Connected Home Bundle Field Study

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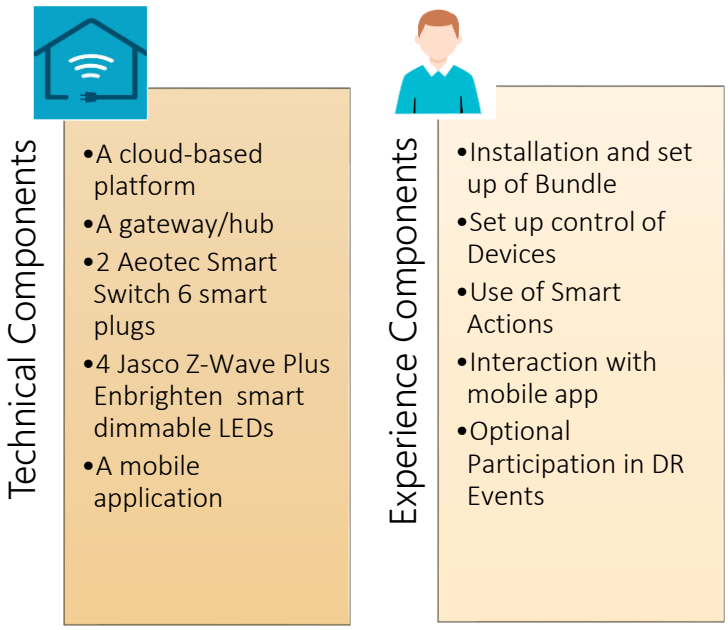
EXECUTIVE SUMMARY

In recent years, many in-home technologies have been introduced to the market creating new ways for residential customers to better manage, and control, their energy use. In particular, the integration of Wi-Fi controlled end-uses and devices with home automation systems provides the energy industry with an exciting opportunity to assist residential customers as they learn to take advantage of new technologies and control strategies. Across the country, utilities are looking for new ways to integrate energy efficiency and demand response programs into customers' lives and in-home technologies hold the promise of opportunities to provide customers with services, education, information, and integrated programs designed to help them manage and understand energy consumption. However, at this point, some of the elements that represent a fully functional, in-home, energy-management-focused control system covering multiple end uses are relatively new to the market. This is particularly true in terms of the role that some of these devices can and will play as energy management information and control gateways.

Because of this, PG&E conducted the Connected Home Bundle Field Study in order to explore the way that customers are currently interacting, and could interact, with new Energy Management Technologies (EMTs) for a variety of different energy management-related applications. Applied Energy Group (AEG) worked with PG&E to evaluate the Field Study and CLEAResult was the implementation contractor. An overview of the study components is shown in the figure to the right.



Study Goals

The goals of the Field Study were to explore the technical and experience components of Connected Home products with a dual focus on assessing customers' experience and energy impacts. The specific objectives of the Field Study are described below:

Customer Experience. Survey instruments were designed to meet most of the customer experience analysis objectives. In addition, an analysis of device data allowed AEG to gain insight into how customers were interacting with their devices and an interview with CLEAResult staff explored technical issues and lessons learned. Specific goals included:

- Learn how customers install their product bundles, identify challenges, and suggest improvements.

- Set up platforms that allow all EMTs to react to a DR event as a bundle, identify challenges, and suggest improvements.
- Observe how customers use (or want to use) their bundles and potential energy impacts.
- Assess overall customer satisfaction with the bundles and their willingness to participate in similar programs in the future.

Energy Impacts. The study team knew at the outset of the project that the sample might be too small to detect significant changes in energy consumption, however, an energy analysis was included in the Field Study to attempt to measure, or at least obtain information on the directionality of energy use and changes in consumption during DR events. Specific goals included:

- Assess customers' response during DR events using smart meter data.
- Determine if customers changed overall energy consumption after the installation of their bundles.

Key Findings and Recommendations

While the Field Study faced numerous challenges, it also demonstrated many successes not the least of which is a wealth of lessons learned and areas for improvement. In addition, the Study validated the technical DR capability along with feasibility of achieving real DR impacts. With very few connected home studies completed in the industry, the information contributed by this Field Study about what works and what needs improvement is incredibly valuable for future program designs and implementations.

Below is a summary of the overarching findings and recommendations surrounding the challenges and successes of the Field Study and several more detailed recommendations are presented on the following page in Figure E-1.

