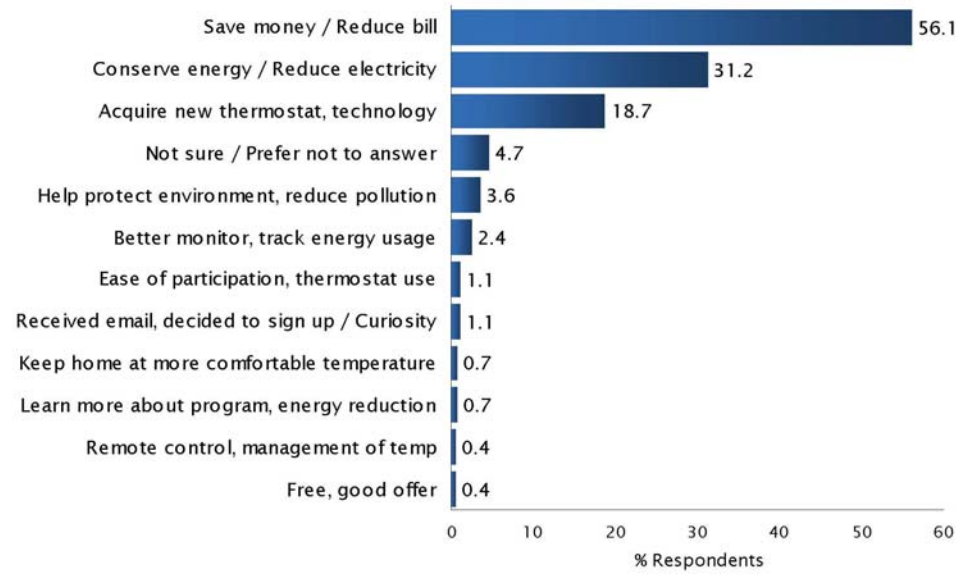
MOTIVATION FOR PARTICIPATING

Question 1 of the Pre-Treatment Survey (administered at the onset of the study after installation of the PowerStat® thermostat) asked customers in an open-ended manner to indicate their main reason for participating in the program. Verbatim responses were recorded and later grouped into the categories shown below in Figure 1. Multiple responses were allowed, so the percentage results shown in the figure represent the percentage of participants who cited each reason.

The most commonly mentioned reason for participating in the PowerStat® program was the desire to save money/reduce their energy bill, mentioned by 56% of respondents, followed by conserve energy/reduce electricity use (31%), and receive a free state-of-the-art thermostat/new technology (19%). No other single reasons were mentioned by at least 5% of respondents.

Question 1 Pre-Treatment *In your own words, what would you say was the main reason you signed up to participate in the PowerStat® pilot program?*

FIGURE 1 REASONS FOR PARTICIPATING IN PROGRAM



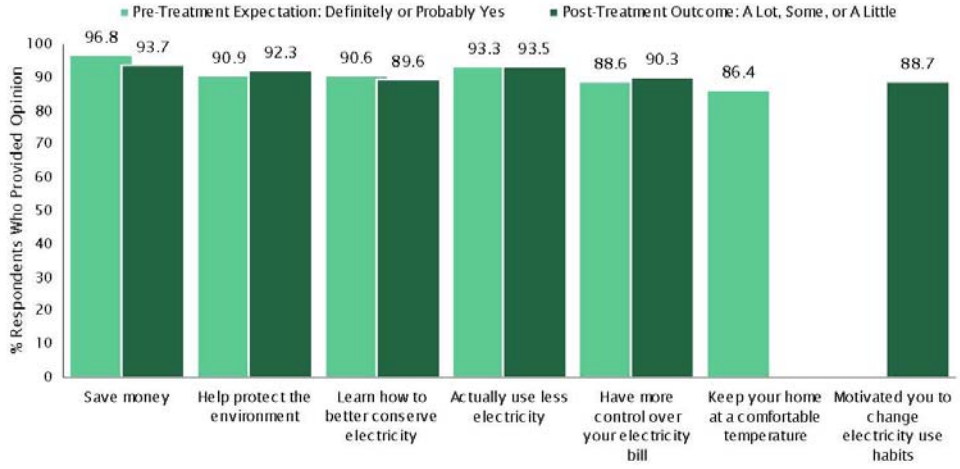
EXPECTATIONS & OUTCOMES The next question of the Pre-Treatment survey asked more specifically about customers' expectations of the program. Respondents were asked whether by participating in the program they expected to achieve each of the six outcomes listed along the bottom of Figure 2. A similar list was presented again to customers at the completion of the study during the Post-Treatment survey, where they were then asked to what degree participating in the pilot program *achieved* each outcome (a lot, some, a little, or none). The results to both of these questions are summarized in Figure 2.

In general, expectations of the program were ultimately on par with the outcomes. At the onset of the program, for example, at least nine-in-ten customers who provided an opinion said they expected to learn how to save money (97%), help protect the environment (91%), learn how to better conserve electricity (91%), and use less energy (93%), whereas 89% expected to have more control over their electricity bill and 86% anticipated being able to keep their home at a comfortable temperature. At the completion of the program, 94% of customers who provided an opinion said the program had saved them money, 92% felt they had helped protect the environment, 90% improved their knowledge about ways to reduce their household's electricity use, 94% said they had reduced the amount of electricity their household uses, and 90% said the program gave them more control over their electricity bill. Its also worth noting that 89% of respondents reported at the conclusion of the program that their experiences during the program motivated them to change their electricity-use habits.

Question 2 Pre-Treatment *By participating in this program, do you expect to _____?*

Question 4 Post-Treatment *In your opinion, how much has participating in the PowerStat® pilot program _____?*

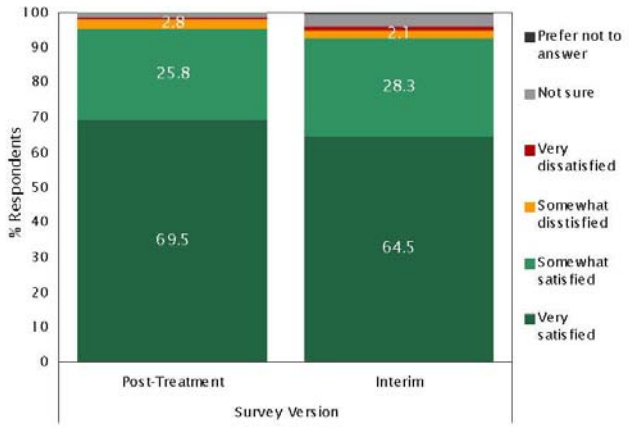
FIGURE 2 EXPECTATIONS & OUTCOMES OF PROGRAM



OVERALL SATISFACTION WITH PILOT Customers were asked to rate their overall experience with the PowerStat® program after each Conservation Day (Interim Surveys) and at the end of the study (Post-Treatment Survey). Figure 3 summarizes the findings of these questions, displaying overall satisfaction with the program at the completion of the study, as well as across all Interim Surveys on Conservation Days. Overall, 95% of customers surveyed indicated they were satisfied with their experience participating in the PowerStat® program at its completion, with 70% offering that they were *very* satisfied. Satisfaction levels were slightly lower on Conservation Days, with 93% being either very (65%) or somewhat (28%) satisfied.

Question 1/5 Post-Treatment/Interim *In general, how would you rate your overall experience participating in the PowerStat® pilot program?*

FIGURE 3 OVERALL SATISFACTION



For the interested reader, Figures 4 through 7 on the following pages present overall satisfaction with the PowerStat® program during the program (Interim Surveys) and at the end of the study (Post-Treatment Survey) by treatment group, by Conservation Day date, and by how much money the individual perceived that they saved by participating in the program.

FIGURE 4 OVERALL SATISFACTION BY PLAN GROUP: INTERIM

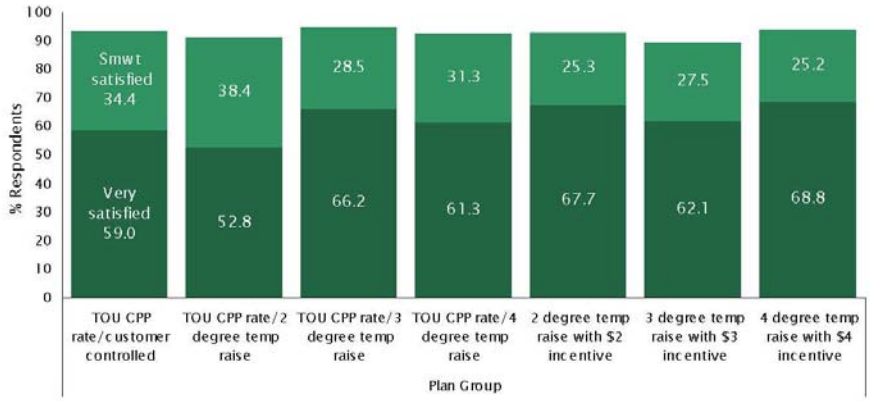


FIGURE 5 OVERALL SATISFACTION BY PLAN GROUP: POST-TREATMENT

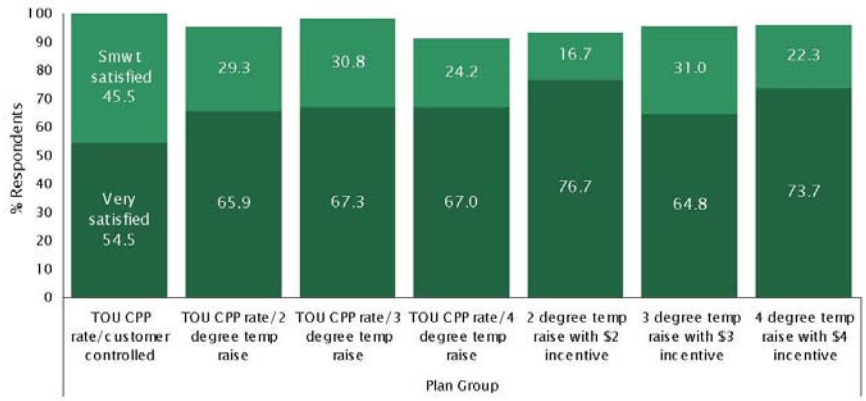


FIGURE 6 OVERALL SATISFACTION BY CONSERVATION DAY: INTERIM

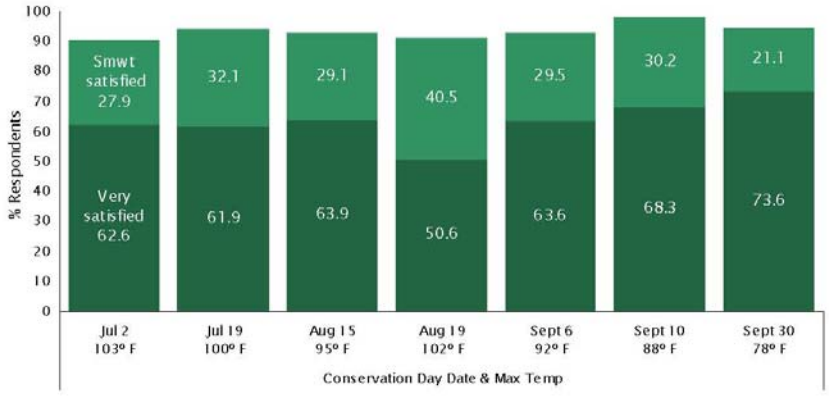
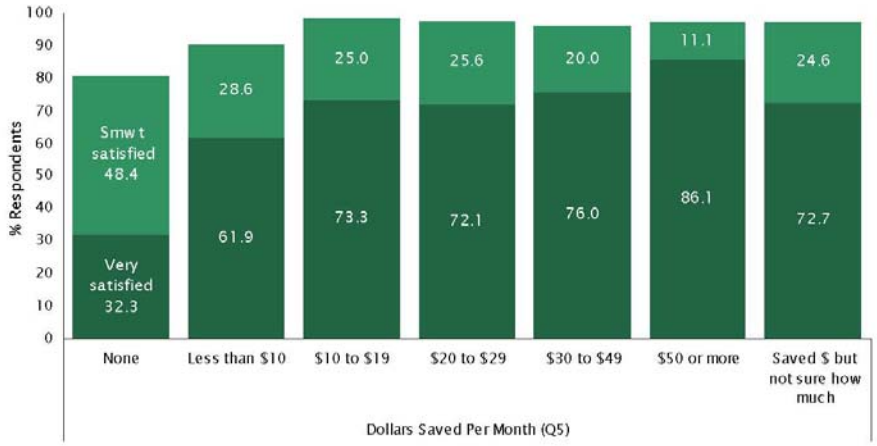


FIGURE 7 OVERALL SATISFACTION BY DOLLARS SAVED PER MONTH: POST-TREATMENT



REASONS FOR DISSATISFACTION WITH PROGRAM As noted above, very few customers indicated that they were dissatisfied with their experiences participating in the PowerStat® program. Among these customers, however, the Interim Survey asked that they describe their reasons for being dissatisfied in an open-ended manner, thereby allowing customers to cite any reasons that came to mind without being prompted by—or restricted to—a particular list of options. The full list of verbatim responses is shown below.

Question 6 Interim *Please describe the reasons why you are dissatisfied with your experience participating in the PowerStat program so far.*

- Given the unanticipated heat waves in region, the conservative dates should NOT be chosen in this period.
- I do not believe that this program will save me any money at all, as stated in the ads. I will be just as uncomfortable and will continue to pay huge electric bills IF I can use my AC at all, which I don't very much because it is just way too much money to spend on electricity.
- I think our thermostat was raised five degrees. But we signed up for three degrees. It was at 83 degrees between 4 and 7 and then it changed to 78. (I'm not sure what we had it on before 4 but I think it was 80) I will watch more carefully tomorrow.
- I would think there would be some sort of balance. Gone through two already and another one tomorrow. Too much too often
- It was and is much too hot. I suffered through it by getting in front of a fan. This weather right now is too hot.
- It's not my participation with the program that made me dissatisfied, it's because I didn't realize that I have my One-hundred-year old father-in-law who is living with us who was very uncomfortable with the temperature and he looks sick in between these hours.
- So far, I have not been aware of the conservation days. No notifications, even though I signed up for them twice and no indicator light on the thermostat.
- Temps not set right for day and night.

- The temp was 2 degrees higher than what I had sign- up for. It supposed to be 3 degrees above my set temp of 78. But the conservation temp on my thermostat was set at 82.9 instead of 81. Called and talk to a supervisor at SMUD but he can't do anything about it.
- Way too hot.
- I normally keep my house at a high temperature. When they want to raise it to another 40 degrees, then it is kind of ridiculous.
- They choose the hottest days. It would be better to choose the moderately hot days instead of the ones that make us uncomfortable or give health issues. It should be done where the conservation would be more effective.
- Conservation days are just too much. It gets so hot.
- I am unaware when the conservation days are. No message, no indicator light on the thermostat.
- I had the thermostat replaced recently and for whatever reason now, I'm no longer in the program.
- I have already talked to one the representatives informing that the temperature during the energy conservation days most especially when the temperature reached to 100's was really hot in my home as I have my one-hundred-year old father-in-law living with us, the person told me that SMUD is going to set the temperature to 76 instead of 78 degrees which was the previous setting of my thermostat but the temperature remains the same since the last time that I have spoke to this person.
- Most of the days that are chosen are when demands are the highest While I see the linear reasoning on these being conservation days, a more nuanced approach would be more successful on getting people to ACTUALLY really conserve. More moderate days would be better as designated conservation days, and getting more participation. See, when people are uncomfortable they don't like to think about the discomfort of family too.
- My house was way too hot during that time of day, and in checking my bill I don't see where I saved anything. My little great-grand baby was very hot and fussy.
- The cost is too expensive on non-conservation days.
- The temp was set 2 degrees higher than what I agreed. I signed up for plus 3 degrees. The thermostat was automatically set at plus 5 between 4 and 7 pm during the conservation day. The temp was very hot at 83F at the house.
- There seemed to be a lot of confusion on rate and Powerstat program because of two accounts.
- Too close together.
- Up until Friday the sixth the program was fine. But for that Friday I was not notified that it was going to be a conservation day and so nether me nor my family were expecting it. What happened?
- I was not aware that the thermostat would be controlled today. I leave my thermostat in the off setting unless I need it turned on to be comfortable. When I went to turn it on at 4:30 I did not know if that would mess up the process. Also, I have asked if it is ok to leave it off and still get credit for the cycle day credit, but got no answer
- I haven't been notified of the conservation days. My thermostat also does not update to conserve energy.
- Thermostat temporarily stopped working and I had difficulty getting it to work again.
- The first time I was informed of a conservation day was September 5th.

- What the hell is/was going on with the back-billing, statements, letters, etc? As a retired Major, U.S. Army, I can only describe what your billing/accounting apartment is: A cluster F..k!. A customer cannot tell if he is cost conserving or just getting jerked around at SMUD's convenience/experiment. I won't participate in a program that is not well thought out and trouble-shooted with SMUD again. I really feel it was not to the customer's advantage, as it was to your billing Department. Cannot believe receiving 7 back bills and having to make two full payments in the next few days, automatically taken out of my checking. I hope the amounts are correct. We have to rely on SMUD's screwed-up process. Count me and my wife out of any future, poorly planned experiment. Feel ripped-off and don't want to cooperate with SMUD in the future. What were you thinking for the past 7 months by not catching your mistake until a couple weeks ago? Too bad, you lost a customer due to your piss poor planning and organization of this program. What a train wreck!!!
- Problems with the thermostat flexibility. Was not contacted for the 9/6 conservation day.
- I have yet to get an email or text informing me of the conservation day.
- Need better thermostat like the NEST. Current thermostats not user friendly and manual to complicated.
- I am not notified ahead of time when you plan to activate the PowerStat program. I seem to miss it every time.
- More than 1 day notification would be nice. I used work phone as contact. As a result, I wouldn't get info until after the fact. For example, received notice 9/8 for 9/9 curtailment. I received at work this morning but am not at home to change settings to accommodate. Of course, if I had checked my voicemail messages this would be moot point! Perhaps add email notification an option? I check email every day so I would have been informed to update thermostat settings...
- I feel that there is a trend of using conservation days just because SMUD said there would be 12. Today's temperature was not hot enough in my opinion to be a conservancy day and i viewed it as more of a saving SMUD money day. I would also like if the thermostat displayed the price per KW during that time period as it is shown as capable as doing. As a side thought, if SMUD can change the temperature of the thermostat, maybe as a bonus of using these smart thermostats and enrolling in future programs such as this, customers can use the website or an app to control their thermostat remotely. This is a benefit to both parties. I have my thermostat scheduled to come on before I get home, if I know I will be home later I can change it remotely and conserve and save money.
- My downstairs stays close to 80 degrees and my upstairs is over 80 degrees and in order to survive I have to run fans. The thermostat is set at 80 degrees all the time.
- Today the weather was cooler so the house was not too bad. the other days were so hot that period of time in my house was miserable even with fans going, They were just circulating hot air.
- Your billing process cumulating in Sept 2013, was really f****ed Up! Who's the rocket scientist to take over 7 months to figure out that customers in this pilot program where not paying enough on their initial bills?? Dumb s***! Get your s*** together for next time. Seemed really unprofessionally throughout.
- I was told that I would receive a $2 credit for each conservation day that I participated in. I have not received a single credit.
- I have yet to be alerted to a conservation day and have not seen any credits on my account.
- The temp is not set to the right temps for me.

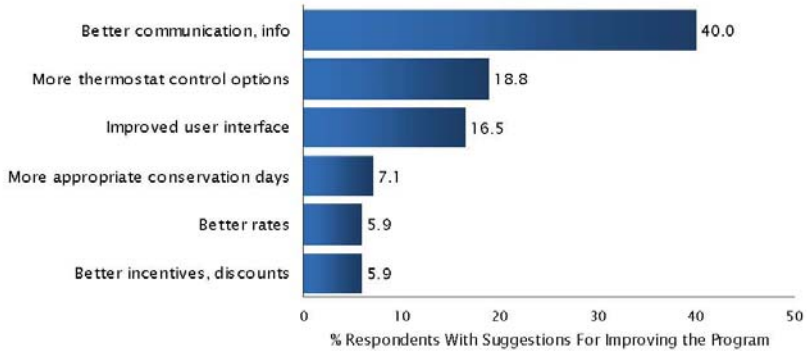
- I wish the controls were easier to adjust. They were set by the installer to go down to 69 at night (when I get out of bed to urinate). It's too freaking cold. Now that winter is coming, I would like an instruction manual to be sent to me.

HOW CAN THE PROGRAM BE IMPROVED? At the completion of the study, customers were asked to describe any changes they thought would most improve the PowerStat® program. Overall, 16% of customers had suggestions for improving the program, and their verbatim responses were later reviewed by True North and grouped into the categories shown below in Figure 8. The most common suggestions centered on better communication about the program and Conservation Days (40%), followed by improved thermostat control options (19%), improved user interface for the thermostat (17%), and selecting more appropriate Conservation Days (7%).

Question 2 Post-Treatment *Do you have any suggestions on how the PowerStat® pilot program can be improved?*

Question 3 Post-Treatment *Please briefly describe the one or two changes you think would most improve the PowerStat® pilot program in the text box below.*

FIGURE 8 CHANGES TO IMPROVE PROGRAM



ELECTRICITY BILL SAVINGS More than nine-in-ten customers indicated that participating in the PowerStat® program resulted in a reduction to their electricity bill. When subsequently asked to indicate how much they saved in a typical summer month, nearly half (48%) indicated that they saved money but weren't sure how much, and an additional 7% preferred not to answer the question. Among the remaining customers, 14% reporting saving less than $10, 11% saved $10 to $19, 8% saved $20 to $29, 5% saved $30 to $49, whereas 7% saved $50 or more in a typical summer month (Figure 9). Overall, the average reported savings was $24.56 among program participants (see Figure 10), with the highest average savings reported by those in the TOU CPP rate/customer controlled treatment group (Group 1).