- Achieving full connectivity was challenging. There were both minor and major challenges throughout the study regarding connecting the bundles, the Vendor's hub/gateway and PG&E meter. Most minor challenges were easily and readily resolved by participants or through customer service calls, however achieving a continual wireless connection enabling data to be sent from the PG&E meter to the hub/gateway. was an unforeseen challenge of the Study. For future work, it will be very important to expect the unexpected and attempt to anticipate such challenges by ensuring the product and process compatibility are maintained by the manufacturer and the utility.
- Energy shifting potential is real. Analysis of AMI data from the DR events indicates that the bundle has the potential to affect load shifting and load shaping with specific, targeted customer education and messaging. For example, future studies could craft and test messages that enhance a customer's ability to take action on climate change, support grid infrastructure, or provide emergency curtailment.
- A larger sample size is needed. To see significant impacts and to meaningfully affect customers' lives. Future work should strive to include more data points and a larger number of customers. More data points such as sensors, triggers, messaging, and control strategies provide the opportunity to impact customer convenience, comfort and safety. Larger numbers of participants will help impact analyses to detect statistically significant changes in consumption. Based on previous experience and the expected effect size (impact), AEG would recommend between 300 and 500 participants.
- Utilities can build new partnerships. These products will likely be tied into the home security market since many of the other types of common Smart Devices include items such as smart doorbells, alarms,

and sensors that can trigger control strategies. In the future, utilities will have an opportunity to establish relationships with home security vendors to bundle energy management with home safety.

- Customer satisfaction was mixed. While customers were satisfied with the Connected Home Bundle overall, they were less likely to say they planned on investing in additional smart devices or participate in a similar pilot in the future.

Figure E-1 Summary of Detailed Findings and Recommendations

Stream My Data's inconsistent performance was a significant problem	Ensure that a wide range of products are "officially qualified products" so that Stream My Data is functional.
	Have instructions, videos and fact sheets available on the PG&E website for installing EMTs and connecting the hub/gateway.
A large group of customers did not install all the bulbs or plugs in the bundle	Include follow up emails reminding participants to install their EMTs, providing ideas, tips and tricks on how to use the EMTs, and suggesting devices participants might want to control with them.
	Allow participants to customize their bundles to select different quantities of each technology to maximize installation rates.
Despite misgivings about PG&E control, most opted into the DR Phase	Including options for notifications and reminders to control EMTs through the app (vs. automated) might increase participation for those wary of utility control.
	Include testimonials from other participants in the DR phase of the Field Study who reported very little disruption in thier daily lives resulting from events.
There was evidence of reductions during DR events	Analysis of AMI revealed a pattern and directionality of point estimates that suggests savings, however the point estiamtes were not statistically significant.
	Increasing sample sizes, minimizing opt-outs, and targeting the most likely windows for reductions (shorter evening events) would improve ability to measure responses.
A small percentage of customers were responsible for Smart Actions	Include enducation on Smart Actions in fact sheets, videos or other materials to encourage more cusotmer interaction with the EMTs.
	Send customers messages through the app suggesting energy tips and control strategies that might help them save energy.
Energy management expectations were not aligned with realized benefits	Provide additional context around potential expected savings for various devices (i.e. LEDs).
	Encourage customers to install Smart Plugs on higher load devices such as level 2 chargers, electric dryers, or dishwashers.
Customers are mixed about plans for the future	In general, participants see themselves as likely to purchase additional Smart devices including to Smart Plugs, LED Lights, and “Smart Technologies”.
	Customers were less optimistic about participating in a similar DR program in the future with 43% saying they were at least somewhat likely to participate.

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INTRODUCTION

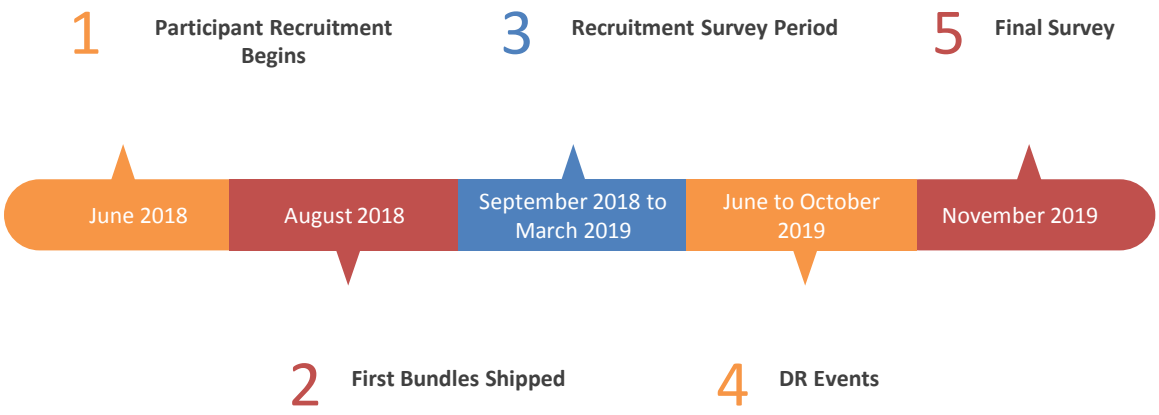
PG&E believes that in-home technologies introduced to the market in the last several years create new opportunities for residential customers to better manage, and control, their energy use. New control devices, home automation systems, and individual end-use controls can now be integrated to make it possible for customers to better understand their energy use, and to efficiently receive, and respond to, information from the utility which might include pricing signals, DR event signals, or other information. However, at this point, some of the elements that represent a fully functional, in-home, energy-management-focused control system covering multiple end uses are relatively new to the market. This is particularly true in terms of the role that some of these devices can and will play as energy management information and control gateways.