Question 5 Post-Treatment *In a typical summer month, approximately how much do you think you saved on your electricity bill by participating in the PowerStat® pilot program?*

FIGURE 9 PERCEIVED DOLLARS SAVED PER MONTH

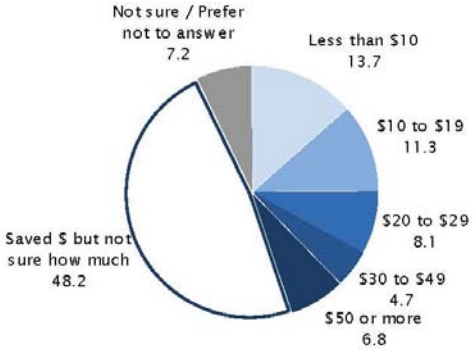
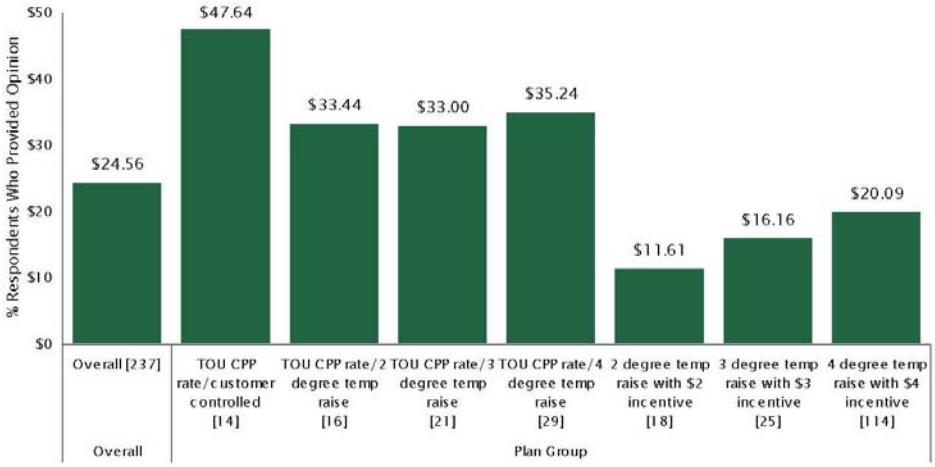


FIGURE 10 PERCEIVED DOLLARS SAVED PER MONTH BY GROUP PLAN



WOULD YOU RECOMMEND THE PROGRAM TO A FRIEND? Question 6 of the Post-Treatment survey can be viewed in many ways a litmus test for the success of the program from the customer's perspective. When customers were asked if they would recommend that a friend participate in the PowerStat® program, 88% of respondents answered in the affirmative, 8% were unsure, and only 4% said no (see Figure 11). The percentage of customers that indicated they would recommend the PowerStat® program to a friend ranged between 78% and 92% across the six treatment groups (see Figure 12).

Question 6 Post-Treatment *If a friend asked you about the PowerStat® pilot program, would you recommend that they participate?*

FIGURE 11 RECOMMEND PROGRAM

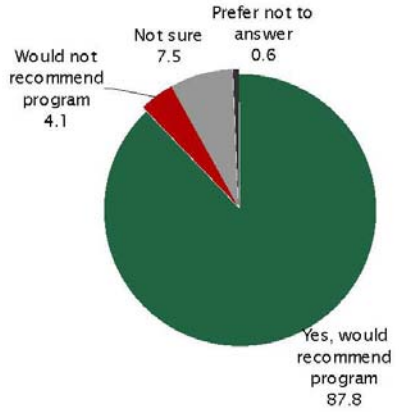
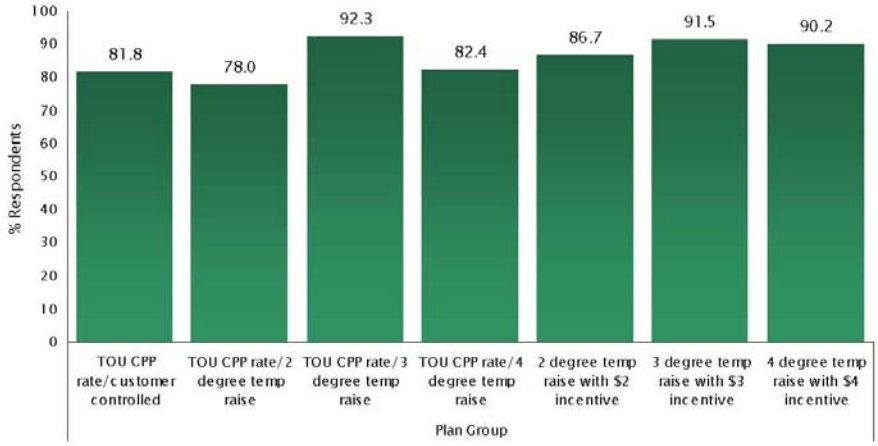


FIGURE 12 RECOMMEND PROGRAM BY PLAN GROUP



WOULD THEY PARTICIPATE AGAIN? Another good measure of customers' overall assessment of the PowerStat® program, Question 13 of the Post-Treatment survey asked respondents if they would be interested in signing-up again for a similar program in the summer of 2014. Even though participants had already received their free thermostat and thus had less incentive to enroll in the program again when compared to this initial period, nearly nine-in-ten customers said they definitely (64%) or probably (25%) would sign up to participate in the PowerStat® program next summer (Figure 13). The percentage of customers that indicated they would sign up again for the PowerStat® program ranged between 80% and 93% across the six treatment groups (see Figure 14).

Question 13 Post-Treatment *Thinking ahead to next summer (2014), would you sign up again to participate in the PowerStat® program?*

FIGURE 13 SIGNING UP AGAIN FOR POWERSTAT PROGRAM

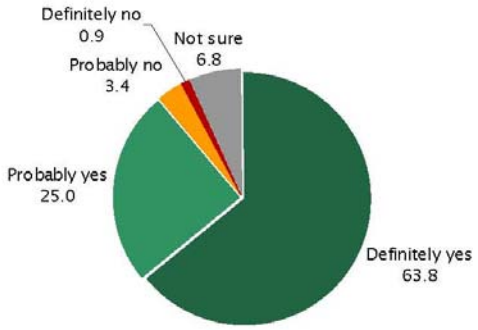
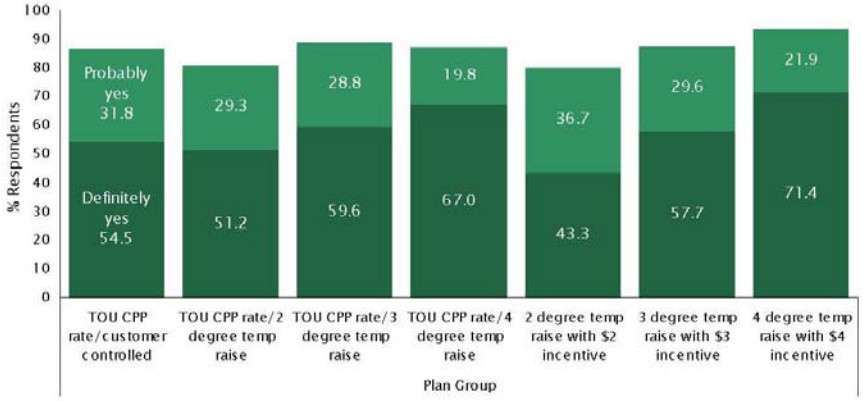


FIGURE 14 SIGNING UP AGAIN FOR POWERSTAT PROGRAM BY PLAN GROUP



TEMPERATURE SETTING & PLAN OPTIONS FOR 2014 Customers who indicated that they would sign up again for the PowerStat® program in 2014 were subsequently asked to indicate the temperature increase they would select for Conservation Days, as well as their preferred method for managing the temperature settings on Conservation Days.

As shown in Figure 15 on the next page, half (50%) of customers indicated that they would select the highest temperature increase (4 degree) on Conservation Days next summer, 18% preferred a three degree increase, 17% opted for a two degree increase, whereas 15% were unsure or preferred to not answer the question. Although customers most often selected the same temperature offset they had in 2013, as shown in Figure 16 approximately one-third of customers in the two degree group were willing to entertain an increase in the temperature for 2014, whereas just 17% of those in the highest temperature group (4 degree) requested a reduction in their temperature increase for 2014.

Question 14 Post-Treatment *Based on your experience this summer, what temperature increase would you select for Conservation Days next summer?*

FIGURE 15 TEMPERATURE INCREASE PREFERENCE FOR NEXT SUMMER

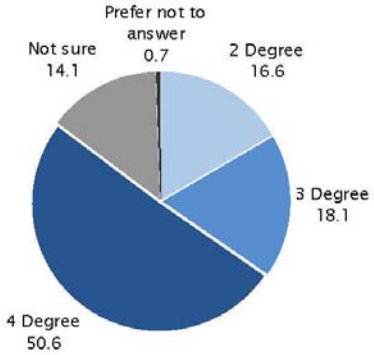
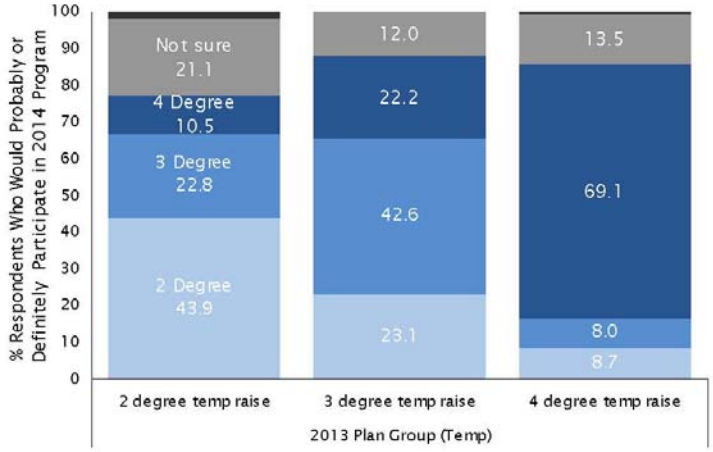


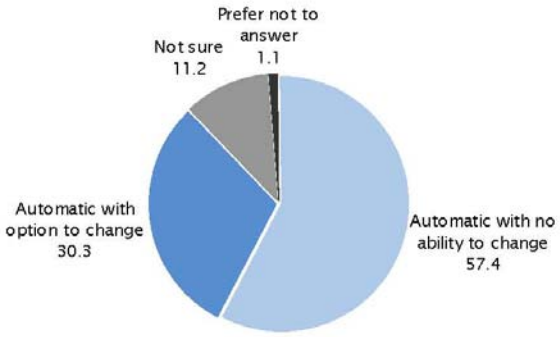
FIGURE 16 TEMPERATURE INCREASE PREFERENCE FOR NEXT SUMMER BY PLAN GROUP (TEMP)



As to how the automatic temperature increase is managed on Conservation Days, most customers (57%) preferred that they agree to a specific temperature increase amount at the outset of the season that remains constant and can not be changed (see Figure 17). Less than one-third (30%) of customers stated that they preferred to maintain control over the automatic temperature increase for Conservation Days and thereby have the ability to change it when they desire. An additional 12% were unsure or preferred to not answer the question.

Question 15 Post-Treatment *Which of the following options would you prefer for how your automatic temperature increase is managed on Conservation Days?*

FIGURE 17 PREFERENCE FOR TEMPERATURE MANAGEMENT



TIMING FOR CONSERVATION DAY NOTICES The final question in this opening section addressed the timing of Conservation Day notices. During the 2013 season, SMUD sent notices the day before regarding an upcoming Conservation Day. Approximately half of customers (51%) indicated that it would also be acceptable if SMUD were instead to send notices on the same day as a Conservation Day, whereas 43% indicated that same-day-notification was unacceptable and 6% were unsure or unwilling to answer the question (Figure 18). Opinions about the timing of Conservation Day notices bore a consistent relationship to the temperature offset—the higher the temperature increase, the less acceptable a customer found same-day notifications (see Figure 19).

Question 16 Post-Treatment *This summer, SMUD sent notices the day before regarding an upcoming Conservation Day. If SMUD were instead to send notices the same day as a Conservation Day, would that be acceptable to you?*

FIGURE 18 OPINION OF SAME-DAY CONSERVATION DAY NOTICES

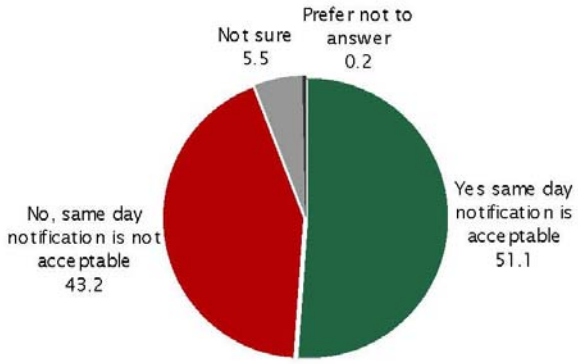
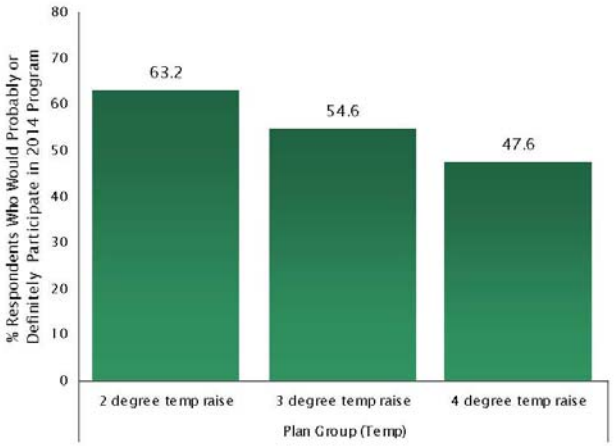


FIGURE 19 OPINION OF SAME-DAY CONSERVATION DAY NOTICES BY PLAN GROUP (TEMP)



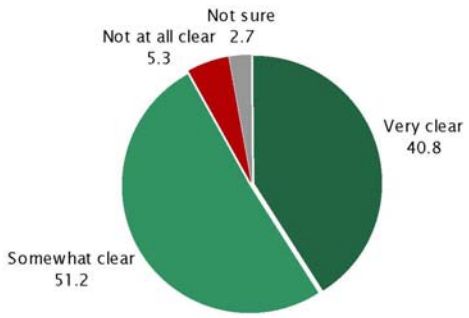
Enrollment & Plan Selection

Customers' initial experiences with the *2014 PowerStat® Program* occurred during the enrollment process, which included responding to a mailed Participation Agreement letter in which they were asked to select among several plan options. Recognizing that customers' experiences during the enrollment process could naturally shape their understanding of the program and related attitudes, the Pre-Treatment survey included several questions designed to profile customers' understanding of the plan options they selected.

CLARITY OF PARTICIPATION AGREEMENT The first question in this series presented an image of the Participation Agreement (see *Participation Agreement* on page 109) as a reminder to respondents, then simply asked them how clear they felt the letter was in describing the different plans and options from which they could choose. Overall, 41% of customers felt the Participation Agreement letter was very clear in describing the different plans and options, 51% indicated it was somewhat clear, 5% stated the letter was not at all clear, and 3% were unsure (Figure 20).

Question 4 Pre-Treatment *When enrolling in the PowerStat® pilot program, you were presented with the following Participation Agreement which described different plan options. Please take a moment to review the document, then hit the next button. In your opinion, how clear was the letter in describing the different plans and options from which you could choose?*

FIGURE 20 CLARITY OF PARTICIPATION AGREEMENT



WHICH PLAN DID YOU SELECT? When asked if they recalled which plan they selected when they initially responded to the Participation Agreement, 24% confided they did not recall or were unsure. Among the remaining respondents, 23% recalled selecting Plan A (Optimum Off Peak Rate + Energate Thermostat), whereas 52% recalled selecting Plan B (2, 3, 4 Plan + Energate Thermostat).

In general, customers who recalled selecting Plan B were quite accurate in their recollections, with at least two-thirds correctly identifying their specific plan. Customers who selected Plan A, on the other hand, were more likely to be unsure of their answer or pick the wrong plan (see Figure 22). Overall, less than half (48%) of participants could correctly identify their actual plan including the temperature offset requested.

Question 5 Pre-Treatment *Do you recall which plan you selected?*

FIGURE 21 PLAN SELECTED

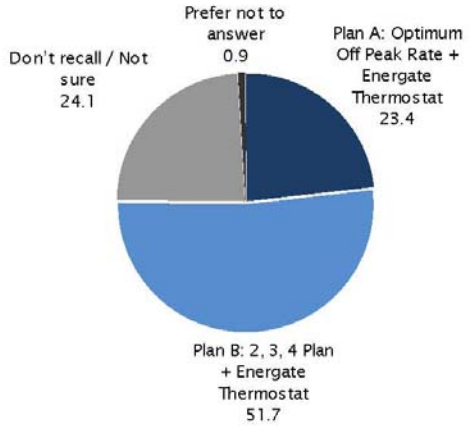
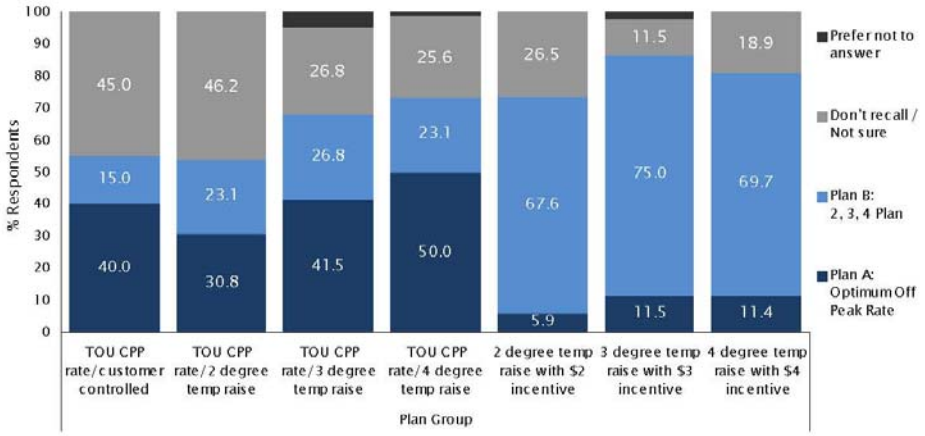


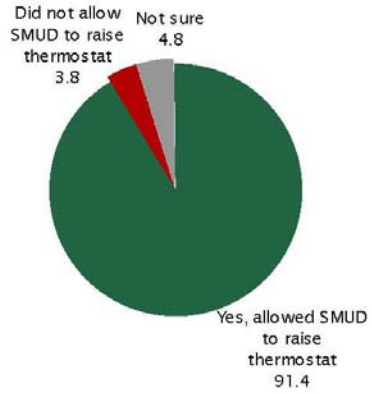
FIGURE 22 PLAN SELECTED BY PLAN GROUP



SMUD AUTOMATICALLY RAISE TEMPERATURE Customers who indicated they selected Plan A were subsequently asked if they checked the 'Yes' box in the agreement that would allow SMUD to automatically raise their thermostat temperature on Conservation Days. Overall, 91% of customers recalled that they checked the 'Yes' box (Figure 23), which is substantially higher than the *actual* percentage of customers who selected the 'Yes' box when they filled out the agreement. In fact, 65% of customers in Group 1 that retained control over their Conservation Day settings throughout the year (and thus did not actually check the 'Yes' box) indicated during the Pre-Treatment survey that they checked the 'Yes' box to have SMUD automatically raise their thermostat temperature.

Question 6 Pre-Treatment *Did you check the 'Yes' box to allow SMUD to automatically raise your thermostat temperature on Conservation Days?*

FIGURE 23 ALLOWED SMUD TO RAISE THERMOSTAT



REASON FOR SELECTING PARTICULAR PLAN

Having identified the plan that customers' *recalled* selecting, Question 7 in the Pre-Treatment survey asked them to identify the main reason why they selected a particular plan. Keeping in mind that less than half (48%) of customers correctly identified their actual plan, Figure 24 shows that more than half (54%) were motivated to maximize their cost savings when selecting a plan, 15% wanted SMUD to automatically control the temperature increase, 10% desired to retain control over their temperature increase, 6% wanted a guaranteed payment per event, 2% wanted to make sure that no one else in their household would over-ride thermostat settings on a Conservation Day, whereas 7% offered a different reason and 6% were unsure.

Question 7 Pre-Treatment *What was the main reason you selected this plan over the others?*

FIGURE 24 MAIN REASON FOR SELECTING PLAN

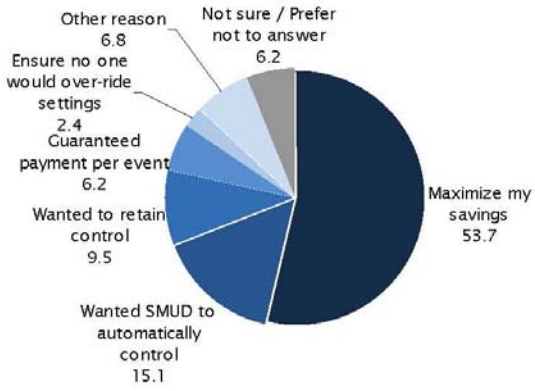
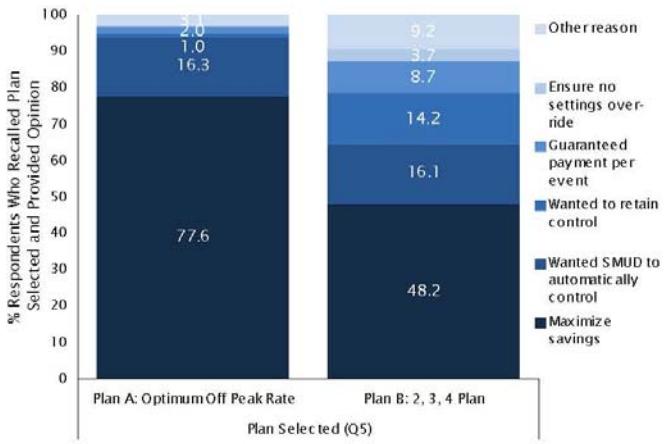


Figure 25 on the next page shows how the motivations expressed by customers varied according to whether they recalled selecting Plan A or Plan B. Note that there are too few respondents who thought that they were retaining control over their thermostat to separate out their responses from the Plan A column.

FIGURE 25 MAIN REASON FOR SELECTING PLAN BY PLAN TYPE CHOSEN (Q5)



RECALLED TEMPERATURE OFFSET The final question in this series asked respondents who thought they were in Group 2 or Group 3 (i.e., were committed to a particular temperature offset for the season) if they recalled the specific temperature increase they selected for Conservation Days. More than half (57%) recalled selecting a four degree increase, 16% a three degree increase, 19% a two degree increase, whereas 8% confided they were not sure.

Question 8 Pre-Treatment *Do you recall which automatic temperature increase you selected for Conservation Days?*

FIGURE 26 SELF-REPORTED TEMPERATURE INCREASE SELECTED

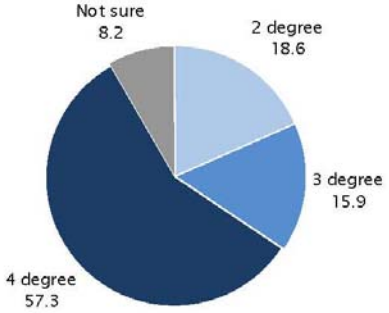
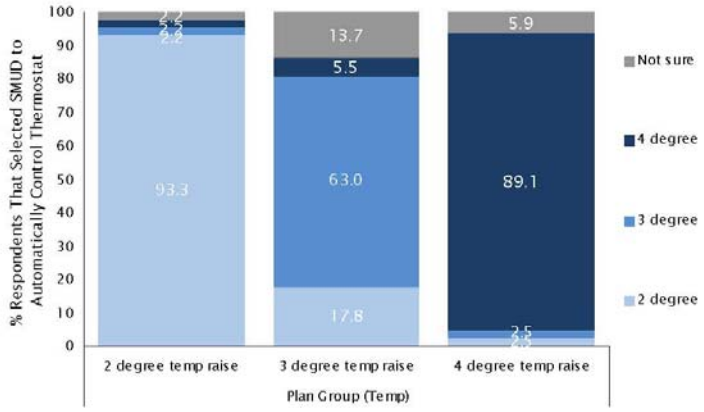


Figure 26 on the next page shows the relationship between the actual temperature offset of the participant's treatment group and what they recalled selecting on the Participation Agreement. Most respondents in every group correctly identified their temperature offset, although the accuracy ranged from a low of 63% for those in the three degree offset group to a high of 93% for those in the two degree offset group.

FIGURE 27 SELF-REPORTED TEMPERATURE INCREASE SELECTED BY PLAN GROUP (TEMP)



INSTALLATION PROCESS

Once a customer had agreed to take part in the PowerStat® program, the first substantial step in participation involved the installation of the new PowerStat® thermostat in the customer's home. The customer's experience and satisfaction with the installation process was examined in the Pre-Treatment Survey.

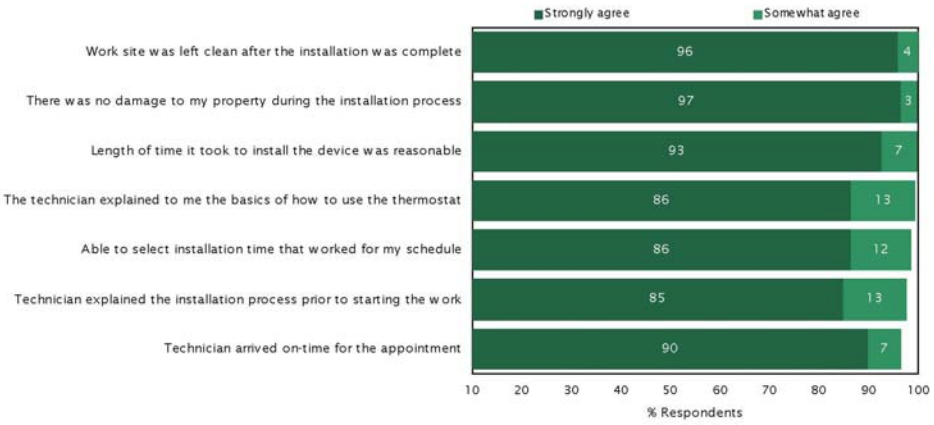
RATINGS FOR INSTALLATION PROCESS After confirming that the respondent was at home during the installation process (93% were), Question 10 presented respondents with a list of seven statements regarding the installation process and asked if they agreed or disagreed with each. Figure 28 presents truncated versions of the statements and the percentage of respondents who strongly or somewhat agreed with each.

All customers surveyed (100%) agreed that the work site was left clean after the installation was complete, there was no damage to their property during the installation process, and the length of time it took to install the device was reasonable. Nearly all respondents also agreed that the technician explained the basics of how to use the thermostat (99%), they were able to select an installation time that worked for their schedule (98%), the technician explained the installation process prior to starting the work (98%), and that the technician arrived on time for the appointment (97%).

Question 9 Pre-Treatment *Were you personally at home when the technician installed your new thermostat?*

Question 10 Pre-Treatment *Please indicate the extent to which you agree or disagree with the following statements about the installation process.*

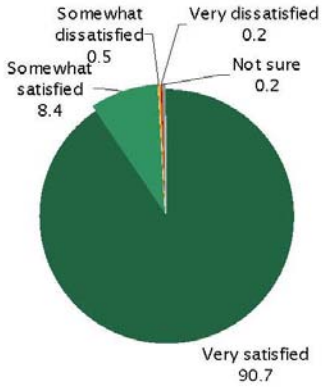
FIGURE 28 AGREEMENT WITH STATEMENTS ABOUT INSTALLATION PROCESS



OVERALL SATISFACTION WITH INSTALLATION After rating various specific aspects of the installation processing in Question 10, customers were asked about their *overall* satisfaction with the installation process for their new thermostat. Consistent with the high levels of agreement found with specific statements about the installation process, nearly every customer (99%) surveyed indicated they were either very (91%) or somewhat (8%) satisfied with the installation of their new thermostat (see Figure 29).

Question 11 Pre-Treatment *Overall, were you satisfied or dissatisfied with the installation process for your new thermostat?*

FIGURE 29 OVERALL SATISFACTION WITH INSTALLATION PROCESS



Less than one percent (1%) of customers indicated that they were dissatisfied with the installation of their new thermostat. Below are their verbatim responses when asked to describe the specific reasons why they were dissatisfied.

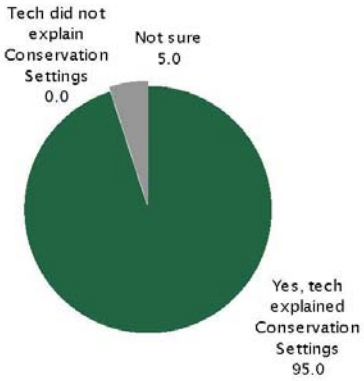
Question 12 Pre-Treatment *Please briefly describe why you were dissatisfied with the installation process.*

- The thermostat stat failed. A/C didn't work right had to pull fuses to shut it off.
- I waited the whole day for the person to show up. I selected the time 10-2, so I waited all morning and all afternoon. He arrived about 3 PM, then left about 4:30 PM.
- The pilot light blew out as a result of the installer's activities and he could not relight it. If I had not been there to identify and resolve the problem, the installation would not have taken place! And we would not be participants.

CONSERVATION DAY SETTINGS During the installation process, technicians were instructed to explain the different types of Conservation Day temperature settings that were available to those customers who retained control of their Conservation Day temperature offset. Overall, 95% of customers in this group indicated that the technician did explain the Conservation Day settings to them during installation (see Figure 30). Although half (50%) of participants did not recall the specific setting they chose during installation, 30% indicated that they selected Max Savings, 10% chose Balanced, 5% selected Comfort, whereas 5% chose Savings (see Figure 31).

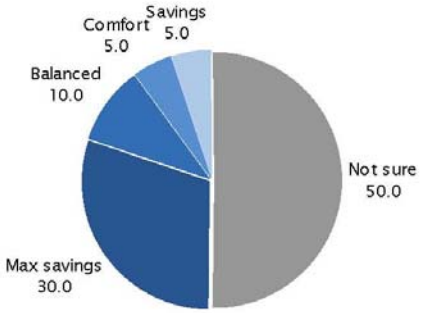
Question 13 Pre-Treatment *During the installation process, did the technician explain the different Conservation Settings that you could choose from on Conservation Days?*

FIGURE 30 TECHNICIAN EXPLAINED CONSERVATION SETTINGS



Question 14 Pre-Treatment *Do you recall which Conservation Setting was selected as your default for Conservation Days?*

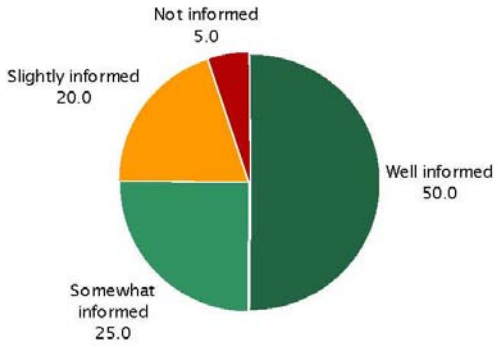
FIGURE 31 DEFAULT CONSERVATION DAY SETTING



INFORMED ABOUT CONSERVATION DAY THERMOSTAT SETTINGS The Conservation Day thermostat offset settings were labeled as Max Comfort, Comfort, Balanced, Savings, and Max Savings. They did not, however, indicate the specific temperature increase associated with each category. Accordingly, Question 15 in the Pre-Treatment survey asked participants who retained control over their Conservation Day settings to indicate how informed they feel about the temperature degree increase that is associated with each setting. Overall, 50% indicated that they were well-informed about the temperature degree increase associated with each Conservation Setting, 25% felt somewhat informed, 20% were slightly informed, whereas 5% stated that they were not at all informed (see Figure 32).

Question 15 Pre-Treatment *How informed do you feel about the temperature degree increase that is associated with each Conservation Setting?*

FIGURE 32 HOW INFORMED ABOUT CONSERVATION TEMPERATURE INCREASE SETTINGS



THERMOSTAT USE & RATINGS

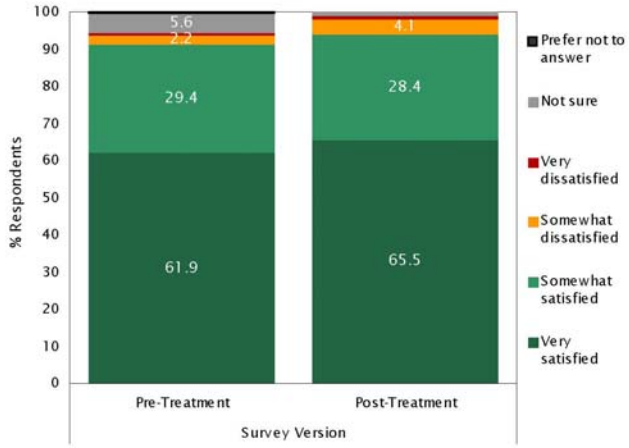
One of the incentives for customers who agreed to participate in the *2014 PowerStat® Program* was the receipt and installation of a new PowerStat® thermostat that would remain in the home after completion of the program. The Pre-Treatment and Post-Treatment surveys included a series of questions to assess customers' experiences and satisfaction with their new thermostat.

OVERALL SATISFACTION WITH THERMOSTAT

When asked to rate their overall satisfaction with the new thermostat, 91% of customers surveyed at the onset of the study (Pre-Treatment) were either very (62%) or somewhat (29%) satisfied. When asked again later in the program, overall satisfaction was a bit higher (94%), with 66% of customers indicating they were very satisfied and 28% saying they were somewhat satisfied (Figure 33).

Question 16/17 Pre-Treatment/Post-Treatment *Overall, how would you rate your satisfaction with the new thermostat?*

FIGURE 33 OVERALL SATISFACTION WITH NEW THERMOSTAT



During both the Pre-Treatment and Post-Treatment surveys, participants who were dissatisfied with their new thermostat were provided the opportunity to describe the specific reasons why they were dissatisfied in an open-ended manner. The verbatim responses to these questions are shown below for the Pre-Treatment and Post-Treatment surveys, respectively. Although the specific reasons varied, a common theme for many is that the unit is too complicated, lacks functionality, and is not user-friendly.

Question 17 Pre-Treatment *Please briefly describe why you are dissatisfied with the thermostat.*

- Would not work with our unit. Had to install another thermostat.
- It seems to run all the time so I have to turn it off.
- I am unable to set it to the desired settings.

- When it gets cooler in the evening and the house is cold it still comes on and I can't adjust the thermostat to cut the air off.
- Don't understand how to change the temp.
- Very hard to program. The heat cycles on and off at random. I have little control. The A/C seems to work better. I'm NOT HAPPY!
- 1) Could have been designed not to require large white backplate in as many cases; 2) Programming is complicated, should have been designed better; should also have been made so the thermostat can be temporarily disconnected and taken to a chair and table to do the programming.
- No weekend away and return settings like there is for weekend days. This is California - we also have core weekend hours we are away from home. Previous SMUD A/C control program Thermostat (Chromotherm III) had those settings. When the program is over, I want my Chromotherm III reinstalled.
- The weekend days do not have 4 time slots like week days for setting temperature.
- Instruction book and thermostat is too complicated to use. Basic functionality of on/off is fine but i have not used other features and functionalities. Should be more easily programmable for being expensive and $350 value of a thermostat.
- I am only not satisfied because I have not taken time to read the directions.
- I can't control through internet.
- I cannot tell if the air conditioner is on or off. I cannot tell what temperature I am trying to achieve. We had people over for dinner on Friday, and I thought tie air would come on at 7:00pm, but it did not.

Question 18 Post-Treatment *Please briefly describe why you are dissatisfied with the thermostat.*

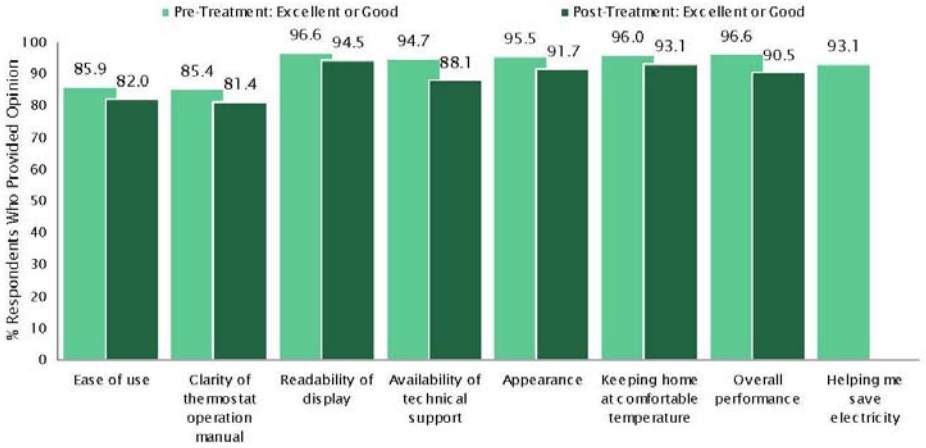
- Not knowing how to easily make a temporary change for a certain number of hours.
- I want my old one back. Too hard to figure this one out.
- Very hard to read, not very user intuitive, poor weekend time setting choices.
- Hard to program. Not showing an accurate temperature reading while on. Once you shut down the A/c, temp go down by 4 degree on rd he display. Meaning, that the A/c is auto on a little longer than it should in order to reach the right temperature.
- Too complicated to program and adjust.
- Not always sure how to set it so that it worked.
- Hard to get it to do what I want it to- seems like I set it at a certain temperature and then it changes to the parameters set by SMUD.
- Functions not working properly for example, setting the auto function for sleep time at 10 pm to be in the range of 74-82. Thinking that if the temperature goes over 82 the AC would come on and when temps fall below 74 then the heat would come on. That was never the case. Some nights house got down to 71 degree and heat never turned on.
- It cannot be changed remotely and the interface is not the best.
- It's ugly and the screen is always on which is disturbing at night. If I wanted a night light I would buy a night light.
- It's too bright. It never dims. I have to cover it with paper or it lights up the whole hallway at night. I know it is LED light, but it should be dark until I press a button

- Unable to reprogram it myself.
- Sat/Sunday only has only 2 temp changes - should be the same as weekdays. \ Visible on/off switch. We generally run with A/C off (other cooling strategies) turning it on when we need it (>95F outside, >80F inside, high humidity, and no sea breeze). Even the programming button for turning the A/C on/off is not labeled.
- Basic on/off functions were fine but anything beyond that i never attempted because it was too confusing.
- I don't seem to be able to get rid of change filter alarm flashing on the screen.
- When the weather is really hot, we would turn it on. Then, early in the morning when it gets cold, the heater turns on. I don't know why, but it wakes me up. I can tell the difference between the sounds, so I would have to get up and play with it.
- I have problems knowing when I have taken over the control or when the heater is going to come on. I have a feeling that I can't go over and turn on the heater when I want to.
- It is confusing, not user-friendly and difficult to program.
- Way too complicated.
- Too many steps to make changes.
- The light inside was way too bright. I had to put something over the thermostat when I went to bed so that I could sleep. I called and asked if there were a way to make it dim, but was told no.
- Hard to understand, program, too much.
- Too sensitive. A/c short cycles.
- The other one was easier to set and change.
- I did not know how to program it.

THERMOSTAT ATTRIBUTES In both the Pre-Treatment and Post-Treatment surveys, customers were asked to rate several attributes of the PowerStat® thermostat using a scale of excellent, good, fair, poor, or very poor. Figure 34 on the next page displays the percentage of respondents that rated an attribute as excellent or good among those who provided an opinion. Ratings were generally very positive and comparable between the Pre-Treatment (light green bars) and Post-Treatment (dark green bars) surveys. The highest rated attributes of the PowerStat® thermostat included the readability of the display (97% Pre-Treatment and 95% Post-Treatment), overall performance (97% and 91%), ability to keep their home at a comfortable temperature (96% and 93%), appearance (96% and 92%), the availability of technical support (95% and 88%), and helping the participant to save money (93% Post-Treatment only). Customers assigned somewhat lower ratings to the clarity of the thermostat operation manual (85% and 81%) and the thermostat's ease of use (86% and 82%).

Question 18/19 Pre-Treatment/Post-Treatment *Please rate the new thermostat on the following attributes.*

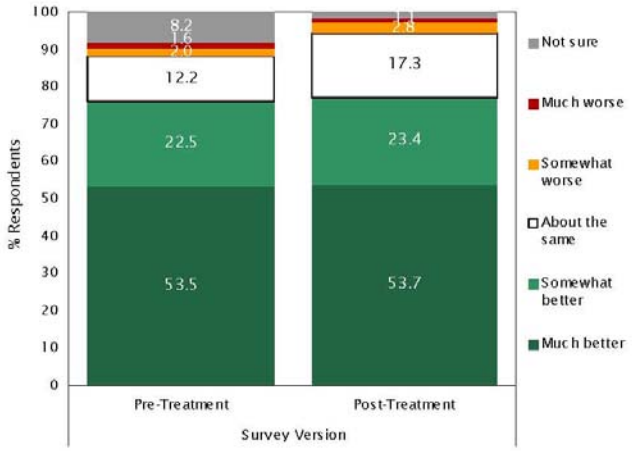
FIGURE 34 RATING ATTRIBUTES OF THE THERMOSTAT



ADDITIONAL PERFORMANCE MEASURES The final two questions in this series asked respondents to rate how their new thermostat performs in comparison to their prior thermostat, as well as the ease or difficulty they experienced in keeping their home at a comfortable temperature since the installation of the PowerStat® thermostat.

Question 19/20 Pre-Treatment/Post-Treatment *When compared to your prior thermostat, would you say that the new thermostat you received through the PowerStat® pilot program performs better, worse or about the same overall?*

FIGURE 35 NEW THERMOSTAT COMPARED WITH OLD THERMOSTAT

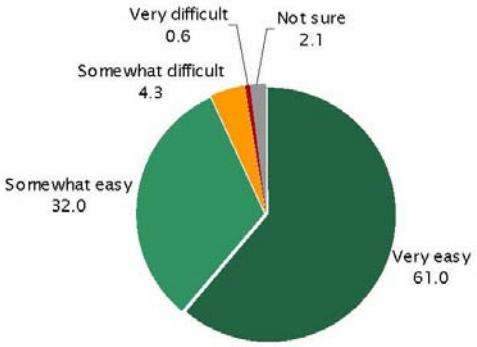


With respect to how the PowerStat® thermostat performs relative to their prior thermostat (see Figure 35), most pilot participants were favorably impressed by the PowerStat® thermostat. During the Pre-Treatment Survey, approximately three-quarters of respondents felt the PowerStat® thermostat was much (54%) or somewhat (23%) better than their prior thermostat, and another 12% said it was about the same. The findings were similarly favorable in the Post-Treatment Survey, with 54% of respondents stating that the PowerStat® thermostat was much better than their prior thermostat, 23% saying it was somewhat better, and 17% indicating it was about the same. At the conclusion of the study, less than 5% of participants indicated that the PowerStat® thermostat underperformed their prior thermostat.

As to the thermostat's performance in keeping their home at a comfortable temperature, more than half (61%) of respondents in the Post-Treatment Survey indicated that it was *very* easy to maintain their home at a comfortable temperature with the PowerStat® thermostat, and an additional 32% stated it was *somewhat* easy. Approximately 5% of customers found it difficult to maintain a comfortable temperature in their home with the new thermostat, whereas 2% were unsure.

Question 21 Post-Treatment *Since enrolling in the PowerStat® pilot program and receiving your new thermostat, how easy or difficult has it been to keep your home at a comfortable temperature?*

FIGURE 36 ABILITY TO KEEP HOME AT COMFORTABLE TEMPERATURE



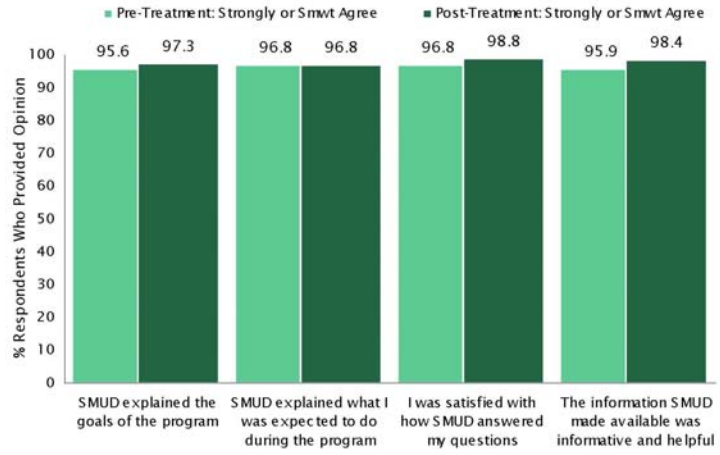
CUSTOMER SERVICE

Satisfaction with the PowerStat® program and perceptions of SMUD could be influenced by a variety of factors throughout the program, including the installation process, the quality and functionality of the PowerStat® thermostat, temperature comfort level on Conservation Days, and of course the customer's energy bill. During the Pre-Treatment and Post-Treatment surveys, respondents were asked about another important aspect of their experience during the pilot program: customer service.

SMUD CUSTOMER SERVICE The Pre-Treatment and Post-Treatment surveys presented respondents with four statements about SMUD's communication and general customer service during the program and asked if they agreed or disagreed with each. Figure 37 displays the performance statements tested, as well as the percentage of customers that strongly or somewhat agreed with each statement. As shown in the figure, SMUD received high marks across the board with respect to the customer service it provided during the program. At least 95% of customers who provided an opinion agreed with the statements: *SMUD clearly explained the goals of the program* (96% Pre-Treatment and 97% Post-Treatment), *SMUD clearly explained what I was expected to do during the program* (97% and 97%), *I was satisfied with how SMUD answered my questions* (97% and 99%), and *The information SMUD made available was informative and helpful* (96% and 98%).

Question 3/22 Pre-Treatment/Post-Treatment *Please indicate the extent to which you agree or disagree with the following statements about your experience enrolling in the PowerStat® pilot program.*

FIGURE 37 AGREEMENT WITH STATEMENTS ABOUT CUSTOMER SERVICE



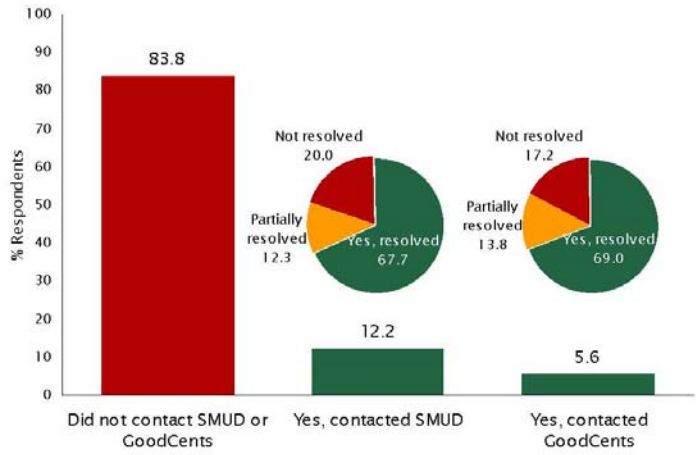
CUSTOMER SERVICE CONTACT & RESOLUTION The Post-Treatment Survey also included a short series of questions to assess the extent to which customers contacted SMUD and/or Good Cents regarding issues related to the PowerStat® program, and whether or not those issues were ultimately resolved to their satisfaction. Figure 38 summarizes the findings of these questions. Overall, 12% of customers indicated that they contacted SMUD, and another 6% stated that they contacted GoodCents during the program. Among customers who contacted SMUD, 68% said their issues were resolved to their satisfaction and another 12% said their issues were partially resolved. Among customers who contacted GoodCents, 69% indicated that their issues were resolved to their satisfaction and an additional 14% said they were partially resolved. Multiplying the percentages reveals that approximately 1% of participants had reason to contact GoodCents regarding an issue that ultimately was not resolved. The corresponding figure for customers who contacted SMUD was 2%.