Because of this, PG&E conducted the Connected Home Bundle Field Study in order to explore the way that customers are currently interacting, and could interact, with new Energy Management Technologies (EMTs). Applied Energy Group (AEG) worked with PG&E to evaluate this field study and CLEAResult was the implementation contractor.

Summary of the Study

PG&E recognizes that the development of new EMTs is ongoing. New products that might have value in supporting different areas of energy management, and / or, that may have value as mechanisms for making EMTs easier to use, are being introduced frequently. Additionally, the ways in which EMTs can and will be connected, and the mechanisms that will enable customer engagement with these technologies, are still being developed.

Figure 2-1 Study Timeline



Even so, PG&E believed that sufficient development has been done in these areas to make it useful to take a first look at how customers might use these technologies to more conveniently manage their

energy usage. As a result, PG&E implemented the Field Study to consider customer reactions to new home-connected product bundles which include the elements necessary for the customer to:

- Understand their energy use across multiple in-home end uses.
- Receive information from the utility (such as DR event signals) that would be relevant to those end uses.
- Allow customers the opportunity to respond to DR signals based on an automated (programmed) response.

To be eligible for the study participants were required to have an existing ecobee smart thermostat. The Connected Home bundle used in this field study included the following components:

- The selected Vendor's cloud-based platform. An enabling orchestration platform acting as a communications / connecting hub.
- The Vendor's hub. The in-home gateway device that helps the Vendor's platform bridge the smart grid and the smart home. Hereafter referred to as hub/gateway.
- Two Aeotec Smart Switch 6 remote control smart plugs.
- Four Jasco Z-Wave Plus Enbrighten Wireless Smart Dimmable LED Bulbs.
- A mobile application which provides an option for customers to receive DR event notifications. The Vendor's app combines imagery and context-rich, real-time data to keep customers actively engaged in their home energy consumption. Key aspects of the Vendor's Mobile Application include:
- Real-time (every three seconds) data from AMI meters via the Vendor's hub/gateway
- 24-Hour Energy Clock that provides participants high resolution for intuitive energy pattern visualization
- Disaggregation so participants understand how individual appliances drive usage in their homes
- Energy budget tracking and comparisons
- Weather overlays to see how outdoor temperatures affect energy consumption
- Historical energy data which facilitates goal setting and enhances success over time

Originally the scope of the study included comparing two platforms. CLEAResult and PG&E were unable, however, to find another platform that met all the study requirements and the Field Study was therefore limited to assessing only one platform.

Goals of the Study

With a Connected Home product bundle in place, customers have the ability to better respond to information provided on their home's energy usage, and as a result, they are better positioned to improve their home's energy efficiency levels. In addition, they, or the product bundle itself, are able to respond to DR events from the utility or 3rd party Demand Response Providers. While the potential value of these bundles is significant, because the systems are new, it is important to both understand how these systems are developing (from the perspective of perceived customer benefits), but also to understand how these systems can work to improve customer response.

The goals of the Field Study were to explore the customer experience and energy impact aspects of Connected Home product bundles that include lights and plugs. The specific objectives of the Field Study were organized into evaluating the customer experience and determining energy impacts.

Customer Experience. Survey instruments were designed to meet most of the customer experience analysis objectives. In addition, an analysis of device data allowed AEG to gain insight into how customers were interacting with their devices and an interview with CLEAResult staff revealed wide-spread technical issues and lessons learned. Specific goals included:

- Learn how customers install their connected product bundles, identify challenges encountered in doing so, and suggest improvements.
- Set up platforms that allow all EMTs to react to a DR event as a bundle, identify challenges associated with doing so, and suggest improvements.
- Observe how customers use (or want to use) their bundles and how that use might impact energy usage.
- Assess overall customer satisfaction with the bundles and their willingness to participate in similar programs in the future.

Energy Impacts. The study team knew at the outset of the project that the sample might be too small to detect significant changes in energy consumption, however, an energy analysis was included in the Field Study to attempt to measure, or at least obtain information on the directionality of energy use. Specific goals included:

- Assess customers' response during DR events using smart meter data.
- Determine whether customers increased or decreased overall energy consumption after the installation of their bundles.

The original scope of the project also included exploring customer interaction with PG&E's Share/Stream my data. But technology issues prohibited customers from having consistent access with this feature and therefore that research objective was not completed.

Organization of this Report

The remainder of the report is organized into the following chapters:

- Chapter 2 – Methodology: Description of the customer recruitment, participant surveys and data analysis.
- Chapter 3 –Results: Findings from the surveys and data analysis.
- Chapter 4 – Conclusions and Lessons Learned: Conclusions reached based on the analysis results, and lessons learned from the Study.

3
METHODOLOGY

This chapter discusses the process used for customer recruitment, describes the event-calling strategy, and presents the approaches used for both the customer experience and energy analysis.