Question 23 Post-Treatment *Did you contact SMUD and/or the installation company (GoodCents) during the past three months about any issue(s) related to the PowerStat® pilot program?*

Question 25 Post-Treatment *Was SMUD able to help resolve the issue(s) to your satisfaction?*

Question 26 Post-Treatment *Was the installation company (GoodCents) able to help resolve the issue(s) to your satisfaction?*

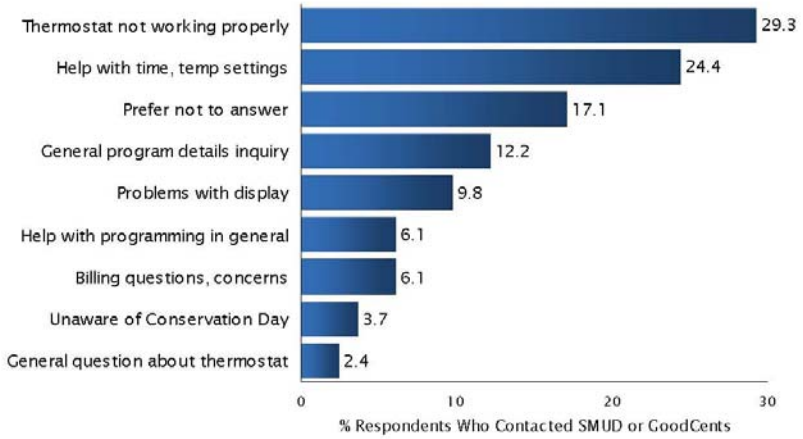
FIGURE 38 CONTACT WITH CUSTOMER SERVICE & RESOLUTION



The 16% of customers who contacted SMUD and/or GoodCents were asked to describe the issue or issues that prompted their contact. Common issues included the thermostat not working properly (29%), seeking assistance with programming time or temperature settings (24%), general questions about the program (12%), and problems with the thermostat display (10%).

Question 24 Post-Treatment *Please briefly describe the issue(s) that prompted your call to SMUD and/or the installation company (GoodCents) in the text box below.*

FIGURE 39 ISSUES THAT PROMPTED CALL TO SMUD/GOODCENTS



Conservation Day Behavior & Opinions

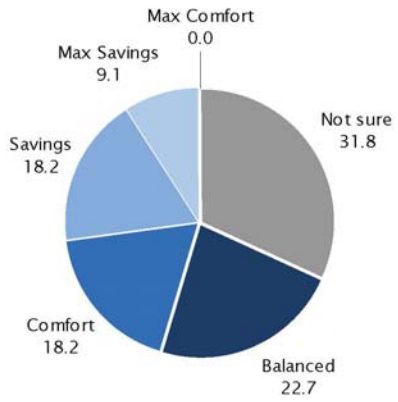
The *2012 PowerStat® Pilot* tested the effects of various pre-cooling strategies on comfort levels in the home. Participants were not educated on behavior change or incentivized in any particular way to alter their behavior during peak hours. In contrast to the above, the *2013 PowerStat® Program* incentivized certain participant groups to modify their behavior by including them in the Optimum Off-Peak Pricing Plan and/or providing them with control over their temperature offset during Conservation Day events. Questions that centered on Conservation Day behaviors are reported in this section.

CHOICE OF CONSERVATION DAY SETTINGS

The defining feature of Treatment Group 1 was that they retained control over their Conservation Day temperature offset throughout the summer season. One of the goals of the Post-Treatment survey was to understand *which* setting this group used most often during the summer season, as well as whether they tended to keep the same setting for the season or adjust the setting on an event-to-event basis.

Question 7 Post-Treatment *Which of the following Conservation Settings did you use most often this summer?*

FIGURE 40 CONSERVATION SETTINGS USED MOST OFTEN

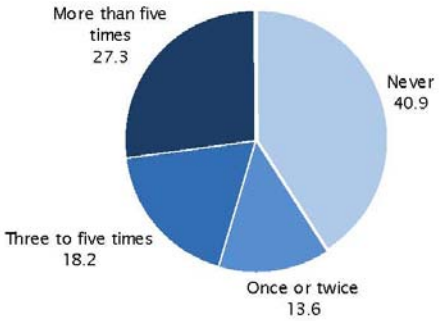


Members of Group 1 were quite mixed in their choice of Conservation Day settings (see Figure 40), with 9% typically selecting Max Savings, 18% Savings, 23% Balanced, 18% Comfort, and 32% being unsure. Not a single respondent from Group 1 indicated that they tended to use the Max Comfort setting.

As for how often they made changes to their Conservation Setting during the summer, 41% reported that they never changed the setting, 14% did so once or twice, 18% changed the setting three to five times, whereas 27% adjusted the Conservation Setting at least five times during the season (see Figure 41).

Question 8 Post-Treatment *How often did you make adjustments to your Conservation Setting this summer?*

FIGURE 41 FREQUENCY OF CONSERVATION SETTING ADJUSTMENT



NORMAL ENERGY-SAVING ACTIONS DURING PEAK PERIOD Regardless of their rate plan, all customers were next asked if they take any actions to reduce their household's energy use during peak hours on a *normal* summer day—not a Conservation Day. Overall, 83% of customers affirmed that they do take actions on normal summer days during peak hours to reduce their household's energy use (Figure 42). Interestingly, however, the tendency to report taking actions to reduce their peak-period electricity use was not significantly higher among participants assigned to the Optimum Off-Peak Pricing Plan (TOU CPP) when compared to those on the Standard Tiered Rate Plan as shown in Figure 43 on the next page.

Question 9 Post-Treatment *On a normal summer day (not a Conservation Day), do you take any actions to reduce your household's energy use during peak hours between 4PM and 7PM?*

FIGURE 42 REDUCED ENERGY USE DURING PEAK TIMES ON NON-CONSERVATION DAYS

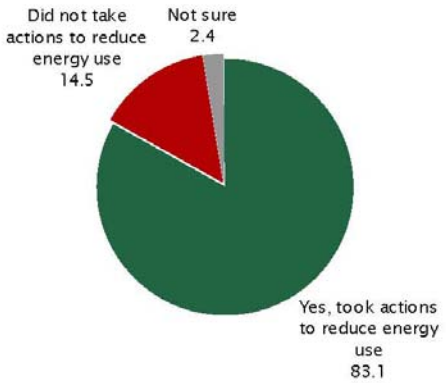
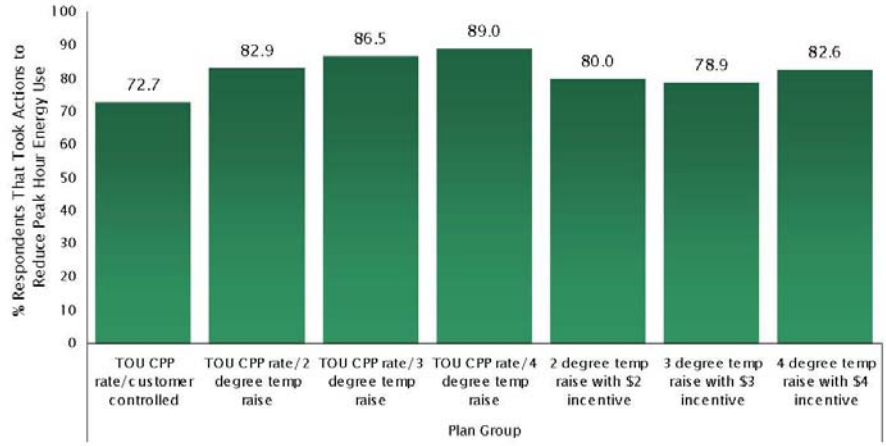


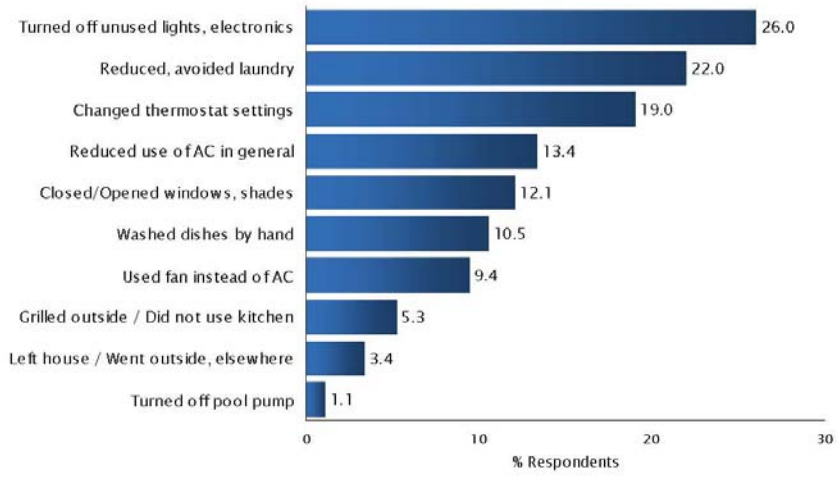
FIGURE 43 REDUCED ENERGY USE DURING PEAK TIMES ON NON-CONSERVATION DAYS BY PLAN GROUP



When asked in an open-ended manner to describe the types of actions they take on a normal summer day to reduce their household's energy use during peak hours (Figure 44), the most frequently reported behaviors included turning off lights and electronics (26%), reducing or avoiding doing laundry (22%), changing thermostat settings (19%), reducing their use of air conditioning in general (13%), adjusting windows and shades (12%), washing dishes by hand (11%), and using a fan instead of air conditioning (9%).

Question 10 Post-Treatment *What actions do you take on a normal summer day to reduce your household's energy use during peak hours?*

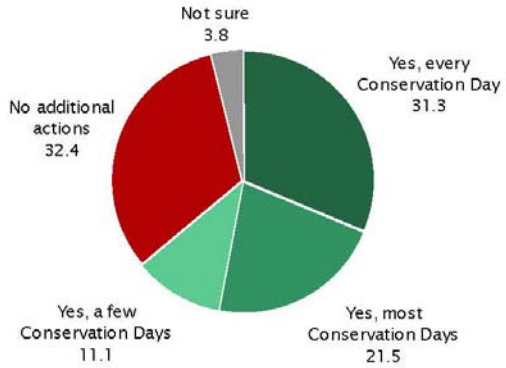
FIGURE 44 ACTIONS TAKEN TO REDUCE ENERGY USE DURING PEAK HOURS ON NON-CONSERVATION DAYS



PEAK-PERIOD ACTIONS ON CONSERVATION DAYS Having established the types of behavior changes customers normally make during peak hours, the survey next asked if they take any *additional* actions on Conservation Days to further reduce their electricity use between 4PM and 7PM. Approximately one-third (31%) stated that they did take additional actions every Conservation Day, 22% indicated that they took additional actions on most Conservation Days, 11% offered that they did so but on just a few Conservation days, whereas 32% did not take additional actions on Conservation Days and 4% were unsure (Figure 45).

Question 11 Post-Treatment *When compared to a normal summer day, did you take any additional actions on Conservation Days to further reduce your electricity use between the hours of 4PM to 7PM?*

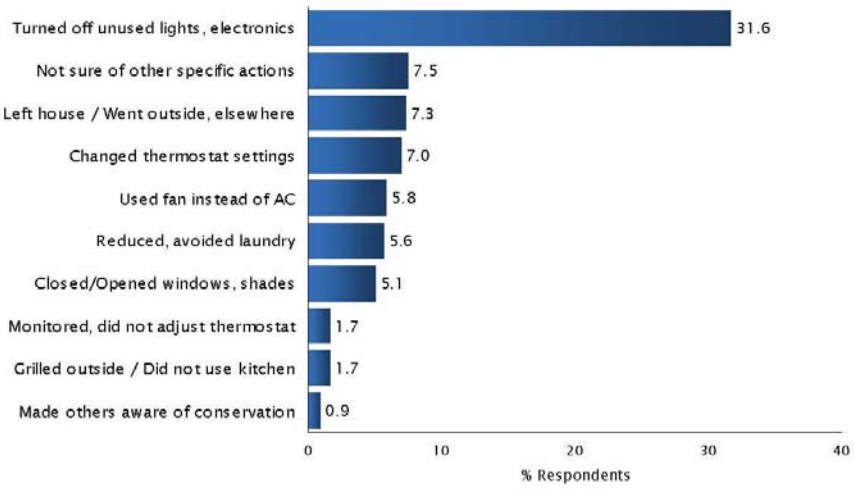
FIGURE 45 TOOK ADDITIONAL ACTIONS TO REDUCE ENERGY USE DURING PEAK HOURS ON CONSERVATION DAYS



As to what actions they took on Conservation Days in addition to their normal actions, 32% reported turning off lights and electronics, 7% left their home, 7% changed their thermostat settings, 6% reported using a fan instead of air conditioning, 6% reduced or avoided doing laundry, and 5% adjusted their windows and shades (see Figure 46).

Question 12 Post-Treatment *What additional actions did you take to further reduce your electricity use on Conservation Days between the hours of 4PM and 7PM?*

FIGURE 46 ADDITIONAL ACTIONS TAKEN TO REDUCE ENERGY USE DURING PEAK HOURS ON CONSERVATION DAYS



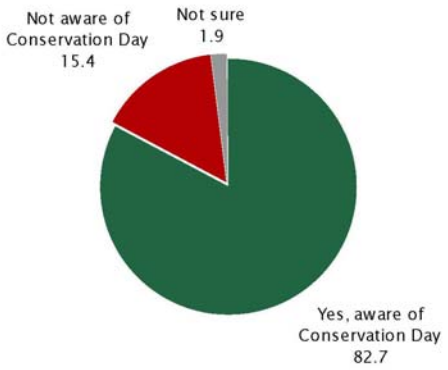
Comfort Level on Conservation Days

One of the primary goals of this study was to profile customers' experiences on Conservation Days. In particular, how did the different PowerStat® treatments affect customers' comfort levels? Did a particular treatment outperform the others in keeping customers' homes at a comfortable temperature? And how did comfort levels vary across the season? Answers to these and related questions are presented in this section.

AWARENESS OF CONSERVATION DAY The first question in this series simply asked respondents whether, prior to taking the Interim Survey, they were aware that a particular recent day was a Conservation Day and that their thermostat would automatically adjust to their Conservation Day setting. Across the summer season and multiple Conservation Day episodes, 83% of participants indicated that they were aware of the most recent Conservation Day, 15% were not aware, whereas 2% were unsure (Figure 47). With the exception of the September 6th episode, awareness levels for Conservation Days were consistently between 82% and 88% (see Figure 48).[3]

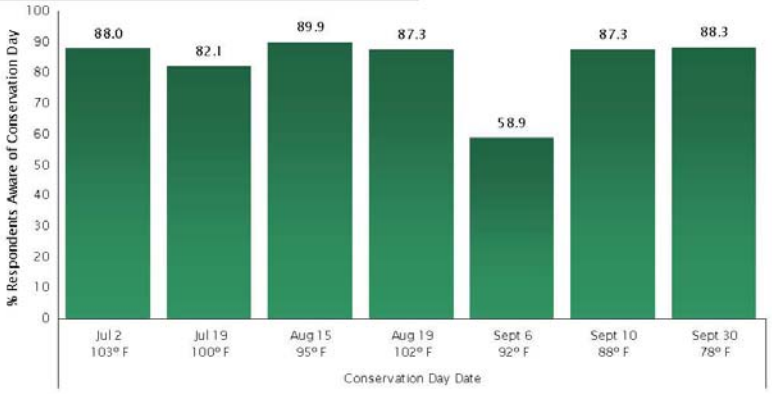
Question 1 Interim *Were you aware that <day, date> was a Conservation Day and the temperature on your thermostat would automatically adjust to your Conservation Day setting?*

FIGURE 47 AWARE OF CONSERVATION DAY



3. SMUD is currently investigating the September 6th episode to determine if customers in certain treatment groups did not receive Conservation Day signals to their thermostats.

FIGURE 48 AWARE OF CONSERVATION DAY BY CONSERVATION DAY DATE[4]

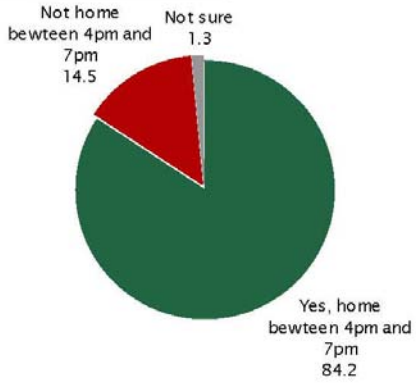


WERE YOU AT HOME TO EXPERIENCE THE EVENT? The survey next screened respondents to identify whether they were *personally* at home to experience the treatment during peak hours on the most recent Conservation Day. Only respondents who were at home during these times were asked questions regarding their comfort level during peak hours.

Across the season, an average 84% of participants surveyed indicated that they were at home for at least 30 minutes between the hours of 4PM and 7PM on the Conservation Day (Figure 49). Although the percentage of participants who were at home during peak hours on a Conservation Day varied somewhat by treatment group and event, it never dipped below 74% for any group or episode (see Figures 50 & 51 on the next page).

Question 2 Interim *Were you personally at home for at least 30 minutes on <day, date> between 4PM and 7PM?*

FIGURE 49 HOME DURING PEAK HOURS ON CONSERVATION DAY



4. SMUD is currently investigating the September 6th episode to determine if customers in certain treatment groups did not receive Conservation Day signals to their thermostats for this episode.

FIGURE 50 HOME DURING PEAK HOURS ON CONSERVATION DAY BY TREATMENT GROUP

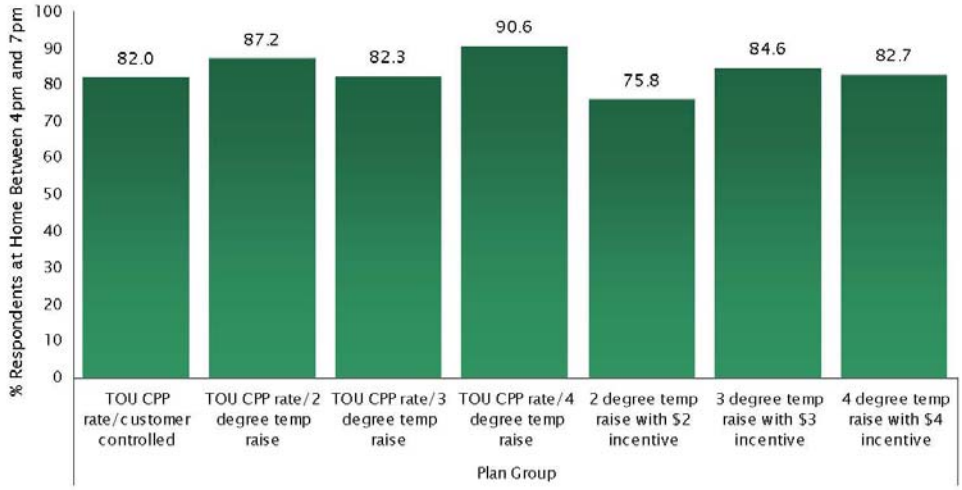
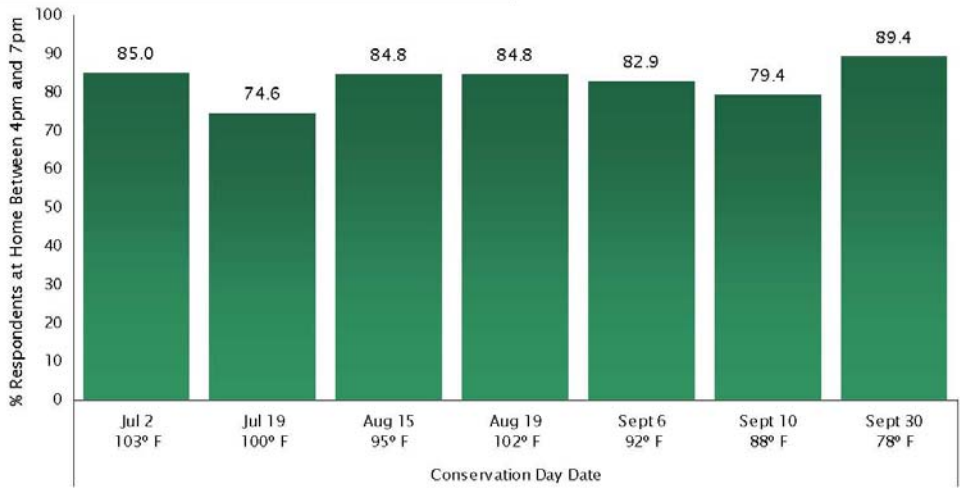


FIGURE 51 HOME DURING PEAK HOURS ON CONSERVATION DAY BY CONSERVATION DAY DATE



RESPONDENT COMFORT LEVEL RATINGS Respondents who indicated that they were at home during peak hours on a Conservation Day and chose not to opt-out of the treatment were asked to rate the temperature in their home between 4PM and 7PM on a five point scale of much too hot, somewhat too hot, about right/comfortable, somewhat too cold, or much too cold. Across the summer season, 57% indicated that the temperature in their home was about right/comfortable during peak hours on Conservation Days, 39% rated it a bit too hot, 4% stated that it was much too hot, whereas less than 1% indicated it was too cool (see Figure 52).

Question 3 Interim *How would you rate the temperature in your home on <day, date> between 4PM and 7PM?*

FIGURE 52 TEMPERATURE RATING DURING PEAK HOURS

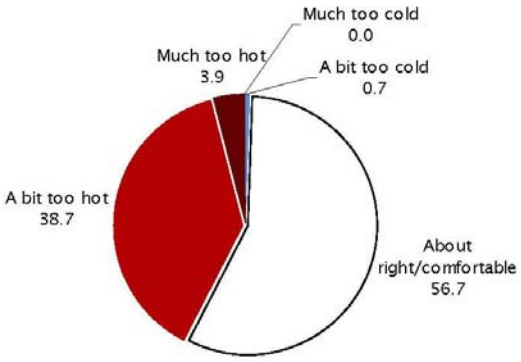


Figure 53 shows how Conservation Day comfort levels varied across treatment groups. The most striking pattern in the figure is the general *consistency* of the responses—the percentage who indicated they were comfortable ranged between 53% and 61% across all seven groups. Similarly, the temperature offset value chosen did not significantly impact participants' comfort levels among those who were treated with a set temperature increase for the entire season (see Figure 54). Those who had a four degree increase expressed comfort levels that were nearly identical to those who experienced a two degree offset.