Customer Recruitment

CLEAResult, with the assistance of PG&E, recruited participants for the Field Study from the pool of customers that had participated in the PG&E Smart Thermostat Rebate program and purchased an ecobee thermostat. The value of using this group was twofold: PG&E already knew which customers had ecobee thermostats (a minimum bar for participation in the Field Study), and email addresses were available for each participant. Having email addresses available enabled email recruitment -- the most cost-effective recruitment channel for the Field Study.

Figure 3-1 Customer Recruitment Process

The participant recruitment included the following steps:

- PG&E identified potential study candidates and sent them an email inviting them to participate in the study. The first recruitment emails were sent on July 21, 2018. The invitation included:
    - A brief overview of the study including goals and customer benefits.
    - A link to the study's webpage
    - Contact information for support
- Interested study candidates clicked through to the study's webpage and completed the online application form. The application form included customer contact information, length of time at their current address, type of home, and current thermostat model.
- The information on the completed forms was reviewed by CLEAResult staff to confirm eligibility. In order to be eligible for the study, interested customers had to meet the following criteria:
    - PG&E customer (validated by a match to the PG&E customer data set)
    - Residing in single family home

- At least one year of billing history
- Owns compatible ecobee smart thermostat

CLEAResult staff notified qualified study candidates by email that their application had been reviewed and accepted. Acceptance was on a first come, first served basis with the goal of getting 200 applications approved. The approval email included a link to complete the participation agreement. Once the completed participation agreement was processed, the candidate was considered a study participant.

CLEAResult drop shipped the components of the Connected Home Bundle to participants starting on August 15, 2018. Customers self-installed the devices in their home. At the end of the recruitment period a total of 153 customers were recruited and able to install the devices in their homes. This fell short of the original goal of 200 participants but since the study was restricted to one platform instead of two as originally planned, the project team felt that number of participants was acceptable.

Approach to DR Events

In order to test how the EMTs could be used for demand response, PG&E asked participants to opt-in to DR events during which PG&E would remotely turn off the customers two Smart Plugs. The Study then executed an event calling strategy designed to test various potential attributes.

Communication and Participation in DR Events

Participants were sent an email notifying them of the DR phase of the study. The email notified participants that in the coming week, PG&E would begin scheduled energy events where the customers' connected smart plugs would be remotely turned off for specified periods of time. Participants were told that simulating these energy events would help PG&E understand how customers may respond to optional requests to reduce energy use of specific devices and appliances to better manage the electrical grid. Customers who opted into the DR phase were offered a $20 Starbucks gift card as an incentive for participating. Ninety-three participants opted into the DR phase. Participants were provided with the following information regarding the events:

- Even if they opted into the DR phase participants could choose to "opt out" of any of the individual energy events.
- Participants had the ability to turn on their plugs to override an DR event signal at a specific connected device even if they did not opt out of the entire event.
- Participation in an energy event was not mandatory and opting out of an event would not affect participation in the overall study.

Customers were also told to avoid using smart plugs for devices essential to medical, health, and safety or "always on" appliances.

Event Calling Strategy

The event calling strategy was designed to test three different attributes: time of day, duration, and notification. Each strategy is listed and discussed briefly below.

- Time of day. Because the smart plugs controlled loads that, for the most part, were uncorrelated with temperature, there was a desire to call events at different times of day including morning, afternoon, and evening.

- Duration. Because it might be possible that participants would respond differently to various event durations, three event lengths were tested, 1-hour, 2-hour, and 6-hour events.
- Notification. Most of the events provided 24-hour (day ahead) notification, but some of the events provided notification on the day of the event.

In addition, participants were randomly assigned into two groups to more effectively test different event strategies. This A group / B group approach allowed the analysis to compare the load profiles of those responding to an event, with those not responding to an event on the same day. In addition, because of the small sample size, for each type of event (i.e. morning, 2-hour, day ahead) both groups were called at the same time for one event. Table 2-2 below shows the DR event schedule.

Table 3-1 DR Event Schedule

Type of Notification	Event Date	Number of Sites Responding	Group	Event Time
Day Ahead	Wednesday, June 19, 2019	20	A	9:00 to 11:00
Day Ahead	Thursday, June 20, 2019	28	B	9:00 to 11:00
Day Ahead	Tuesday, June 25, 2019	20	A	12:00 to 18:00
Day Ahead	Wednesday, June 26, 2019	28	B	12:00 to 18:00
Day of	Monday, July 1, 2019	22	A	19:00 to 20:00
Day of	Wednesday, July 17, 2019	27	B	19:00 to 20:00
Day Ahead	Thursday, July 18, 2019	23	A	15:00 to 17:00
Day of	Tuesday, July 23, 2019	23	A	18:00 to 24:00
Day of	Wednesday, July 24, 2019	27	B	18:00 to 24:00
Day of	Wednesday, July 31, 2019	24	A	7:00 to 8:00
Day Ahead	Thursday, August 1, 2019	26	B	7:00 to 8:00

Type of Notification	Event Date	Number of Sites Responding	Group	Event Time
Day Ahead	Thursday, August 8, 2019	23	A	19:00 to 21:00
Day of	Friday, August 9, 2019	26	B	19:00 to 21:00
Day of	Wednesday, August 14, 2019	50	Both	9:00 to 11:00
Day of	Thursday, August 22, 2019	49	Both	12:00 to 18:00
Day of	Tuesday, August 27, 2019	48	Both	19:00 to 20:00
Day Ahead	Thursday, September 5, 2019	47	Both	6:00 to 12:00
Day Ahead	Wednesday, September 11, 2019	45	Both	15:00 to 17:00
Day Ahead	Wednesday, September 18, 2019	43	Both	18:00 to 24:00
Day of	Tuesday, September 24, 2019	45	Both	7:00 to 8:00
Day Ahead	Wednesday, October 2, 2019	46	Both	19:00 to 21:00

Customer Experience Analysis

The customer experience analysis included the development and execution of participant surveys, the analysis of device level data, and an interview with CLEAResult's program staff.

Customer Surveys

Survey instruments were designed to meet most of the customer experience analysis objectives. The surveys collected information about installation and connection of the bundles, reaction to DR events, and assessed overall customers satisfaction.

During the study period participants received two surveys:

- Initial Survey. A survey at the beginning of the study that assessed relevant background attitudes and experience, as well as initial Field Study device set up. This survey occurred shortly after the bundle was delivered to ensure that the experience was still fresh in participants' minds.

- Final Survey. A survey at the end of the field period was conducted that assessed customer engagement and customer reaction to the connected devices and DR events. This survey also assessed the customers' overall attitude toward using Connected Home devices to manage electricity usage, and the likelihood of participating in DR in the future.

The online surveys were administered via email. The response rate to the survey is shown in Table 2-1 below. The survey instruments are presented in Appendix A.

Table 3-2 Survey Response Rates

Survey	Number of Participants	Number of Completed Surveys	Response Rate
Initial Survey	153	134	88%
Final Survey	153	96	63%

Analysis of Device Level Data

Device-level data was available for participants that opted into the DR phase. This data allowed for AEG to observe how customers use their bundles in conjunction with the DR events and how that use might impact energy usage. The data was analyzed to determine the following information for DR events:

- The percent of participants that successfully received the DR signal
- The percent of participants that opted out of the event
- The percent of participants that manually adjusted the smart plug during the event
- The average number of participants that responded to each event window.

The Vendor also provided summary data on how often participants interacted with the mobile app.

Interviews with CLEAResult Staff

At the end of the Study period, AEG conducted in-depth interviews with CLEAResult's implementation staff to get their perspective on changes in the scope of work, technology issues encountered, and lessons learned from the Study.

Energy Analysis

The energy analysis included an attempt to quantify the changes in consumption resulting from the DR events.

AEG requested and received hourly interval data for all customers who received a connected home bundle. Data was provided for a period beginning January 1, 2018 and ending in September 31, 2019. Because the measures in the bundles themselves are not particularly weather sensitive, we did not require a full year data before or after the installation period. The data was cleaned and validated using algorithms that have been fully vetted with PG&E during many past projects. AEG received data for a total of 86 participants, and while approximately 8% of the observations were removed during the cleaning process all 86 participants were used in the analysis.

It is important to remember that because the number of participants was quite small, and the impacts were expected to be small, we knew that detecting significant changes in consumption would be difficult. Therefore, the key goal of the EE impact assessment was to determine if there was any evidence of load reductions after the installation of each participant's bundle.

AEG developed a simple daily regression model in order to test for significant changes in daily consumption after the installation of the bundles. The actual installation date was not provided for all customers so for those that we didn't have the installation date we used a full month after the customer requested their bundle. The model specification was as follows:

$$Daily\ kWh_{it} = \alpha_{it} + \beta_1 Monthly_{it} + \beta_2 Weekend_{it} + \beta_3 Daily\ CDD_{it} + \beta_4 Daily\ HDD_{it} + \beta_5 Participation_{it} + \varepsilon_{it}$$

Where:

$Daily\ kWh_{it}$ is the total daily consumption of customer i in time t

α_{it} is the intercept

$Monthly_{it}$ represents a set of monthly dummy variables

$Daily\ CDD_{it}$ represents the average daily cooling degree days with a base of 65 degrees for customer i in time t

$Daily\ HDD_{it}$ represents the average daily heating degree days with a base of 55 degrees for customer i in time t

$Participation_{it}$ is an indicator variable with a value of one after the participant installed their bundle

ε_{it} is the error term picking up the change in daily kWh that isn't explained by the variables in the model.

The coefficient on the variable $Participation_{it}$ is the model's estimate of an average per customer daily response to the installation of their bundle.

The results of the EE analysis were statistically insignificant. The point estimate on Participation indicated a small amount of daily savings, however the results were inconclusive. In addition, it is not unexpected to have insignificant point estimates given the small sample size, and the small impact.