FIGURE 53 TEMPERATURE RATING DURING PEAK HOURS BY PLAN GROUP

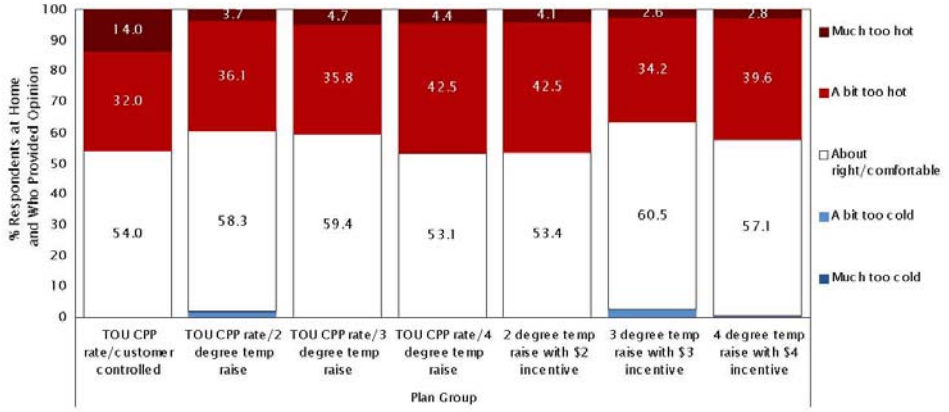
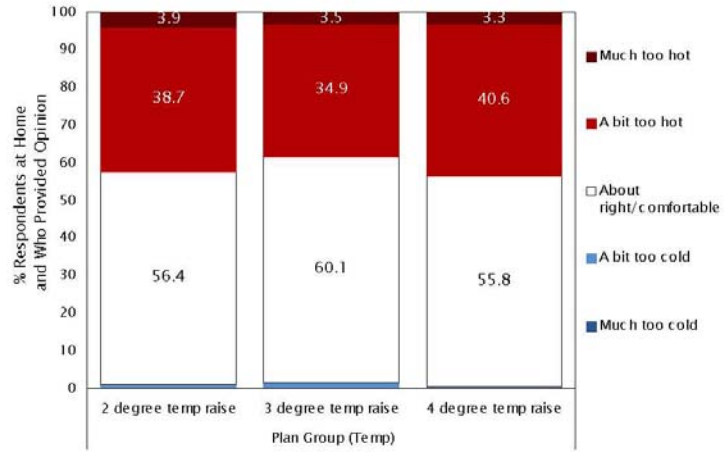
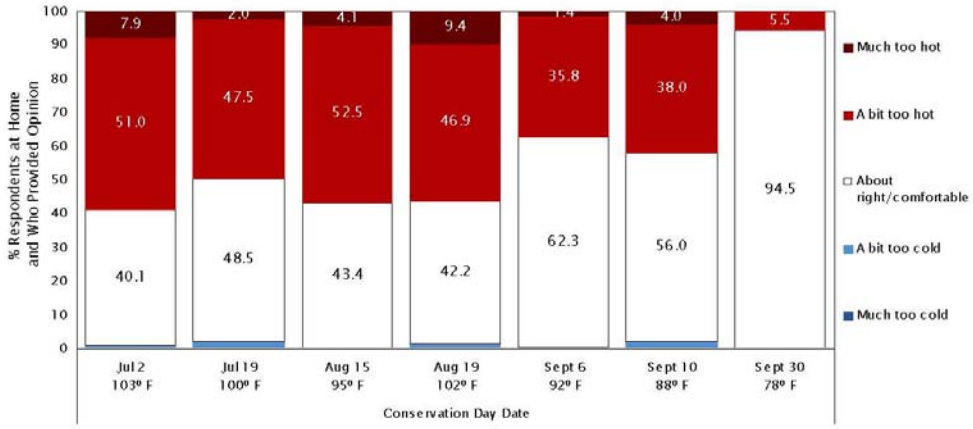


FIGURE 54 TEMPERATURE RATING DURING PEAK HOURS BY PLAN GROUP (TEMP)[5]



Although comfort levels did not vary significantly across treatment groups, they did vary across Conservation Days in a way that indicates outside temperature does impact in-home comfort despite the use of air conditioning. As shown in Figure 55, comfort levels expressed during the hotter Conservation Day episodes in July and August were substantially lower than the levels reported for the cooler September episodes.

FIGURE 55 TEMPERATURE RATING DURING PEAK HOURS BY CONSERVATION DAY DATE

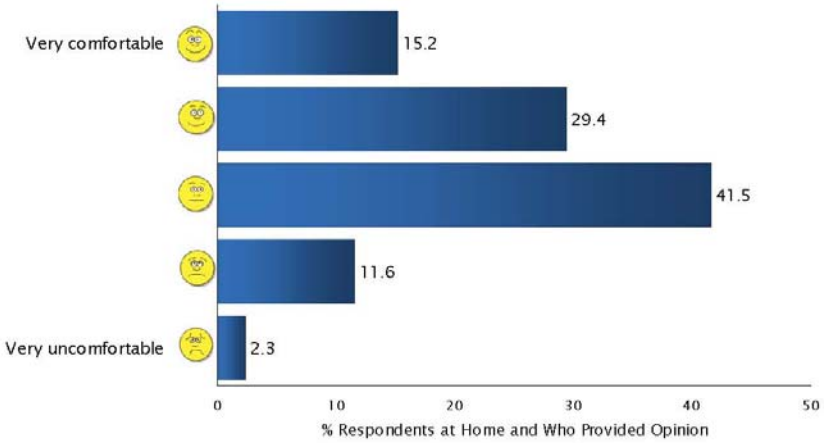


5. This figure combines Groups 2 and 3 according to their temperature offset. Because Group 1 retained control over their temperature offset and could vary the degree, Group 1 participants are not included in this figure.

PERSONAL COMFORT SCALE In addition to asking respondents to rate the temperature in their home using the scale shown in Question 3, all participants were also asked to rate their personal comfort using a variation on the Wong-Baker visual scale for measuring pain. As shown in Figure 56, 42% of customers selected the face associated with the middle of the comfort scale, 29% selected the somewhat comfortable face, and 15% selected the very comfortable face as best representing their comfort level on the Conservation Day during peak hours. Overall, 12% of participants chose the somewhat uncomfortable face and 2% the very uncomfortable face to represent their comfort level during peak hours on the Conservation Day.

Question 4 Interim *Thinking about the temperature in your home on <day, date> between 4PM and 7PM, which of the following best represents your comfort level?*

FIGURE 56 COMFORT LEVEL DURING PEAK HOURS ON CONSERVATION DAY



To ease comparisons across treatment groups, the five-point face scale shown in Question 4 can be converted to a mean score with 1 representing very uncomfortable and 5 representing very comfortable. Figures 57-59 present the mean scores for each identified subgroup in the dark green bar, and identify the upper and lower bounds of the 95% confidence interval for the mean using the light green brackets. As shown in the figures, there was very little difference in the average Conservation Day comfort levels expressed by participants based on treatment group (Figure 57) and temperature offset (Figure 58). The average comfort level ranged from a low of 3.31 to a high of 3.59, although these differences were not statistically significant. The average comfort scores were substantially higher for the September 30th Conservation Day episode, although as noted earlier that reflects the much lower temperature on that day (see Figure 59).

FIGURE 57 MEAN COMFORT LEVEL DURING PEAK HOURS ON CONSERVATION DAY BY PLAN GROUP

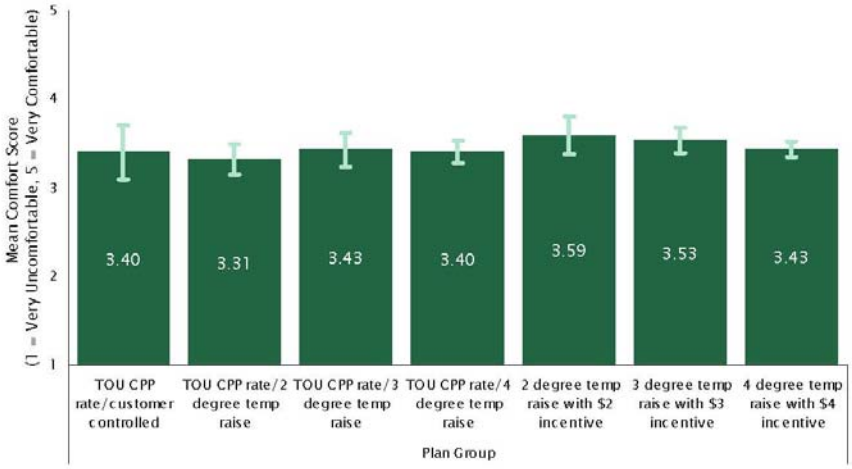


FIGURE 58 MEAN COMFORT LEVEL DURING PEAK HOURS ON CONSERVATION DAY BY PLAN GROUP (TEMP)

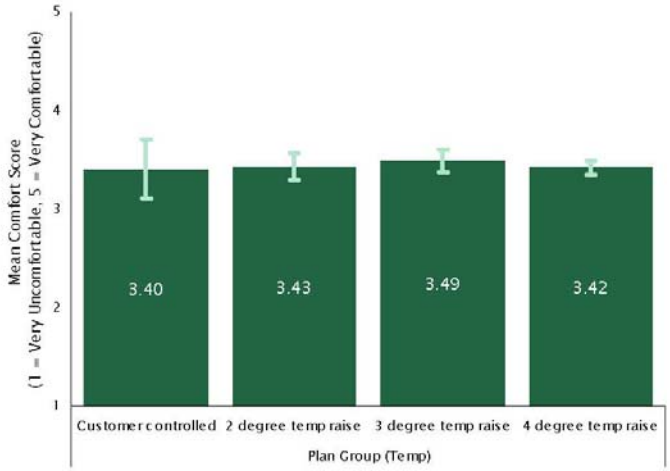
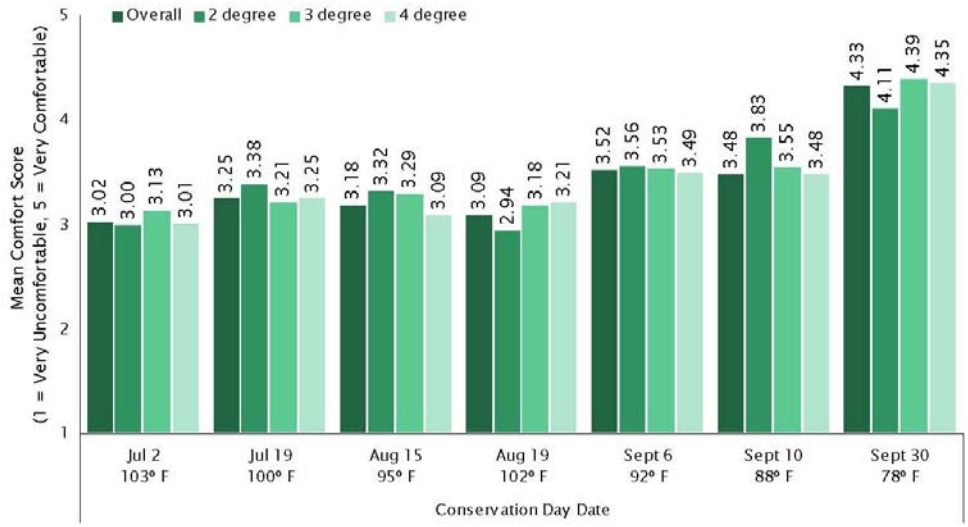


FIGURE 59 MEAN COMFORT LEVEL DURING PEAK HOURS ON CONSERVATION DAY BY PLAN GROUP (TEMP) & CONSERVATION DAY DATE



ATTITUDES ABOUT SMUD

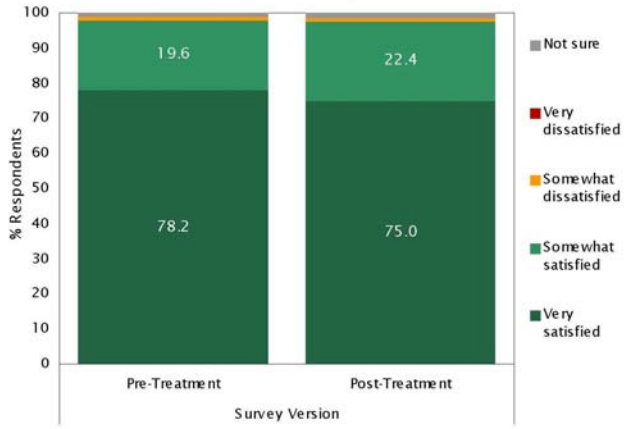
The PowerStat® program is just one example of the types of innovative programs and services that SMUD offers its customers to help them better manage their energy use, save money, and improve the environment. Awareness of and participation in such programs often contributes to higher levels of customer satisfaction and more positive views of SMUD as a leader in the utility industry, an energy partner, and an active member of the local community[6]. Although the focus of the PowerStat® surveys was on profiling customers' experiences and comfort levels throughout the PowerStat® program, one related area of interest was to understand how participation in the program may have affected customers' attitudes about SMUD.

OVERALL SATISFACTION WITH SMUD

The Pre-Treatment and Post-Treatment surveys asked customers to indicate if, overall, they were satisfied or dissatisfied with the job that SMUD is doing to provide electricity services to their household. Because this question does not reference a specific aspect of service and requested that the respondent consider SMUD's performance in general, the findings of this question may be regarded as an overall performance rating for the company. Comparing the overall satisfaction ratings with SMUD between the Pre-Treatment and Post-Treatment surveys is an *indirect* way of gauging the impact of program participation on respondents' opinions of SMUD's performance in providing electricity services.

Question 23/27 Pre-Treatment/Post-Treatment *Generally speaking, are you satisfied or dissatisfied with the job SMUD is doing to provide electricity services to your household?*

FIGURE 60 OVERALL SATISFACTION WITH SMUD



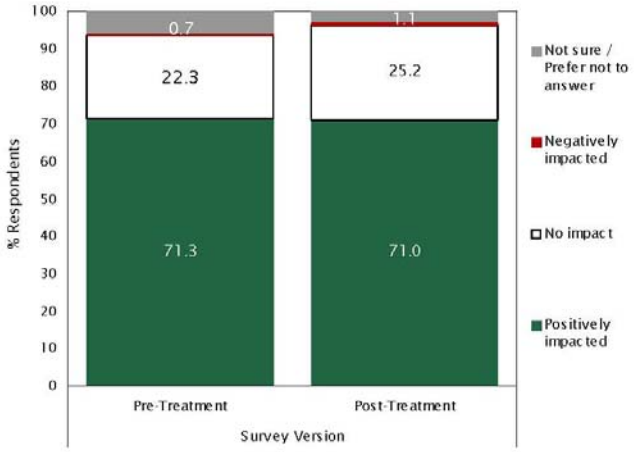
As shown in Figure 60, at the onset of the study nearly all (98%) of customers indicated they were satisfied with SMUD's efforts to provide electricity services, with more than three-quarters (78%) stating that they were *very* satisfied. Overall satisfaction was virtually identical at the completion of the study, with 97% indicating they were very (75%) or somewhat (22%) satisfied. The differences between the satisfaction ratings pre and post-program were not statistically significant.

6. Source: SMUD Perception Tracker Study, 2013.

IMPACT OF PARTICIPATION ON ATTITUDES ABOUT SMUD In contrast to the indirect method described above, the surveys also directly asked respondents whether their participation in the PowerStat® program had impacted their opinion of SMUD in any way. As displayed in Figure 61, 71% of customers surveyed just after installation of their PowerStat® thermostat (Pre-Treatment Survey) indicated that their participation in the program to that point had positively impacted their opinion of SMUD, 22% said it had no impact, less than 1% indicated it had negatively impacted their opinion of SMUD, and the remaining 6% were unsure. At the completion of the program (Post-Treatment Survey), the findings were nearly identical, with 71% stating that their participation had positively impacted their opinion of SMUD, 25% said it had no impact, and 1% felt it had a negative impact. Collectively, the findings of these questions suggest that simply making the program and free thermostat available to these customers had a positive impact for most (71%), and their participation in the pilot after enrollment did not significantly alter their very favorable opinions of SMUD.

Question 24/28 Pre-Treatment/Post-Treatment *Would you say that your participation in the PowerStat® pilot program to this point has positively impacted your opinion of SMUD, negatively impacted your opinion of SMUD, or has it not changed your opinion either way?*

FIGURE 61 EFFECT OF PROGRAM PARTICIPATION ON OPINION OF SMUD



RATE PLAN

In the final section of the Post-Treatment survey, participants were asked to identify the rate plan their household is on, as well as their understanding of the different rate plans offered by SMUD.

RATE PLAN FOR HOUSEHOLD When asked to select between the Optimum Off-Peak Pricing Plan and the Standard Tiered Rate Plan, nearly half (49%) of respondents could not identify which plan their household is on. The remaining respondents were rather evenly divided between those who thought their household was on the Standard Tiered Rate Plan (26%) and those who selected the Optimum Off-Peak Pricing Plan (25%).

Question D1 Post-Treatment *Which of the following rate plans is your household on?*

FIGURE 62 SELF-REPORTED RATE PLAN

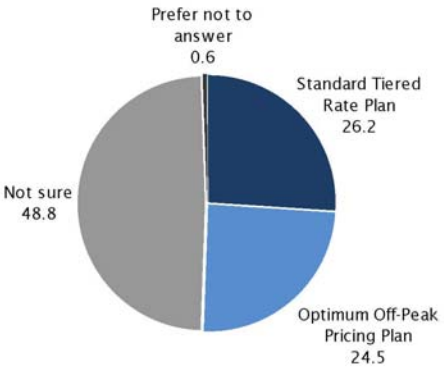
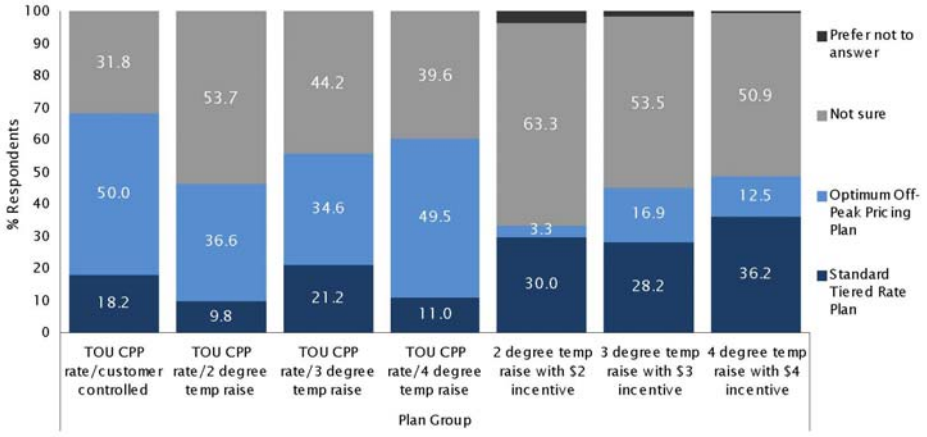


Figure 63 shows the relationship between the rate plan a respondent thought they were on and their treatment group. The four bars on the left correspond to participants who actually receive the Optimum Off-Peak Pricing Plan, whereas the three bars on the right represent groups with the Standard Tiered Rate. As the figure indicates, in all but one case a minority of respondents were able to correctly identify the rate plan for their household.

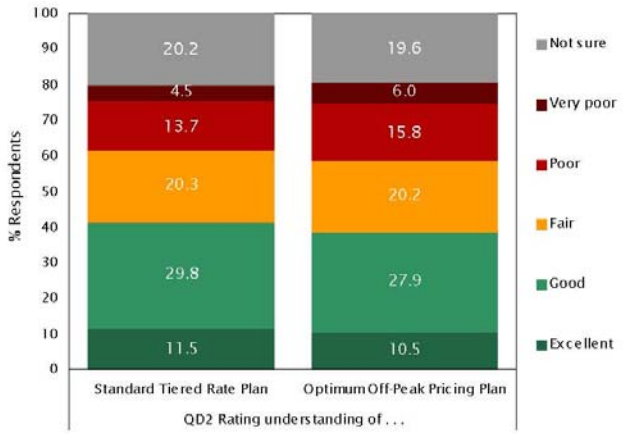
FIGURE 63 SELF-REPORTED RATE PLAN BY PLAN GROUP



UNDERSTANDING OF RATE PLANS Having established whether participants know which rate plan their household is currently on, the survey next asked that they describe their understanding of each rate plan. As shown in Figure 64, there was little difference between the two plans with respect to how well customers stated they understood the plan. For the Standard Tiered Rate Plan, 41% rated their understanding of the plan as excellent or good, 20% indicated it is fair, whereas 18% confided they have a poor or very poor understanding of the plan and 20% were unsure. The results for the Optimum Off-Peak Pricing Plan were very similar, with 38% rating their understanding of the plan as excellent or good, 20% indicating it is fair, 22% stating they have a poor or very poor understanding of the plan, and 20% unsure.

Question D2 *How would you rate your understanding of each rate plan?*

FIGURE 64 UNDERSTANDING OF RATE PLANS



TRUE NORTH RESEARCH

SMUD PowerStat 13 Pre-Treatment Survey
Residential Customers
Final Toplines (449 Respondents)
December 2013

Section 1: Introduction

Welcome! Thank you for taking this survey about the PowerStat® pilot program in which your household is participating. By sharing your opinions with us, you will help SMUD evaluate the PowerStat® pilot and decide what type of program to offer to customers in the future.

This is the first of several surveys that you agreed to complete as part of your participation in the pilot. Your individual responses to this and future surveys will be kept strictly CONFIDENTIAL.

Web Instructions:
During the survey, please do not use your browser's 'Forward' and 'Back' buttons. To move through the survey, use the 'Back' and 'Next' buttons at the bottom of each page.

When you have finished the survey click the 'Done' button to submit your survey.

If you need to stop while taking this survey, your answers will be saved so that you may return and resume where you left off.

To see the survey most clearly, MAXIMIZE this browser screen.

Section 2: Participation & Overall Satisfaction

Q1 In your own words, what would you say was the main reason you signed up to participate in the PowerStat® pilot program? *Insert response in text box below.* Verbatim responses recorded and later grouped into categories shown below.

Save money / Reduce bill	56%
Conserve energy / Reduce electricity	31%
Acquire new thermostat, technology	19%
Not sure / Prefer not to answer	5%
Help protect environment, reduce pollution	4%
Better monitor, track energy usage	2%
Learn more about program, energy reduction	1%
Keep home at more comfortable temperature	1%
Received email, decided to sign up / Curiosity	1%
Ease of participation, thermostat use	1%

Q2 By participating in this program, do you expect to _____?