Assessment of DR Impacts

AEG requested and received hourly interval data for all the Field Study participants that opted into the DR events. Data was provided for a period beginning January 1, 2019 and ending after all events had been called on October 15, 2019. Because the measures in the bundles themselves are not particularly weather sensitive, we did not require a full year data. The data was cleaned and validated using algorithms that have been fully vetted with PG&E during many past projects. AEG received data for a total of 86 participants, and while approximately 5% of the observations were removed during the cleaning process all 86 participants were used in the analysis.

It is important to remember that because the samples were quite small, only 86 total participants, and the impacts were expected to be small, we knew that detecting significant changes in consumption would be difficult. Therefore, the key goal of the DR impact assessment was to determine if there was any evidence of load reductions during events.

AEG developed a simple hourly regression model in order to test for significant changes in hourly consumption during DR events for those participants who responded to events. The model specification was as follows, and the same model was estimated for each hour of the day:

$$kWh_{it} = \alpha_{it} + \beta_1 monthly_{it} + \beta_2 CDD_{it} + \beta_3 event_{it} + \beta_4 responder_{it} + \varepsilon_{it}$$

Where:

kWh_{it} is the consumption of customer i in time t

α_{it} is the intercept

$monthly_{it}$ represents a set of monthly dummy variables

CDD_{it} represents the cooling degree days for customer i in time t

$event_{it}$ is an indicator variable with a value of one on an event day

$responder_{it}$ is an indicator variable with a value of one on an event day for a customer that responded to the event.

The coefficient on the variable $responder_{it}$ is the model's estimate of an average per customer response in a given hour. Recall from our description of the event calling strategy, that the use of a randomized A group / B group approach allowed the regression model to leverage the load of customers in one group as a control for customers in another group on an event day. In this manner the two groups function as controls for each other on the various event days.

4
RESULTS

This chapter discusses the results of the customer experience and energy analyses. The customer experience analysis focused on the results gleaned from the surveys, device data and an interview with CLEAResult's project staff while the energy analysis sought to determine if there were energy savings over the course of the Study or during the DR events.

Customer Experience Results

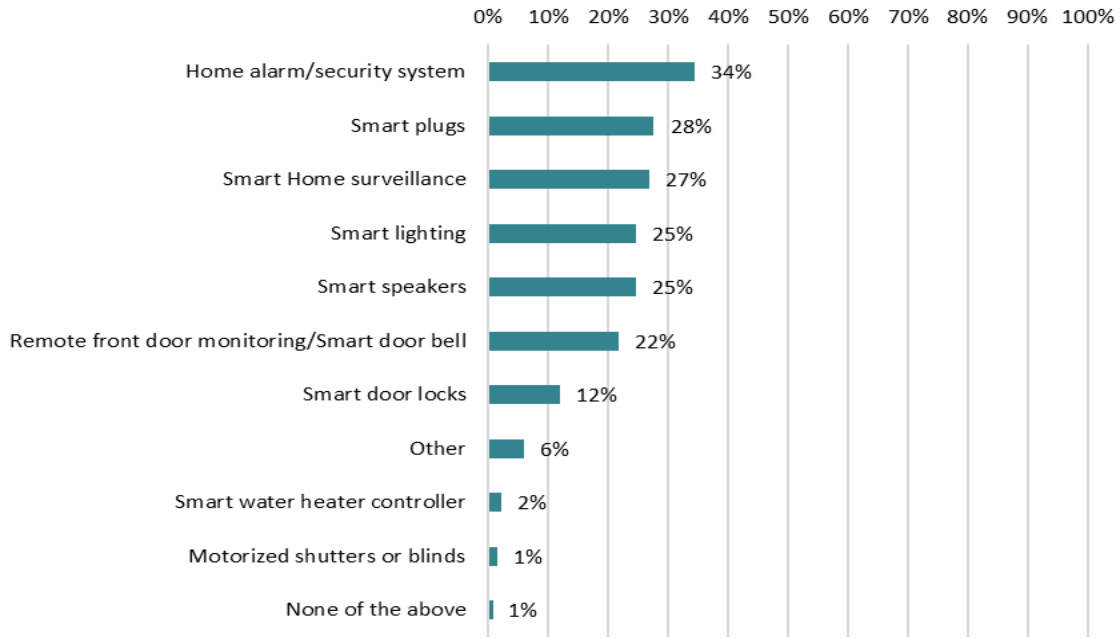
This section includes an analysis of the results of the two surveys and the device data as well as qualitative information from an interview with CLEAResult's staff.

Profile of Participants

The installation survey was designed to determine how "techy" participants were by asking about their experience with new technologies and their agreement with attitudinal statements regarding the use of technology. Although most of the customers that participated in the Field Study use mobile apps and half have a voice assistant, most of the customers did not have experience with sophisticated technologies prior to the Study other than their ecobee smart thermostats. However, the customers do tend to think of themselves as "early adopters" and believe that investment in technology for energy efficiency and convenience is worthwhile.