	Randomize	Yes, definitely	Yes, probably	No, probably not	No, definitely not	Not Sure	Prefer not to answer
A	Save money on your electric bill	64%	31%	3%	0%	2%	0%
B	Help protect the environment	46%	41%	8%	1%	4%	1%
C	Learn how to better conserve electricity	44%	43%	9%	0%	3%	0%

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D	Actually use less electricity	50%	40%	6%	0%	3%	0%
E	Have more control over your electricity bill	43%	40%	10%	1%	6%	0%
F	Keep your home at a comfortable temperature	36%	46%	12%	1%	5%	0%

Q3	Please indicate the extent to which you agree or disagree with the following statements about your experience enrolling in the PowerStat® pilot program.							
	Randomize	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree	Not Sure	Doesn't Apply	Prefer not to answer
A	SMUD clearly explained the goals of the program	68%	28%	2%	0%	1%	0%	0%
B	SMUD clearly explained what I was expected to do during the program	68%	27%	3%	0%	1%	1%	0%
C	I was satisfied with how SMUD's representative answered my questions	72%	22%	1%	0%	1%	4%	0%
D	The information SMUD made available was informative and helpful	65%	32%	2%	0%	1%	0%	0%

Section 3: Plan Selection

This section appears in online version of survey only due to need to show Participation Agreement Letter

When enrolling in the PowerStat® pilot program, you were presented with the following Participation Agreement which described different plan options. Please take a moment to review the document, then hit the next button. *Show document.*

Q4	In your opinion, how clear was the letter in describing the different plans and options from which you could choose?		
	1	Very clear	41%
	2	Somewhat clear	51%
	3	Not at all clear	5%
	98	Not sure	3%
	99	Prefer not to answer	0%

Q5	Do you recall which plan you selected?			
	1	Plan A: Optimum Off Peak Rate + Energate Thermostat	23%	*Ask Q6*
	2	Plan B: 2, 3, 4 Plan + Energate Thermostat	52%	*Skip to Q7*
	98	Don't recall/Not sure	24%	*Skip to Q9*
	99	Prefer not to answer	1%	*Skip to Q9*

Q6	Did you check the 'Yes' box to allow SMUD to automatically raise your thermostat temperature on Conservation Days?		
	1	Yes	91%
	2	No	4%
	98	Don't recall/Not sure	5%
	99	Prefer not to answer	0%
Q7	What was the main reason you selected this plan over the others?		
	1	Maximize my savings	54%
	2	Guaranteed payment per event	6%
	3	I wanted to retain control of my thermostat on event days	9%
	4	I wanted SMUD to automatically manage my thermostat on event days	15%
	5	I wanted to make sure no one in my house will over-ride thermostat settings on event days	2%
	6	Other	7%
	98	Not sure	6%
	99	Prefer not to answer	1%

Ask Q8 if (Q5=1 AND Q6=1) OR Q5=2
(ie, Q8 is asked of Groups 2 & 3 based on self-reported assignment. Both of these groups selected SMUD to automatically control thermostat on Conservation Days)

Q8	Do you recall which automatic temperature increase you selected for Conservation Days?		
	1	2 Degree	19%
	2	3 Degree	16%
	3	4 Degree	57%
	98	Don't recall/Not sure	8%
	99	Prefer not to answer	0%

Section 4: Installation Process				
Q9	Were you personally at home when the technician installed your new thermostat?			
	1	Yes	93%	*Ask Q10*
	2	No	7%	*Skip to Q13*
	99	Prefer not to answer	0%	*Skip to Q13*

Q10	Please indicate the extent to which you agree or disagree with the following statements about the installation process.						
	Read in Order	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree	Not Sure	Doesn't Apply
A	I was able to select an installation appointment time that worked best for my schedule	86%	12%	1%	0%	0%	0%
B	The technician arrived on-time for the appointment	90%	7%	2%	1%	0%	0%
C	The technician explained the installation process prior to starting the work	85%	13%	2%	0%	0%	0%
D	The length of time it took to install the device was reasonable	93%	7%	0%	0%	0%	0%
E	The work site was left clean after the installation was complete	96%	4%	0%	0%	0%	0%
F	There was no damage to my property during the installation process	97%	3%	0%	0%	0%	0%
G	The technician explained to me the basics of how to use the thermostat	86%	13%	0%	0%	0%	0%

Q11	Overall, were you satisfied or dissatisfied with the installation process for your new thermostat?			
	1	Very satisfied	91%	*Skip to Q13*
	2	Somewhat satisfied	8%	*Skip to Q13*
	3	Somewhat dissatisfied	0%	*Ask Q12*
	4	Very dissatisfied	0%	*Ask Q12*
	98	Not sure	0%	*Skip to Q13*
	99	Prefer not to answer	0%	*Skip to Q13*

Q12	Please briefly describe why you were dissatisfied with the installation process. *Insert response in text box below.* Verbatim responses for the 3 dissatisfied customers presented below.
	The T stat failed. A/C didn't work right had to pull fuses to shut it off.
	I waited the whole day for the person to show up. I selected the time 10-2, so I waited all morning and all afternoon. He arrived about 3 PM, then left about 4:30 PM.
	The pilot light blew out as a result of the installers activities and he could not relight it. If I had not been there to identify and resolve the problem, the installation would not have taken place! And we would not be participants.

Only ask Q13-Q15 if in Group 1
(Note: Group 1=Plan A + No Auto. These questions will be asked based on their actual group assignment, NOT what they 'recall' in the survey)

Q13	During the installation process, did the technician explain the different Conservation Settings that you could choose from on Conservation Days?		
	1	Yes	95%
	2	No	0%
	98	Don't know/wasn't there	5%
	99	Prefer not to answer	0%
Q14	Do you recall which Conservation Setting was selected as your default for Conservation Days?		
	1	Max Comfort	0%
	2	Comfort	5%
	3	Balanced	10%
	4	Savings	5%
	5	Max Savings	30%
	98	Don't recall/Not sure	50%
	99	Prefer not to answer	0%
Q15	How informed do you feel about the temperature degree increase that is associated with each Conservation Setting?		
	1	Well informed	50%
	2	Somewhat informed	25%
	3	Slightly informed	20%
	4	Not informed	5%
	98	Don't recall/Not sure	0%
	99	Prefer not to answer	0%

Section 5: Use & Product Ratings

The next few questions focus on the thermostat and your experiences when using it.

Q16	Overall, how would you rate your satisfaction with the new thermostat?			
	1	Very satisfied	62%	*Skip to Q18*
	2	Somewhat satisfied	29%	*Skip to Q18*
	3	Somewhat dissatisfied	2%	*Ask Q17*
	4	Very dissatisfied	1%	*Ask Q17*
	98	Not sure	6%	*Skip to Q18*
	99	Prefer not to answer	0%	*Skip to Q18*

Q17	Please briefly describe why you are dissatisfied with the thermostat. *Insert response in text box below.* Verbatim responses for the 13 dissatisfied customers presented below.
	Would not work with our unit. Had to install another thermostat.
	It seems to run all the time so I have to turn it off.
	I am unable to set it to the desired settings.
	When it gets cooler in the evening and the house is cold it still comes on and I can't adjust the thermostat to cut the air off.
	Don't understand how to change the temp.
	Very hard to program. The heat cycles on and off at random. I have little control. The A/C seems to work better. I'm NOT HAPPY!
	1) Could have been designed not to require large white backplate in as many cases; 2) Programming is complicated, should have been designed better; should also have been made so the thermostat can be temporarily disconnected and taken to a chair and table to do the programming.
	No weekend away and return settings like there is for weekend days. This is California - we also have core weekend hours we are away from home. Previous SMUD A/C control program Thermostat (Chromotherm III) had those settings. When the program is over, I want my Chromotherm III reinstalled.
	The weekend days do not have 4 time slots like week days for setting temperature.
	Instruction book and thermostat is too complicated to use. Basic functionality of on/off is fine but i have not used other features and functionalities. Should be more easily programmable for being expensive and $350 value of a thermostat.
	I am only not satisfied because I have not taken time to read the directions.
	I can't control through internet.
	I cannot tell if the air conditioner is on or off. I cannot tell what temperature I am trying to achieve. We had people over for dinner on Friday, and I thought tie air would come on at 7:00pm, but it did not.

Q18 Please rate the new thermostat on the following attributes.

	Randomize. But always have H appear last.	Excellent	Good	Fair	Poor	Very Poor	Not Sure/Doesn't Apply
A	Ease of use	44%	38%	11%	1%	1%	5%
B	Clarity of thermostat operation manual	41%	39%	12%	2%	0%	7%
C	Readability of display	74%	22%	3%	0%	0%	1%
D	Availability of technical support	29%	27%	3%	0%	0%	42%
E	Appearance	65%	29%	4%	0%	0%	1%
F	Keeping my home at a comfortable temperature	50%	36%	3%	0%	0%	10%
G	Helping me save electricity	36%	31%	5%	0%	0%	29%
H	Overall performance	51%	37%	2%	0%	0%	9%

Section 6: Thermostat Comparison			
Q19	When compared to your prior thermostat, would you say that the new thermostat you received through the PowerStat® pilot program performs better, worse or about the same overall?		
	1	Much better	53%
	2	Somewhat better	22%
	3	About the same	12%
	4	Somewhat worse	2%
	5	Much worse	2%
	98	Not sure	8%
	99	Prefer not to answer	0%
Q20	During the summer, what temperature is your thermostat normally set at between noon and 4PM?		
			Average temp: 78.32
Q21	During the summer, what temperature is your thermostat normally set at between 4PM and 7PM?		
			Average temp: 77.89

Section 7: Thermostat Adjusting Behavior			
Q22	Which of the following best describes the way you typically control the temperature in your home?		
	1	We rely on the thermostat program to automatically adjust the temperature in our home. We don't make manual adjustments.	14%
	2	We *generally* rely on the thermostat program to automatically adjust the temperature in our home, but we occasionally manually adjust the thermostat temperature too.	58%
	3	We manually adjust the thermostat settings to control the temperature in our home. We don't use the auto programming features of the thermostat.	26%
	98	Not sure	2%
	99	Prefer not to answer	0%

Section 8: Attitudes about SMUD			
Q23	Generally speaking, are you satisfied or dissatisfied with the job SMUD is doing to provide electricity services to your household?		
	1	Very satisfied	78%
	2	Somewhat satisfied	20%
	3	Somewhat dissatisfied	1%
	4	Very dissatisfied	0%
	98	Not sure	1%
	99	Refused	0%
Q24	Would you say that your participation in the PowerStat® pilot program to this point has positively impacted your opinion of SMUD, negatively impacted your opinion of SMUD, or has it not changed your opinion either way?		
	1	Positively impacted opinion of SMUD	71%
	2	Negatively impacted opinion of SMUD	1%
	3	No impact	22%
	98	Not sure	6%
	99	Prefer not to answer	0%

Section 9: Household Information			
Next are a few background questions for statistical purposes.			
Q25	Which of the following best describes your home?		
	1	Detached, single family residence	93%
	2	Duplex	2%
	3	Townhome/row house/triplex	3%
	4	Apartment/condominium	1%
	5	Mobile home	0%
	98	Not sure	0%
	99	Prefer not to answer	0%
Q26	What is the approximate square footage of your home?		
			Average sqft: 1,792

Q27	Including yourself, how many people live in your home?			
	1	One	21%	*Skip to Q29*
	2	Two	43%	*Ask Q28*
	3	Three	16%	*Ask Q28*
	4	Four	12%	*Ask Q28*
	5	Five or more	6%	*Ask Q28*
	99	Prefer not to answer	2%	*Ask Q28*
Q28	Is anyone in your home less than two years old?			
	1	Yes	7%	
	2	No	92%	
	99	Prefer not to answer	1%	
Q29	Is anyone in your home over the age of 65?			
	1	Yes	39%	
	2	No	60%	
	99	Prefer not to answer	1%	
Q30	During a typical summer weekday, is there at least one person in your home for at least one hour between 10AM and 4PM?			
	1	Yes	79%	
	2	No	16%	
	99	Prefer not to answer	4%	
Thank you for participating in this survey!				

Sample Items			
S1	Plan Group		
	1	TOU CPP rate/customer controlled	4%
	22	TOU CPP rate/2 degree temp raise	9%
	23	TOU CPP rate/3 degree temp raise	9%
	24	TOU CPP rate/4 degree temp raise	17%
	32	2 degree temp raise with $2 incentive per Conservation Day	8%
	33	2 degree temp raise with $3 incentive per Conservation Day	12%
	34	4 degree temp raise with $4 incentive per Conservation Day	41%

TRUE NORTH RESEARCH

SMUD PowerStat 13 Pre-Treatment Survey
Commercial Customers
Final Toplines (4 Respondents)
December 2013

Section 1: Introduction

Welcome! Thank you for taking this survey about the PowerStat® pilot program in which your business is participating. By sharing your opinions with us, you will help SMUD evaluate the PowerStat® pilot and decide what type of program to offer to customers in the future.

This is the first of several surveys that you agreed to complete as part of your participation in the pilot. Your identity will be held in the strictest confidence and your answers will be kept anonymous in any publications of findings.

Web Instructions:
During the survey, please do not use your browser's 'Forward' and 'Back' buttons. To move through the survey, use the 'Back' and 'Next' buttons at the bottom of each page.

When you have finished the survey click the 'Done' button to submit your survey.

If you need to stop while taking this survey, your answers will be saved so that you may return and resume where you left off.

To see the survey most clearly, MAXIMIZE this browser screen.

Section 2: Participation & Overall Satisfaction

Q1	In your own words, what would you say was the main reason you signed up to participate in the PowerStat® pilot program? *Insert response in text box below.*	
	To save energy and money.	
	To save energy.	
	Save money.	

Q2 By participating in this program, do you expect to _____?

	Randomize	Yes, definitely	Yes, probably	No, probably not	No, definitely not	Not Sure	Prefer not to answer
A	Save money on your electric bill	75%	25%	0%	0%	0%	0%
B	Help protect the environment	75%	0%	25%	0%	0%	0%
C	Learn how to better conserve electricity	75%	25%	0%	0%	0%	0%
D	Actually use less electricity	50%	50%	0%	0%	0%	0%
E	Have more control over your electricity bill	50%	50%	0%	0%	0%	0%
F	Keep your business at a comfortable temperature	75%	25%	0%	0%	0%	0%

 Page 1

Q3	Please indicate the extent to which you agree or disagree with the following statements about your experience enrolling in the PowerStat® pilot program.							
	Randomize	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree	Not Sure	Doesn't Apply	Prefer not to answer
A	SMUD clearly explained the goals of the program	100%	0%	0%	0%	0%	0%	0%
B	SMUD clearly explained what I was expected to do during the program	100%	0%	0%	0%	0%	0%	0%
C	I was satisfied with how SMUD's representative answered my questions	100%	0%	0%	0%	0%	0%	0%
D	The information SMUD made available was informative and helpful	75%	25%	0%	0%	0%	0%	0%

Section 3: Plan Selection

This section appears in online version of survey only due to need to show Participation Agreement Letter.

When enrolling in the PowerStat® pilot program, you were presented with the following Participation Agreement which described different plan options. Please take a moment to review the document, then hit the next button. *Show document.*

Q4	In your opinion, how clear was the letter in describing the different plans and options from which you could choose?			
	1	Very clear	50%	
	2	Somewhat clear	25%	
	3	Not at all clear	25%	
	98	Not sure	0%	
	99	Prefer not to answer	0%	
Q5	Do you recall which plan you selected?			
	1	Plan A: Optimum Off Peak Rate + Energate Thermostat	25%	*Ask Q6*
	2	Plan B: 2, 3, 4 Plan + Energate Thermostat	25%	*Skip to Q7*
	98	Don't recall/Not sure	25%	*Skip to Q9*
	99	Prefer not to answer	25%	*Skip to Q9*
Q6	Did you check the 'Yes' box to allow SMUD to automatically raise your thermostat temperature on Conservation Days?			
	1	Yes	100%	
	2	No	0%	
	98	Don't recall/Not sure	0%	
	99	Prefer not to answer	0%	

Q7	What was the main reason you selected this plan over the others?		
	1	Maximize my savings	100%
	2	Guaranteed payment per event	0%
	3	I wanted to retain control of my thermostat on event days	0%
	4	I wanted SMUD to automatically manage my thermostat on event days	0%
	5	Other	0%
	98	Not sure	0%
	99	Prefer not to answer	0%

Ask Q8 if (Q5=1 AND Q6=1) OR Q5=2.
(ie, Q8 is asked of Groups 2 & 3 based on self-reported assignment. Both of these groups selected SMUD to automatically control thermostat on Conservation Days)

Q8	Do you recall which automatic temperature increase you selected for Conservation Days?		
	1	2 Degrees	0%
	2	3 Degrees	50%
	3	4 Degrees	50%
	98	Don't recall/Not sure	0%
	99	Prefer not to answer	0%

Section 4: Installation Process

Q9	Were you personally at your business location when the technician installed your new thermostat?			
	1	Yes	100%	*Ask Q10*
	2	No	0%	*Skip to Q13*
	99	Prefer not to answer	0%	*Skip to Q13*

Q10	Please indicate the extent to which you agree or disagree with the following statements about the installation process.							
	Read in Order	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree	Not Sure	Doesn't Apply
A	I was able to select an installation appointment time that worked best for my schedule	100%	0%	0%	0%	0%	0%
B	The technician arrived on time for the appointment	100%	0%	0%	0%	0%	0%
C	The technician explained the installation process prior to starting the work	100%	0%	0%	0%	0%	0%

D	The length of time it took to install the device was reasonable	100%	0%	0%	0%	0%	0%
E	The work site was left clean after the installation was complete	100%	0%	0%	0%	0%	0%
F	There was no damage to the property during the installation process	100%	0%	0%	0%	0%	0%
G	The technician explained to me the basics of how to use the thermostat	100%	0%	0%	0%	0%	0%

Q11	Overall, were you satisfied or dissatisfied with the installation process for your new thermostat?			
	1	Very satisfied	100%	*Skip to Q13*
	2	Somewhat satisfied	0%	*Skip to Q13*
	3	Somewhat dissatisfied	0%	*Ask Q12*
	4	Very dissatisfied	0%	*Ask Q12*
	98	Not sure	0%	*Skip to Q13*
	99	Prefer not to answer	0%	*Skip to Q13*
Q12	Please briefly describe why you were dissatisfied with the installation process. *Insert response in text box below.*			
			No dissatisfied respondents	

Only ask Q13-Q15 if in Group 1
(Note: Group 1=Plan A + No Auto. These questions will be asked based on their actual group assignment, NOT what they 'recall' in the survey)

Q13	During the installation process, did the technician explain the different Conservation Settings that you could choose from on Conservation Days?		
	1	Yes	0%
	2	No	0%
	98	Don't know/wasn't there	0%
	99	Prefer not to answer	0%
Q14	Do you recall which Conservation Setting was selected as your default for Conservation Days?		
	1	Max Comfort	0%
	2	Comfort	0%
	3	Balanced	0%
	4	Savings	0%
	5	Max Savings	0%
	98	Don't recall/Not sure	0%
	99	Prefer not to answer	0%

Q15	How informed do you feel about the temperature degree increase that is associated with each Conservation Setting?		
	1	Well informed	0%
	2	Somewhat informed	0%
	3	Slightly informed	0%
	4	Not informed	0%
	98	Don't recall/Not sure	0%
	99	Prefer not to answer	0%

Section 5: Use & Product Ratings

The next few questions focus on the thermostat and your experiences when using it.

Q16	Overall, how would you rate your satisfaction with the new thermostat?			
	1	Very satisfied	100%	*Skip to Q18*
	2	Somewhat satisfied	0%	*Skip to Q18*
	3	Somewhat dissatisfied	0%	*Ask Q17*
	4	Very dissatisfied	0%	*Ask Q17*
	98	Not sure	0%	*Skip to Q18*
	99	Prefer not to answer	0%	*Skip to Q18*

Q17	Please briefly describe why you are dissatisfied with the thermostat. *Insert response in text box below.*	
		No dissatisfied respondents

Q18 Please rate the new thermostat on the following attributes.

	Randomize. But always have H appear last.	Excellent	Good	Fair	Poor	Very Poor	Not Sure/Doesn't Apply
A	Ease of use	100%	0%	0%	0%	0%	0%
B	Clarity of thermostat operation manual	75%	25%	0%	0%	0%	0%
C	Readability of display	100%	0%	0%	0%	0%	0%
D	Availability of technical support	75%	0%	0%	0%	0%	25%
E	Appearance	100%	0%	0%	0%	0%	0%
F	Keeping my building at a comfortable temperature	75%	25%	0%	0%	0%	0%
G	Helping me save electricity	50%	25%	0%	0%	0%	25%

H	Overall performance	100%	0%	0%	0%	0%	0%

Section 6: Thermostat Comparison			
Q19	When compared to your prior thermostat, would you say that the new thermostat you received through the PowerStat® pilot program performs better, worse or about the same overall?		
	1	Much better	75%
	2	Somewhat better	0%
	3	About the same	25%
	4	Somewhat worse	0%
	5	Much worse	0%
	98	Not sure	0%
	99	Prefer not to answer	0%
Q20	During the summer, what temperature is your thermostat normally set at between noon and 4PM?		
			Average temp: 76.33
Q21	During the summer, what temperature is your thermostat normally set at between 3PM and 6PM?		
			Average temp: 77.00

Section 7: Thermostat Adjusting Behavior			
Q22	Which of the following best describes the way you typically control the temperature at your place of business?		
	1	We rely on the thermostat program to automatically adjust the temperature in the building. We don't make manual adjustments.	0%
	2	We *generally* rely on the thermostat program to automatically adjust the temperature in the building, but we occasionally manually adjust the thermostat temperature too.	75%
	3	We manually adjust the thermostat settings to control the temperature in the building. We don't use the auto programming features of the thermostat.	25%
	98	Not sure	0%
	99	Prefer not to answer	0%

Section 8: Attitudes about SMUD			
Q23	Generally speaking, are you satisfied or dissatisfied with the job SMUD is doing to provide electricity services to your business?		
	1	Very satisfied	100%
	2	Somewhat satisfied	0%
	3	Somewhat dissatisfied	0%
	4	Very dissatisfied	0%
	98	Not sure	0%
	99	Refused	0%
Q24	Would you say that your participation in the PowerStat® pilot program to this point has positively impacted your opinion of SMUD, negatively impacted your opinion of SMUD, or has it not changed your opinion either way?		
	1	Positively impacted opinion of SMUD	50%
	2	Negatively impacted opinion of SMUD	0%
	3	No impact	25%
	98	Not sure	25%
	99	Prefer not to answer	0%

Section 9: Business Information			
Next are a few background questions for statistical purposes.			
Q25	Which of the following best describes your business location?		
	1	Office	50%
	2	Retail	0%
	3	Other	0%
	98	Not sure	0%
	99	Prefer not to answer	50%
Q26	What is the approximate square footage of your building?		
			Square footage on file for 1 respondent

Q27	Does your business lease or own the building?		
	1	Lease	100%
	2	Own	0%
	98	Not sure	0%
	99	Prefer not to answer	0%
Q28	Including yourself, how many people work at your business location?		
	1	5 or fewer	75%
	2	6 to 10	0%
	3	11 to 20	0%
	4	21 to 49	0%
	5	50 to 99	25%
	6	100 or more	0%
	98	Not sure	0%
	99	Prefer not to answer	0%
Thank you for participating in this survey!			

TRUE NORTH RESEARCH

SMUD PowerStat Conservation Day Survey
Residential Customers
Final Toplines: Episodes 1~7 (1,461 Respondents)
December 2013

Section 1: Introduction

Welcome! Thank you for taking this short survey about the PowerStat pilot program in which your household is participating. Your identity will be held in the strictest confidence and your answers will be kept anonymous in any publication of findings.

Web Instructions:
During the survey, please do not use your browser's 'Forward' and 'Back' buttons. To move through the survey, use the 'Back' and 'Next' buttons at the bottom of each page.

When you have finished the survey click the 'Done' button to submit your survey.

If you need to stop while taking this survey, your answers will be saved so that you may return and resume where you left off.

To see the survey most clearly, MAXIMIZE this browser screen.

Section 2: Notification

Q1	Were you aware that <day, date> was a Conservation Day and the temperature on your thermostat would automatically adjust to your Conservation Day setting?		
	1	Yes	83%
	2	No	15%
	98	Not sure	2%
	99	Prefer not to answer	0%

Section 3: Conservation Day Comfort

Q2	Were you personally at home for at least 30 minutes on <day, date> between 4PM and 7PM?			
	1	Yes	84%	*Ask Q3*
	2	No	15%	*Skip to Q5*
	98	Not sure	1%	*Skip to Q5*
	99	Prefer not to answer	0%	*Skip to Q5*
Q3	How would you rate the temperature in your home on <day, date> between 4PM and 7PM?			
	-2	Much too cold	0%	
	-1	A bit too cold	1%	
	0	About right/comfortable	56%	
	+1	A bit too hot	38%	
	+2	Much too hot	4%	
	98	Not sure	1%	
	99	Prefer not to answer	0%	

Q3		Overall	TOU CPP rate/customer controlled	TOU CPP rate/2 degree temp raise	TOU CPP rate/3 degree temp raise	TOU CPP rate/4 degree temp raise	2 degree temp raise with $2 incentive per Conservation Day	3 degree temp raise with $3 incentive per Conservation Day	4 degree temp raise with $4 incentive per Conservation Day
	Mean temperature score: -2 = Much too cold -1 = A bit too cold 0 = About right/comfortable +1 = A bit too hot +2 = Much too hot	0.46	0.60	0.42	0.45	0.51	0.51	0.37	0.45

Q4	Thinking about the temperature in your home on <day, date> between 4PM and 7PM, which of the following best represents your comfort level?	
	5 Very comfortable	15%
	4	29%
	3	41%
	2	11%
	1 Very uncomfortable	2%
	98 Not sure	1%
	99 Prefer not to answer	0%

Q4		Overall	TOU CPP rate/customer controlled	TOU CPP rate/2 degree temp raise	TOU CPP rate/3 degree temp raise	TOU CPP rate/4 degree temp raise	2 degree temp raise with $2 incentive per Conservation Day	3 degree temp raise with $3 incentive per Conservation Day	4 degree temp raise with $4 incentive per Conservation Day
	Mean temperature score: 5 = Very comfortable 1 = Very uncomfortable	3.44	3.4	3.31	3.43	3.4	3.59	3.53	3.43

Section 4: Overall Satisfaction				
Q5	In general, how would you rate your overall experience participating in the PowerStat program to this point?			
	1	Very satisfied	65%	*Skip to End*
	2	Somewhat satisfied	28%	*Skip to End*
	3	Somewhat dissatisfied	2%	*Ask Q6*
	4	Very dissatisfied	1%	*Ask Q6*
	98	Not sure	4%	*Skip to End*
	99	Prefer not to answer	0%	*Skip to End*
Q6	Please describe the reasons why you are dissatisfied with your experience participating in the PowerStat program so far. *Please insert your comments in text field below.*			
	Given the unanticipated heat waves in region, the conservative dates should NOT be chosen in this period.			
	I do not believe that this program will save me any money at all, as stated in the ads. I will be just as uncomfortable and will continue to pay huge electric bills IF I can use my AC at all, which I don't very much because it is just way too much money to spend on electricity.			
	I think our thermostat was raised five degrees. But we signed up for three degrees. It was at 83 degrees between 4 and 7 and then it changed to 78. (I'm not sure what we had it on before 4 but I think it was 80) I will watch more carefully tomorrow.			
	I would think there would be some sort of balance. Gone through two already and another one tomorrow. Too much too often			
	It was and is much too hot. I suffered through it by getting in front of a fan. This weather right now is too hot.			
	It's not my participation with the program that made me dissatisfied, it's because I didn't realize that I have my One-hundred-year old father-in-law who is living with us who was very uncomfortable with the temperature and he looks sick in between these hours.			
	So far, I have not been aware of the conservation days. No notifications, even though I signed up for them twice and no indicator light on the thermostat.			
	Temps not set right for day and night.			
	The temp was 2 degrees higher than what I had sign- up for. It supposed to be 3 degrees above my set temp of 78. But the conservation temp on my thermostat was set at 82.9 instead of 81. Called and talk to a supervisor at SMUD but he can't do anything about it.			
	Way too hot.			
	I normally keep my house at a high temperature. When they want to raise it to another 40 degrees, then it is kind of ridiculous.			
	They choose the hottest days. It would be better to choose the moderately hot days instead of the ones that make us uncomfortable or give health issues. It should be done where the conservation would be more effective.			
	Conservation days are just too much. It gets so hot.			
	I am unaware when the conservation days are. No message, no indicator light on the thermostat.			
	I had the thermostat replaced recently and for whatever reason now, I'm no longer in the program.			

I have already talked to one the representatives informing that the temperature during the energy conservation days most especially when the temperature reached to 100's was really hot in my home as I have my one-hundred-year old father-in-law living with us, the person told me that SMUD is going to set the temperature to 76 instead of 78 degrees which was the previous setting of my thermostat but the temperature remains the same since the last time that I have spoke to this person.
Most of the days that are chosen are when demands are the highest While I see the linear reasoning on these being conservation days, a more nuanced approach would be more successful on getting people to ACTUALLY really conserve. More moderate days would be better as designated conservation days, and getting more participation. See, when people are uncomfortable they don't like to think about the discomfort of family too.
My house was way too hot during that time of day, and in checking my bill I don't see where I saved anything. My little great-grand baby was very hot and fussy.
The cost is too expensive on non-conservation days.
The temp was set 2 degrees higher than what I agreed. I signed up for plus 3 degrees. The thermostat was automatically set at plus 5 between 4 and 7 pm during the conservation day. The temp was very hot at 83F at the house.
There seemed to be a lot of confusion on rate and Powerstat program because of two accounts.
Too close together.
Up until Friday the sixth the program was fine. But for that Friday I was not notified that it was going to be a conservation day and so nether me nor my family were expecting it. What happened?
I was not aware that the thermostat would be controlled today. I leave my thermostat in the off setting unless I need it turned on to be comfortable. When I went to turn it on at 4:30 I did not know if that would mess up the process. Also, I have asked if it is ok to leave it off and still get credit for the cycle day credit, but got no answer
I haven't been notified of the conservation days. My thermostat also does not update to conserve energy.
Thermostat temporarily stopped working and I had difficulty getting it to work again.
The first time I was informed of a conservation day was September 5th.
What the hell is/was going on with the back-billing, statements, letters, etc? As a retired Major, U.S. Army, I can only describe what your billing/accounting apartment is: A cluster F..k!. A customer cannot tell if he is cost conserving or just getting jerked around at SMUD's convenience/experiment. I won't participate in a program that is not well thought out and trouble-shooted with SMUD again. I really feel it was not to the customer's advantage, as it was to your billing Department. Cannot believe receiving 7 back bills and having to make two full payments in the next few days, automatically taken out of my checking. I hope the amounts are correct. We have to rely on SMUD's screwed-up process. Count me and my wife out of any future, poorly planned experiment. Feel ripped-off and don't want to cooperate with SMUD in the future. What were you thinking for the past 7 months by not catching your mistake until a couple weeks ago?? Too bad, you lost a customer due to your piss poor planning and organization of this program. What a train wreck!!!
Problems with the thermostat flexibility. Was not contacted for the 9/6 conservation day.
I have yet to get an email or text informing me of the conservation day.
Need better thermostat like the NEST. Current thermostats not user friendly and manual to complicated.
I am not notified ahead of time when you plan to activate the PowerStat program. I

seem to miss it every time.
More than 1 day notification would be nice. I used work phone as contact. As a result, I wouldn't get info until after the fact. For example, received notice 9/8 for 9/9 curtailment. I received at work this morning but am not at home to change settings to accommodate. Of course, if I had checked my voicemail messages this would be moot point! Perhaps add email notification an option? I check email every day so I would have been informed to update thermostat settings...
I feel that there is a trend of using conservation days just because SMUD said there would be 12. Today's temperature was not hot enough in my opinion to be a conservancy day and i viewed it as more of a saving SMUD money day. I would also like if the thermostat displayed the price per KW during that time period as it is shown as capable as doing. As a side thought, if SMUD can change the temperature of the thermostat, maybe as a bonus of using these smart thermostats and enrolling in future programs such as this, customers can use the website or an app to control their thermostat remotely. This is a benefit to both parties. I have my thermostat scheduled to come on before I get home, if I know I will be home later I can change it remotely and conserve and save money.
My downstairs stays close to 80 degrees and my upstairs is over 80 degrees and in order to survive I have to run fans. The thermostat is set at 80 degrees all the time.
Today the weather was cooler so the house was not too bad. the other days were so hot that that period of time in my house was miserable even with fans going, They were just circulating hot air.
Your billing process cumulating in Sept 2013, was really f****ed Up! Who's the rocket scientist to take over 7 months to figure out that customers in this pilot program where not paying enough on their initial bills?? Dumb shit! Get your shit together for next time. Seemed really unprofessionally throughout.
I was told that I would receive a $2 credit for each conservation day that I participated in. I have not received a single credit.
I have yet to be alerted to a conservation day and have not seen any credits on my account.
The temp is not set to the right temps for me.
I wish the controls were easier to adjust. They were set by the installer to go down to 69 at night (when I get out of bed to urinate). It's too freaking cold. Now that winter is coming, I would like an instruction manual to be sent to me.
Thank you for participating in this survey!

S1	Plan Group		
	1	TOU CPP rate/customer controlled	4%
	22	TOU CPP rate/2 degree temp raise	9%
	23	TOU CPP rate/3 degree temp raise	9%
	24	TOU CPP rate/4 degree temp raise	18%
	32	2 degree temp raise with $2 incentive per Conservation Day	7%
	33	3 degree temp raise with $3 incentive per Conservation Day	12%
	34	4 degree temp raise with $4 incentive per Conservation Day	42%

INTERIM SURVEY QUESTIONNAIRE: COMMERCIAL

TRUE NORTH RESEARCH

SMUD PowerStat Conservation Day Survey
Commercial Customers
Final Toplines: Episodes 1~7 (18 Respondents)
December 2013

Section 1: Introduction
Welcome! Thank you for taking this short survey about the PowerStat pilot program in which your business is participating. Your identity will be held in the strictest confidence and your answers will be kept anonymous in any publication of findings.
Web Instructions: During the survey, please do not use your browser's 'Forward' and 'Back' buttons. To move through the survey, use the 'Back' and 'Next' buttons at the bottom of each page. When you have finished the survey click the 'Done' button to submit your survey. If you need to stop while taking this survey, your answers will be saved so that you may return and resume where you left off. To see the survey most clearly, MAXIMIZE this browser screen.

Section 2: Notification			
Q1	Were you aware that <day, date> was a Conservation Day and the temperature on your thermostat would automatically adjust to your Conservation Day setting?		
	1	Yes	61%
	2	No	28%
	98	Not sure	11%
	99	Prefer not to answer	0%

Section 3: Conservation Day Comfort				
Q2	Were you personally at your place of business for at least 30 minutes on <day, date> between 3PM and 6PM?			
	1	Yes	83%	*Ask Q3*
	2	No	17%	*Skip to Q5*
	98	Not sure	0%	*Skip to Q5*
	99	Prefer not to answer	0%	*Skip to Q5*
Q3	How would you rate the temperature in your building on <day, date> between 3PM and 6PM?			
		Mean temperature score:	0.36	
	-2	Much too cold	0%	
	-1	A bit too cold	0%	
	0	About right/comfortable	67%	
	+1	A bit too hot	20%	
	+2	Much too hot	7%	
	98	Not sure	7%	
	99	Prefer not to answer	0%	

SMUD

Q4	Thinking about the temperature in your building on <day, date> between 3PM and 6PM, which of the following best represents your comfort level?	
	Mean comfort score:	3.47
	5 Very comfortable	13%
	4	33%
	3	40%
	2	13%
	1 Very uncomfortable	0%
	98 Not sure	0%
	99 Prefer not to answer	0%

Section 4: Overall Satisfaction

Q5	In general, how would you rate your overall experience participating in the PowerStat program to this point?			
	1	Very satisfied	89%	*Skip to End*
	2	Somewhat satisfied	11%	*Skip to End*
	3	Somewhat dissatisfied	0%	*Ask Q6*
	4	Very dissatisfied	0%	*Ask Q6*
	98	Not sure	0%	*Skip to End*
	99	Prefer not to answer	0%	*Skip to End*
Q6	Please describe the reasons why you are dissatisfied with your experience participating in the PowerStat program so far.			
			No dissatisfied respondents	

Thank you for participating in this survey!

S1	Plan Group		
	1	TOU CPP rate/customer controlled	11%
	22	TOU CPP rate/2 degree temp raise	0%
	23	TOU CPP rate/3 degree temp raise	0%
	24	TOU CPP rate/4 degree temp raise	6%
	32	2 degree temp raise with $2 incentive per Conservation Day	28%
	33	3 degree temp raise with $3 incentive per Conservation Day	0%
	34	4 degree temp raise with $4 incentive per Conservation Day	56%

POST-TREATMENT SURVEY QUESTIONNAIRE: RESIDENTIAL

TRUE NORTH RESEARCH

SMUD 2013 PowerStat Post-Treatment Survey
Residential Customers
Final Toplines (531 Respondents)
December 2013

Section 1: Introduction

Welcome! Thank you for taking this survey about the PowerStat® pilot program in which your household is participating. This is the final survey you will be asked to complete as part of the PowerStat® pilot. By sharing your opinions with us, you will help SMUD evaluate the PowerStat® pilot and decide what type of program to offer to customers in the future.

Your identity will be held in the strictest confidence and your answers will be kept anonymous in any publications of findings.

Web Instructions:
During the survey, please do not use your browser's 'Forward' and 'Back' buttons. To move through the survey, use the 'Back' and 'Next' buttons at the bottom of each page. When you have finished the survey click the 'Done' button to submit your survey.

If you need to stop while taking this survey, your answers will be saved so that you may return and resume where you left off. To see the survey most clearly, MAXIMIZE this browser screen.

Section 2: Overall Pilot Rating & Impacts

Q1	In general, how would you rate your overall experience participating in the PowerStat® pilot program?			
	1	Very satisfied	69%	
	2	Somewhat satisfied	26%	
	3	Somewhat dissatisfied	3%	
	4	Very dissatisfied	0%	
	98	Not sure	2%	
	99	Prefer not to answer	0%	
Q2	Do you have any suggestions on how the PowerStat® pilot program can be improved?			
	1	Yes	16%	*Ask Q3*
	2	No	80%	*Skip to Q4*
	99	Prefer not to answer	4%	*Skip to Q4*
Q3	Please briefly describe the one or two changes you think would most improve the PowerStat® pilot program in the text box below. Verbatim responses recorded and later grouped into categories shown below.			
	Better communication, info		40%	
	More thermostat control options		19%	
	Improved user interface		16%	
	Choose more appropriate/hotter conservation days		7%	
	Better incentives, discounts		6%	
	Better rates		6%	
	Not sure		2%	

Q4	In your opinion, how much has participating in the PowerStat® pilot program _____?						
	Randomize	A lot	Some	A little	None	Not Sure	Prefer not to answer
A	Helped you save money on your electric bill	26%	40%	21%	6%	7%	0%
B	Helped you protect the environment	24%	38%	19%	7%	11%	0%
C	Improved your knowledge about ways you can reduce your household's electricity use	27%	35%	25%	10%	2%	0%
D	Reduced the amount of electricity your household uses	21%	43%	23%	6%	7%	0%
E	Given you more control over your electricity bill	26%	36%	22%	9%	7%	0%
F	Motivated you to change your electricity use habits	29%	37%	21%	11%	2%	0%

Ask Q5 if Q4a = (1,2,3). Otherwise skip to Q6.

Q5	In a typical summer month, approximately how much do you think you saved on your electricity bill by participating in the PowerStat® pilot program?	
	Average among those who provided a response	$24.55
	Less than $10	14%
	$9 to $19	11%
	$20 to $29	8%
	$30 to $49	5%
	$50 or more	7%
	Saved $ but not sure how much	48%
	Not sure / Prefer not to answer	7%

Q6	If a friend asked you about the PowerStat® pilot program, would you recommend that they participate?		
	1	Yes	88%
	2	No	4%
	98	Not sure	8%
	99	Prefer not to answer	1%

Section 3: Conservation Day Behavior				
Only ask Q7 & Q8 if in Group 1 (Note: Group 1 = Plan A + No Auto. These questions will be asked based on their actual group assignment, NOT what they 'recall' in the survey)				
Q7	Which of the following Conservation Settings did you use most often this summer?			
	1	Max Comfort	0%	
	2	Comfort	18%	
	3	Balanced	23%	
	4	Savings	18%	
	5	Max Savings	9%	
	98	Don't recall/Not sure	32%	
	99	Prefer not to answer	0%	
Q8	How often did you make adjustments to your Conservation Setting this summer?			
	1	Never	41%	
	2	Once or twice	14%	
	3	Three to five times	18%	
	4	More than five times	27%	
	98	Not sure	0%	
	99	Prefer not to answer	0%	
Q9	On a normal summer day (not a Conservation Day), do you take any actions to reduce your household's energy use during peak hours between 4PM and 7PM?			
	1	Yes	83%	*Ask Q10*
	2	No	15%	*Skip to Q11*
	98	Not sure	2%	*Skip to Q11*
	99	Prefer not to answer	0%	*Skip to Q11*
Q10	What actions do you take on a normal summer day to reduce your household's energy use during peak hours? *Please be specific – insert response in text box below.*			
	Turned off unused lights, electronics		31%	
	Reduced, avoided laundry		27%	
	Changed thermostat settings		23%	
	Reduced use of AC in general		16%	
	Closed/Opened windows, shades		15%	
	Washed dishes by hand		13%	
	Used fan instead of AC		11%	

	Grilled outside / Did not use kitchen		6%	
	Left house / Went outside, elsewhere		4%	
	Not sure		4%	
	Prefer not to answer		4%	
	Turned off pool pump		1%	
Q11	When compared to a normal summer day, did you take any *additional* actions on Conservation Days to further reduce your electricity use between the hours of 4PM to 7PM?			
	1	Yes, took additional actions on *every* Conservation Day	31%	*Ask Q12*
	2	Yes, took additional actions on *most* of the Conservation Days	21%	*Ask Q12*
	3	Yes, took additional actions on *a few* of the Conservation Days	11%	*Ask Q12*
	4	No, did not take additional actions on Conservation Days	32%	*Skip to Q13*
	98	Not sure	3%	*Skip to Q13*
	99	Prefer not to answer	1%	*Skip to Q13*
Q12	What *additional* actions did you take to further reduce your electricity use on Conservation Days between the hours of 4PM and 7PM? *Please be specific – insert response in text box below.* Verbatim responses recorded and later grouped into categories shown below.			
	Turned off unused lights, electronics		50%	
	Left house / Went outside, elsewhere		12%	
	Not sure		12%	
	Changed thermostat settings		11%	
	Reduced, avoided laundry		9%	
	Used fan instead of AC		9%	
	Closed/Opened windows, shades		8%	
	Prefer not to answer		7%	
	Grilled outside / Did not use kitchen		3%	
	Monitored, did not adjust thermostat		3%	
	Made others aware of conservation		1%	

Section 4: Interest in Participating Again				
Q13	Thinking ahead to *next* summer (2014), would you sign up again to participate in the PowerStat® program?			
	1	Definitely yes	64%	*Go to Q14*
	2	Probably yes	25%	*Go to Q14*
	3	Probably no	3%	*Skip to Q17*
	4	Definitely no	1%	*Skip to Q17*
	98	Not sure	6%	*Skip to Q17*
	99	Prefer not to answer	0%	*Skip to Q17*
Only ask Q14 if NOT in Group 1. Otherwise skip to Q15.				
Q14	Based on your experience this summer, what temperature increase would you select for Conservation Days next summer?			
	1	2 Degree	17%	
	2	3 Degree	18%	
	3	4 Degree	51%	
	98	Not sure	14%	
	99	Prefer not to answer	1%	
Q15	Which of the following options would you prefer for how your automatic temperature increase is managed on Conservation Days? *Randomize the order options 1 & 2 are shown.*			
	1	I agree to an automatic temperature increase amount (2, 3 or 4 degrees) that is the same for all Conservation Days. It can't be changed.	57%	
	2	I program my thermostat for an automatic temperature increase (1, 2, 3, 4 or 5 degrees) for Conservation Days. I can change the increase amount whenever I want.	30%	
	98	Not sure	11%	
	99	Prefer not to answer	1%	
Q16	This summer, SMUD sent notices the day before regarding an upcoming Conservation Day. If SMUD were instead to send notices the same day as a Conservation Day, would that be acceptable to you?			
	1	Yes, same day notification is acceptable	51%	
	2	No, same day notification is not acceptable	43%	
	98	Not sure	6%	
	99	Prefer not to answer	0%	

Section 5: Use & Product Ratings				
The next few questions focus on the thermostat and your experiences when using it.				
Q17	Overall, how would you rate your satisfaction with the new thermostat?			
	1	Very satisfied	66%	*Skip to Q19*
	2	Somewhat satisfied	28%	*Skip to Q19*
	3	Somewhat dissatisfied	4%	*Ask Q18*
	4	Very dissatisfied	1%	*Ask Q18*
	98	Not sure	1%	*Skip to Q19*
	99	Prefer not to answer	0%	*Skip to Q19*
Q18	Please briefly describe why you are dissatisfied with the thermostat. *Insert response in text box below.* Verbatim responses provided below.			
	Not knowing how to easily make a temporary change for a certain number of hours.			
	I want my old one back. Too hard to figure this one out.			
	Very hard to read, not very user intuitive, poor weekend time setting choices.			
	Hard to program. Not showing an accurate temperature reading while on. Once you shut down the A/c, temp go down by 4 degree on rd he display. Meaning, that the A/c is auto on a little longer than it should in order to reach the right temperature.			
	Too complicated to program and adjust.			
	Not always sure how to set it so that it worked.			
	Hard to get it to do what I want it to- seems like I set it at a certain temperature and then it changes to the parameters set by SMUD.			
	Functions not working properly for example, setting the auto function for sleep time at 10 pm to be in the range of 74-82. Thinking that if the temperature goes over 82 the AC would come on and when temps fall below 74 then the heat would come on. That was never the case. Some nights house got down to 71 degree and heat never turned on.			
	It cannot be changed remotely and the interface is not the best.			
	It's ugly and the screen is always on which is disturbing at night. If I wanted a night light I would buy a night light.			
	It's too bright. It never dims. I have to cover it with paper or it lights up the whole hallway at night. I know it is LED light, but it should be dark until I press a button			
	Unable to reprogram it myself.			
	Sat/Sunday only has only 2 temp changes - should be the same as weekdays. \ Visible on/off switch. We generally run with A/C off (other cooling strategies) turning it on when we need it (>95F outside, >80F inside, high humidity, and no sea breeze). Even the programming button for turning the A/C on/off is not labeled.			
	Basic on/off functions were fine but anything beyond that i never attempted because it was too confusing.			
	I don't seem to be able to get rid of change filter alarm flashing on the screen.			
	When the weather is really hot, we would turn it on. Then, early in the morning when it gets cold, the heater turns on. I don't know why, but it wakes me up. I can tell the			

	difference between the sounds, so I would have to get up and play with it.
	I have problems knowing when I have taken over the control or when the heater is going to come on. I have a feeling that I can't go over and turn on the heater when I want to.
	It is confusing, not user-friendly and difficult to program.
	Way too complicated.
	Too many steps to make changes.
	The light inside was way too bright. I had to put something over the thermostat when I went to bed so that I could sleep. I called and asked if there were a way to make it dim, but was told no.
	Hard to understand, program, too much.
	Too sensitive. A/c short cycles.
	The other one was easier to set and change.
	I did not know how to program it.