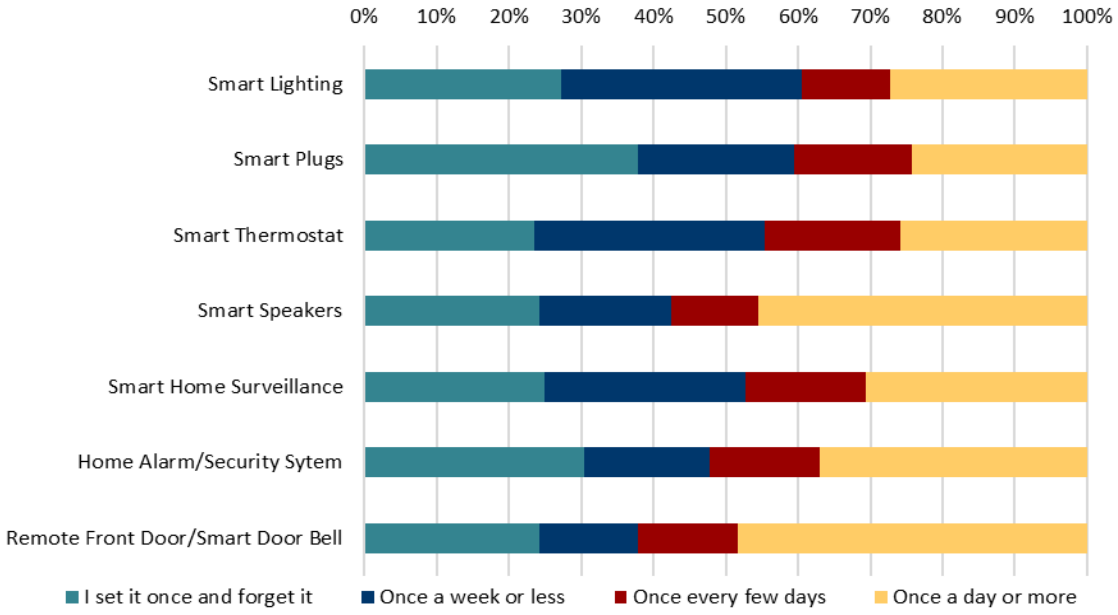
A little over a third of participants have a home alarm/security system while about a quarter have smart plugs, smart home surveillance, smart lighting, smart speakers and/or smart doorbells. Ninety-seven percent of participants with these technologies report using a smartphone app to control, monitor, or schedule at least some of these technologies.

Figure 4-1 Smart Technologies in Participants' Homes Prior to Study



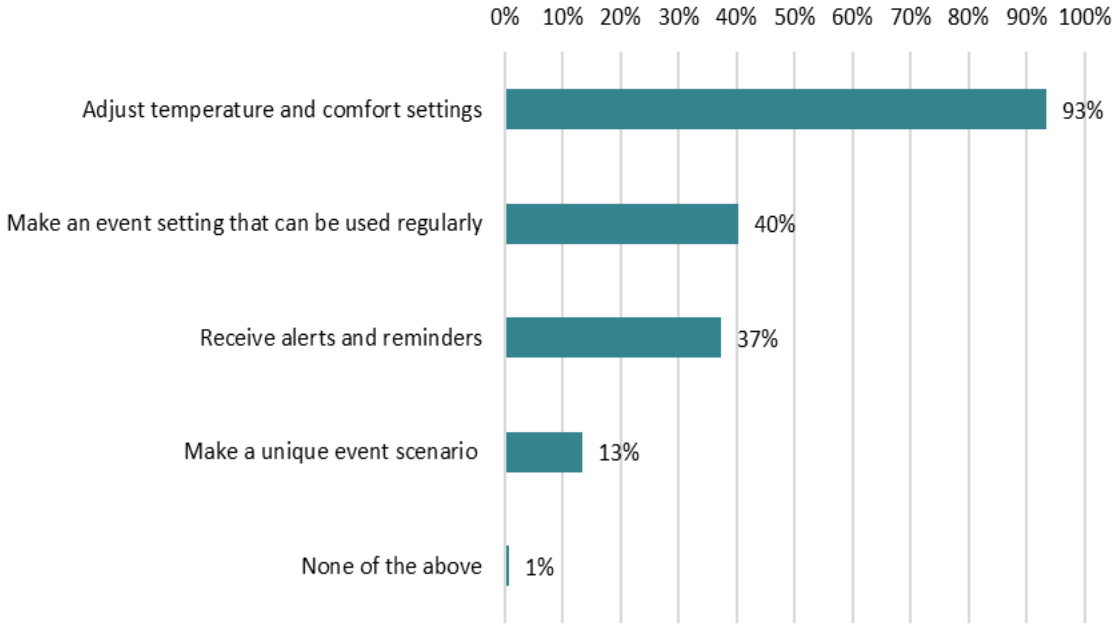
In general, among users of each of these technologies, ~30% set it once and forget it, while over 20% interact with each system daily. Smart speakers, home alarms, and smart doorbells are the most frequently interacted-with technologies.