Q19	Please rate the new thermostat on the following attributes.						
	Randomize. But always have G appear last.	Excellent	Good	Fair	Poor	Very Poor	Not Sure/Doesn't Apply
A	Ease of use	40%	41%	13%	4%	1%	1%
B	Clarity of thermostat operation manual	37%	40%	13%	3%	1%	6%
C	Readability of display	65%	28%	4%	2%	0%	1%
D	Availability of technical support	26%	24%	5%	1%	1%	43%
E	Appearance	56%	36%	7%	1%	1%	1%
F	Keeping my home at a comfortable temperature	50%	41%	6%	1%	0%	2%
G	Overall performance	51%	38%	8%	1%	0%	1%

Q20	When compared to your prior thermostat, would you say that the new thermostat you received through the PowerStat® Pilot program performs better, worse or about the same overall?	
1	Much better	54%
2	Somewhat better	23%
3	About the same	17%
4	Somewhat worse	3%
5	Much worse	1%
98	Not sure	1%
99	Prefer not to answer	1%

Q21	Since enrolling in the PowerStat® pilot program and receiving your new thermostat, how easy or difficult has it been to keep your home at a comfortable temperature?	
	1 Very easy	61%
	2 Somewhat easy	32%
	3 Somewhat difficult	4%
	4 Very difficult	1%
	98 Not sure	2%
	99 Prefer not to answer	0%

Section 6: Customer Service

Q22 Please indicate the extent to which you agree or disagree with the following statements about your experience participating in the PowerStat® pilot program.

	Randomize	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree	Not Sure	Doesn't Apply	Prefer not to answer
A	SMUD clearly explained the goals of the program	69%	25%	4%	1%	1%	0%	0%
B	SMUD clearly explained what I was expected to do during the program	69%	27%	3%	0%	0%	0%	0%
C	I was satisfied with how SMUD answered my questions	61%	25%	2%	1%	2%	8%	1%
D	The information SMUD made available was informative and helpful	64%	30%	3%	1%	1%	1%	1%

Q23	Did you contact SMUD and/or the installation company (GoodCents) during the past three months about any issue(s) related to the PowerStat® pilot program? *You can check one or both 'yes' options below.*	
	1 Yes, called SMUD	12%
	2 Yes, called installation company GoodCents	6%
	3 No	84%
	99 Prefer not to answer	1%

Ask Q24 if Q23 = (1,2).

Q24	Please briefly describe the issue(s) that prompted your call to SMUD and/or the installation company (GoodCents) in the text box below. Verbatim responses recorded and later grouped into categories shown below.	
	Thermostat not working properly	29%
	Help with time, temp settings	24%
	Prefer not to answer	17%
	General program details inquiry	12%
	Problems with display	10%

	Billing questions, concerns	6%
	Help with programming in general	6%
	Unaware of Conservation Day	4%
	General question about thermostat	2%
	Not sure	1%

Ask Q25 if Q23 = 1.

Q25	Was SMUD able to help resolve the issue(s) to your satisfaction?		
	1	Yes	68%
	2	No	20%
	3	Yes for some issues, no for others	12%
	99	Prefer not to answer	0%

Ask Q26 if Q23 = 2.

Q26	Was the installation company (GoodCents) able to help resolve the issue(s) to your satisfaction?		
	1	Yes	67%
	2	No	17%
	3	Yes for some issues, no for others	13%
	99	Prefer not to answer	3%

Section 7: Attitudes about SMUD

Q27	Generally speaking, are you satisfied or dissatisfied with the job SMUD is doing to provide electricity services to your household?		
	1	Very satisfied	75%
	2	Somewhat satisfied	22%
	3	Somewhat dissatisfied	1%
	4	Very dissatisfied	0%
	98	Not sure	1%
	99	Refused	0%
Q28	Would you say that your participation in the PowerStat® Pilot program has positively impacted your opinion of SMUD, negatively impacted your opinion of SMUD, or has it not changed your opinion either way?		
	1	Positively impacted opinion of SMUD	71%
	2	Negatively impacted opinion of SMUD	1%
	3	No impact	25%
	98	Not sure	2%
	99	Prefer not to answer	0%

Section 8: Background Questions			
D1	Which of the following rate plans is your household on?		
	1	Standard Tiered Rate Plan that has a flat rate regardless of time of use, but the rate increases once your household has used a certain amount of electricity each month	26%
	2	Optimum Off-Peak Pricing Plan that provides a discount for electricity used during off-peak hours, but higher rates for electricity used during peak hours	24%
	98	Not sure	49%
	99	Refused	1%

D2	How would you rate your understanding of each rate plan?						
	Randomize	Excellent	Good	Fair	Poor	Very Poor	Not Sure/Doesn't Apply
A	Standard Tiered Rate Plan	11%	30%	20%	14%	5%	20%
B	Optimum Off-Peak Pricing Plan	11%	28%	20%	16%	6%	20%

D3	Which of the following best describes your household's Internet connection?		
	1	Dial-up (low speed)	2%
	2	DSL (high speed)	51%
	3	Cable (high speed)	40%
	4	Use neighbor's wifi connection	0%
	5	No Internet connection	2%
	98	Not sure	4%
	99	Refused	0%

Thank you for participating in this survey!

Sample Items			
S1	Plan Group		
	1	TOU CPP rate/customer controlled	4%
	22	TOU CPP rate/2 degree temp raise	8%
	23	TOU CPP rate/3 degree temp raise	10%
	24	TOU CPP rate/4 degree temp raise	17%
	32	2 degree temp raise with $2 incentive per Conservation Day	6%
	33	3 degree temp raise with $3 incentive per Conservation Day	13%
	34	4 degree temp raise with $4 incentive per Conservation Day	42%

POST-TREATMENT SURVEY QUESTIONNAIRE: COMMERCIAL

TRUE NORTH RESEARCH

SMUD 2013 PowerStat Post-Treatment Survey
Commercial Customers
Final Toplines (4 Respondents)
December 2013

Section 1: Introduction

Welcome! Thank you for taking this survey about the PowerStat® pilot program in which your business is participating. This is the final survey you will be asked to complete as part of the PowerStat® pilot. By sharing your opinions with us, you will help SMUD evaluate the PowerStat® pilot and decide what type of program to offer to customers in the future.

Your identity will be held in the strictest confidence and your answers will be kept anonymous in any publications of findings.

Web Instructions:
During the survey, please do not use your browser's 'Forward' and 'Back' buttons. To move through the survey, use the 'Back' and 'Next' buttons at the bottom of each page. When you have finished the survey click the 'Done' button to submit your survey.

If you need to stop while taking this survey, your answers will be saved so that you may return and resume where you left off. To see the survey most clearly, MAXIMIZE this browser screen.

Section 2: Overall Pilot Rating & Impacts

Q1	In general, how would you rate your overall experience participating in the PowerStat® pilot program?			
	1	Very satisfied	100%	
	2	Somewhat satisfied	0%	
	3	Somewhat dissatisfied	0%	
	4	Very dissatisfied	0%	
	98	Not sure	0%	
	99	Prefer not to answer	0%	
Q2	Do you have any suggestions on how the PowerStat® pilot program can be improved?			
	1	Yes	0%	*Ask Q3*
	2	No	100%	*Skip to Q4*
	99	Prefer not to answer	0%	*Skip to Q4*
Q3	Please briefly describe the one or two changes you think would most improve the PowerStat® pilot program in the text box below.			
			No changes mentioned	

SMUD®

Q4	In your opinion, how much has participating in the PowerStat® pilot program _____?						
	Randomize	A lot	Some	A little	None	Not Sure	Prefer not to answer
A	Helped you save money on your electric bill	25%	50%	25%	0%	0%	0%
B	Helped you protect the environment	0%	75%	25%	0%	0%	0%
C	Improved your knowledge about ways you can reduce your business's electricity use	25%	50%	25%	0%	0%	0%
D	Reduced the amount of electricity your business uses	0%	50%	50%	0%	0%	0%
E	Given you more control over your electricity bill	25%	50%	25%	0%	0%	0%
F	Motivated you to change your electricity use habits	25%	25%	50%	0%	0%	0%

Ask Q5 if Q4a = (1,2,3). Otherwise skip to Q6.

Q5	In a typical summer month, approximately how much do you think you saved on your electricity bill by participating in the PowerStat® pilot program?	
	Not sure / Prefer not to answer	100%

Q6	If a friend asked you about the PowerStat® pilot program, would you recommend that they participate?		
	1	Yes	75%
	2	No	0%
	98	Not sure	25%
	99	Prefer not to answer	0%

Section 3: Conservation Day Behavior				
Only ask Q7 & Q8 if in Group 1 (Note: Group 1 = Plan A + No Auto. These questions will be asked based on their actual group assignment, NOT what they 'recall' in the survey)				
Q7	Which of the following Conservation Settings did you use most often this summer?			
	1	Max Comfort	0%	
	2	Comfort	0%	
	3	Balanced	0%	
	4	Savings	0%	
	5	Max Savings	0%	
	98	Don't recall/Not sure	0%	
	99	Prefer not to answer	0%	
Q8	How often did you make adjustments to your Conservation Setting this summer?			
	1	Never	0%	
	2	Once or twice	0%	
	3	Three to five times	0%	
	4	More than five times	0%	
	98	Not sure	0%	
	99	Prefer not to answer	0%	
Q9	On a normal summer day (not a Conservation Day), do you take any actions to reduce your business's energy use during peak hours between 4PM and 7PM?			
	1	Yes	50%	*Ask Q10*
	2	No	25%	*Skip to Q11*
	98	Not sure	25%	*Skip to Q11*
	99	Prefer not to answer	0%	*Skip to Q11*
Q10	What actions do you take on a normal summer day to reduce your business's energy use during peak hours? *Please be specific – insert response in text box below.* Verbatim responses provided below.			
	Closed blinds.			
	Didn't run any equipment that wasn't absolutely necessary.			

Q11	When compared to a normal summer day, did you take any *additional* actions on Conservation Days to further reduce your electricity use between the hours of 4PM to 7PM?			
	1	Yes, took additional actions on *every* Conservation Day	25%	*Ask Q12*
	2	Yes, took additional actions on *most* of the Conservation Days	25%	*Ask Q12*
	3	Yes, took additional actions on *a few* of the Conservation Days	0%	*Ask Q12*
	4	No, did not take additional actions on Conservation Days	50%	*Skip to Q13*
	98	Not sure	0%	*Skip to Q13*
	99	Prefer not to answer	0%	*Skip to Q13*
Q12	What *additional* actions did you take to further reduce your electricity use on Conservation Days between the hours of 4PM and 7PM? *Please be specific – insert response in text box below.* Verbatim responses provided below.			
	Avoided heavy usage during late afternoon hours.			

Section 4: Interest in Participating Again				
Q13	Thinking ahead to *next* summer (2014), would you sign up again to participate in the PowerStat® program?			
	1	Definitely yes	25%	*Go to Q14*
	2	Probably yes	75%	*Go to Q14*
	3	Probably no	0%	*Skip to Q17*
	4	Definitely no	0%	*Skip to Q17*
	98	Not sure	0%	*Skip to Q17*
	99	Prefer not to answer	0%	*Skip to Q17*
Only ask Q14 if NOT in Group 1. Otherwise skip to Q15.				
Q14	Based on your experience this summer, what temperature increase would you select for Conservation Days next summer?			
	1	2 Degree	25%	
	2	3 Degree	25%	
	3	4 Degree	25%	
	98	Not sure	25%	
	99	Prefer not to answer	0%	

Q15	Which of the following options would you prefer for how your automatic temperature increase is managed on Conservation Days? *Randomize the order options 1 & 2 are shown.*		
	1	I agree to an automatic temperature increase amount (2, 3 or 4 degrees) that is the same for all Conservation Days. It can't be changed.	50%
	2	I program my thermostat for an automatic temperature increase (1, 2, 3, 4 or 5 degrees) for Conservation Days. I can change the increase amount whenever I want.	25%
	98	Not sure	25%
	99	Prefer not to answer	0%
Q16	This summer, SMUD sent notices the day before regarding an upcoming Conservation Day. If SMUD were instead to send notices the same day as a Conservation Day, would that be acceptable to you?		
	1	Yes, same day notification is acceptable	75%
	2	No, same day notification is not acceptable	25%
	98	Not sure	0%
	99	Prefer not to answer	0%

Section 5: Use & Product Ratings				
The next few questions focus on the thermostat and your experiences when using it.				
Q17	Overall, how would you rate your satisfaction with the new thermostat?			
	1	Very satisfied	100%	*Skip to Q19*
	2	Somewhat satisfied	0%	*Skip to Q19*
	3	Somewhat dissatisfied	0%	*Ask Q18*
	4	Very dissatisfied	0%	*Ask Q18*
	98	Not sure	0%	*Skip to Q19*
	99	Prefer not to answer	0%	*Skip to Q19*
Q18	Please briefly describe why you are dissatisfied with the thermostat. *Insert response in text box below.* Verbatim responses provided below.			
			No dissatisfied respondents	

Q19	Please rate the new thermostat on the following attributes.						
	Randomize. But always have G appear last.	Excellent	Good	Fair	Poor	Very Poor	Not Sure/Doesn't Apply
A	Ease of use	75%	25%	0%	0%	0%	0%
B	Clarity of thermostat operation manual	75%	25%	0%	0%	0%	0%
C	Readability of display	75%	25%	0%	0%	0%	0%
D	Availability of technical support	25%	25%	0%	0%	0%	50%
E	Appearance	100%	0%	0%	0%	0%	0%
F	Keeping my business at a comfortable temperature	75%	25%	0%	0%	0%	0%
G	Overall performance	75%	25%	0%	0%	0%	0%

Q20	When compared to your prior thermostat, would you say that the new thermostat you received through the PowerStat® Pilot program performs better, worse or about the same overall?	
1	Much better	50%
2	Somewhat better	50%
3	About the same	0%
4	Somewhat worse	0%
5	Much worse	0%
98	Not sure	0%
99	Prefer not to answer	0%

Q21	Since enrolling in the PowerStat® pilot program and receiving your new thermostat, how easy or difficult has it been to keep your business at a comfortable temperature?	
1	Very easy	75%
2	Somewhat easy	25%
3	Somewhat difficult	0%
4	Very difficult	0%
98	Not sure	0%
99	Prefer not to answer	0%

Section 6: Customer Service									
Q22	Please indicate the extent to which you agree or disagree with the following statements about your experience participating in the PowerStat® pilot program.								
	Randomize		Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree	Not Sure	Doesn't Apply	Prefer not to answer
A	SMUD clearly explained the goals of the program		75%	25%	0%	0%	0%	0%	0%
B	SMUD clearly explained what I was expected to do during the program		75%	25%	0%	0%	0%	0%	0%
C	I was satisfied with how SMUD answered my questions		50%	25%	0%	0%	0%	25%	0%
D	The information SMUD made available was informative and helpful		75%	25%	0%	0%	0%	0%	0%
Q23	Did you contact SMUD and/or the installation company (GoodCents) during the past three months about any issue(s) related to the PowerStat® pilot program? *You can check one or both 'yes' options below.*								
	1	Yes, called SMUD	0%						
	2	Yes, called installation company GoodCents	0%						
	3	No	100%						
	99	Prefer not to answer	0%						
Ask Q24 if Q23 = (1,2).									
Q24	Please briefly describe the issue(s) that prompted your call to SMUD and/or the installation company (GoodCents) in the text box below.								
			No respondents contacted SMUD/installation company						
Ask Q25 if Q23 = 1.									
Q25	Was SMUD able to help resolve the issue(s) to your satisfaction?								
	1	Yes	0%						
	2	No	0%						
	3	Yes for some issues, no for others	0%						
	99	Prefer not to answer	0%						

Ask Q26 if Q23 = 2.			
Q26	Was the installation company (GoodCents) able to help resolve the issue(s) to your satisfaction?		
	1	Yes	0%
	2	No	0%
	3	Yes for some issues, no for others	0%
	99	Prefer not to answer	0%

Section 7: Attitudes About SMUD			
Q27	Generally speaking, are you satisfied or dissatisfied with the job SMUD is doing to provide electricity services to your business?		
	1	Very satisfied	100%
	2	Somewhat satisfied	0%
	3	Somewhat dissatisfied	0%
	4	Very dissatisfied	0%
	98	Not sure	0%
	99	Refused	0%
Q28	Would you say that your participation in the PowerStat® Pilot program has positively impacted your opinion of SMUD, negatively impacted your opinion of SMUD, or has it not changed your opinion either way?		
	1	Positively impacted opinion of SMUD	50%
	2	Negatively impacted opinion of SMUD	0%
	3	No impact	25%
	98	Not sure	25%
	99	Prefer not to answer	0%
Section 8: Background Questions			
D1	Which of the following rate plans is your business on?		
	1	**Standard Tiered Rate Plan** that has a flat rate regardless of time of use, but the rate increases once your business has used a certain amount of electricity each month	0%
	2	**Optimum Off-Peak Pricing Plan** that provides a discount for electricity used during off-peak hours, but higher rates for electricity used during peak hours	25%
	98	Not sure	75%
	99	Refused	0%

D2	How would you rate your understanding of each rate plan?						
	Randomize	Excellent	Good	Fair	Poor	Very Poor	Not Sure/Doesn't Apply
A	Standard Tiered Rate Plan	0%	0%	25%	25%	0%	50%
B	Optimum Off-Peak Pricing Plan	0%	25%	25%	25%	0%	25%

D3		Which of the following best describes your business's Internet connection?
	1	Dial-up (low speed) 0%
	2	DSL (high speed) 75%
	3	Cable (high speed) 25%
	4	Use neighbor's wifi connection 0%
	5	No Internet connection 0%
	98	Not sure 0%
	99	Refused 0%

Thank you for participating in this survey!

Sample Items			
S1	Plan Group		
	1	TOU CPP rate/customer controlled	0%
	22	TOU CPP rate/2 degree temp raise	0%
	23	TOU CPP rate/3 degree temp raise	0%
	24	TOU CPP rate/4 degree temp raise	0%
	32	2 degree temp raise with $2 incentive per Conservation Day	50%
	33	3 degree temp raise with $3 incentive per Conservation Day	0%
	34	4 degree temp raise with $4 incentive per Conservation Day	50%

PARTICIPATION AGREEMENT

SMUD's 2013 PowerStat® Pilot - Participation Agreement

This Participation Agreement ("Agreement") for SMUD's Energy Insights 2013 PowerStat Pilot ("Pilot") is entered into between the Sacramento Municipal Utility District ("SMUD"), the customer ("Customer")." The Parties agree as follows:

1. **Term.** This Agreement is effective upon the date of last execution by the Parties and shall continue until December 31, 2013, unless earlier terminated by default or by either Party with prior written notice.
2. **Scope.** This Pilot will provide select residential customers a thermostat(s) to manage energy use and costs, and help SMUD test and study new residential technologies and rates. This Pilot is part of SMUD's Department of Energy Smart Grid Investment Grant (Assistance Agreement DE-OE0000214). In exchange for Customer's participation in the Pilot (subject to the Prices in section 3), SMUD will provide an Energate Thermostat(s) and installation at no cost to Customer. As a condition of participating in the Pilot, Customer agrees to remain in the Pilot through December 31, 2013.
3. **Prices.** As described in the Customer offer letter, if Customer chooses to enroll in the Optimum Off-Peak Plan the prices are in effect June 1, 2013 through September 30, 2013 (Summer Period). For a detailed description of the rate and exact prices, please refer to the SmartSacramento® Pricing Pilot Combined Time of Use and Critical Peak Rate (Summer Season Only) on Page 3 of the R Residential Service Rate Schedule. The Rate Schedule can be found online at smud.org by clicking on the Customer service link and then Rates, Rules & Regulations link. If Customer changes his/her rate plan, rate, or billing option during the term of this Agreement, Customer may no longer participate in the Pilot.

***** Choose ONE of the following options (A or B) by checking the box*****

A. ❑ Optimum Off Peak Rate + Energate Thermostat

YES, I want to change my rate to the Optimum Off Peak Plan rate:

Off-Peak Base Use	$0.0721 /kWh	all day on weekends and holidays + before 4 p.m. and after 7 p.m. on weekdays
Off-Peak Base Plus Use	$0.1411 /kWh	applies to off-peak use exceeding 700 kWh in a billing period for standard customers
On-Peak Use	$0.2700 /kWh	3 hours (4-7 p.m.) on normal weekdays (except for holidays)
Event Use	$0.7500 /kWh	3 hours (4-7 p.m.) on 12 Conservation Day event weekdays (except for holidays) - events are noticed one day in advance
System Infrastructure Fixed Charge	$10/month	

Prices for the following observed holidays will be the same as the weekend prices in the same month:
- Independence Day (July 4, 2013)
- Labor Day (September 2, 2013)

Customer agrees to be charged and billed for electric service at the Optimum Off Peak plan rate from June 1 through September 30, 2013.

For Customer's convenience, you have the option to have SMUD automatically raise your thermostat temperature by 2, 3, or 4 degrees during Conservation Days.

If "Yes", choose 2, 3 or 4 degrees below (If "No", please leave blank):

❑ **YES, I will allow SMUD to automatically raise my thermostat temperature up 2, 3, or 4 degrees during Conservation Days.**

This option will automatically increase the temperature set point by 2, 3, or 4 degrees from 4 p.m. to 7 p.m. during Conservation Days. Customer is allowed to override the increased temperature setpoint during any of these 12 days during the 2013 summer period.

Choose 2, 3 or 4 degrees below:

❑ 2 Degree Automatic Temperature Control

OR

❑ 3 Degree Automatic Temperature Control

OR

❑ 4 Degree Automatic Temperature Control

— OR —

B. ❑ 2, 3, 4 Plan + Energate Thermostat

YES, I want to try the new technologies, and I will allow SMUD to automatically raise my thermostat temperature 2, 3, or 4 degrees during Conservation Days. I'd like to keep my current rate.

SMUD agrees to pay Customers $2, 3, or 4 for each of the 12 Conservation Days not overridden by Customer between June and September 2013. Customer's bill will be credited each month.

Choose 2, 3 or 4 degrees below:

❑ 2 Degree Automatic Temperature Control	$2.00/Conservation Day
OR	
❑ 3 Degree Automatic Temperature Control	$3.00/Conservation Day
OR	
❑ 4 Degree Automatic Temperature Control	$4.00/Conservation Day

PS-RES-A

SMUD

SMUD