Figure 4-2 Frequency with which Participants Monitor and Control Technologies



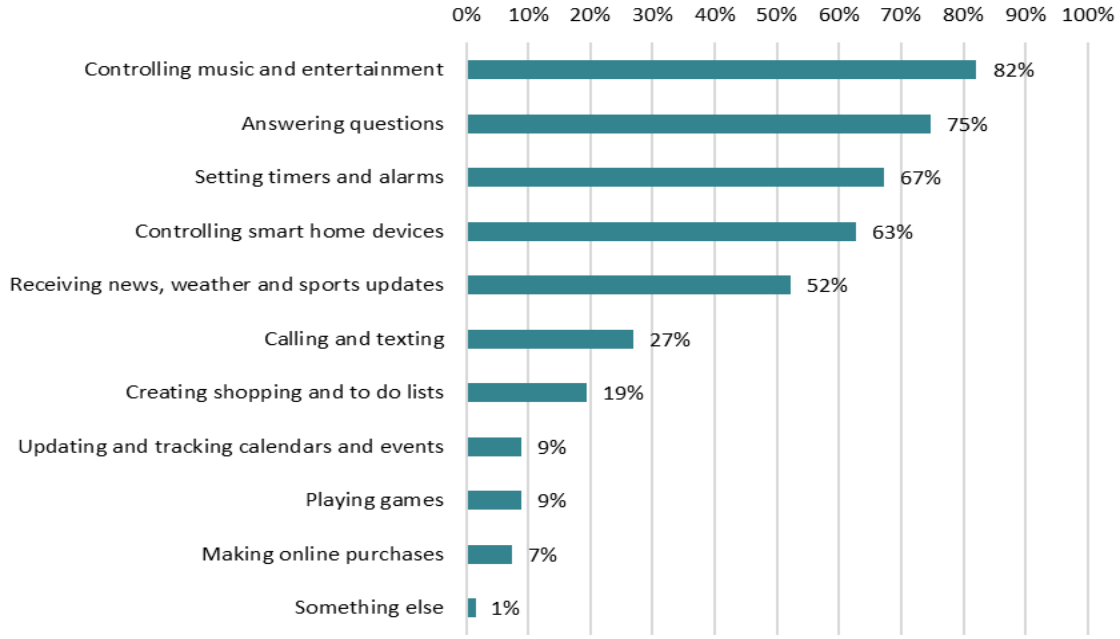
Almost all (99%) of participants indicated that they used a smartphone app to control and monitor their ecobee thermostat. Mostly they use the app to adjust temperature and comfort settings, with less than half using the other tested features.

Figure 4-3 Features of the ecobee App Used



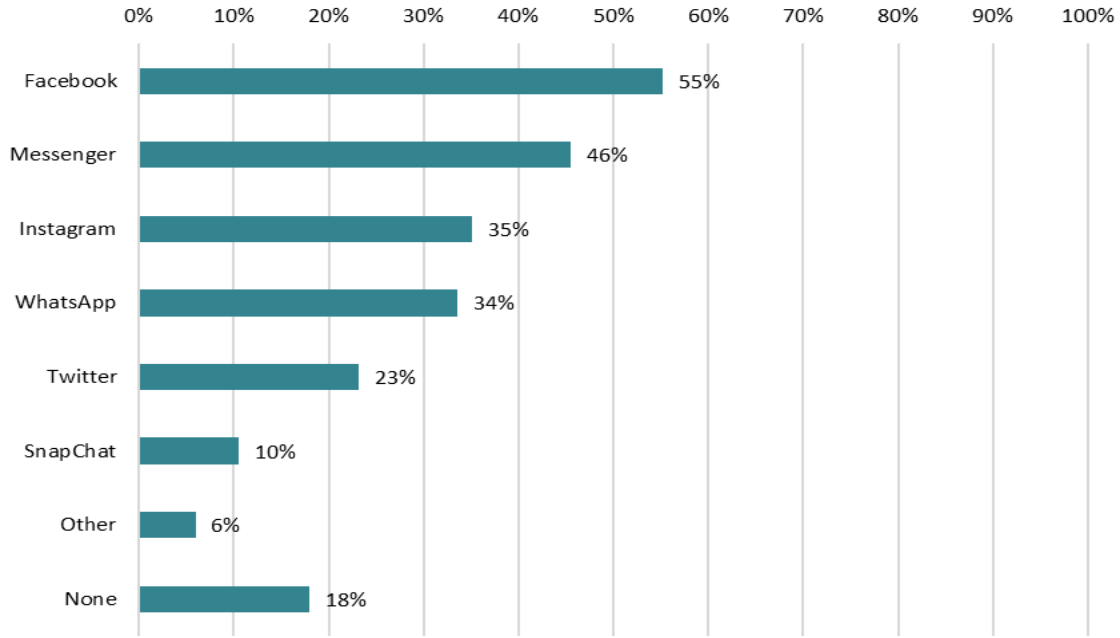
Half of participants also report having a voice assistant, such as Alexa, in their home. Among those who have a voice assistant, about two-thirds (63%) report using it to control smart home devices.

Figure 4-4 Use of Voice Assistant



The use of smart phone apps for social media is very prevalent among participants. Eighty-two percent use an app for at least one form of social media.

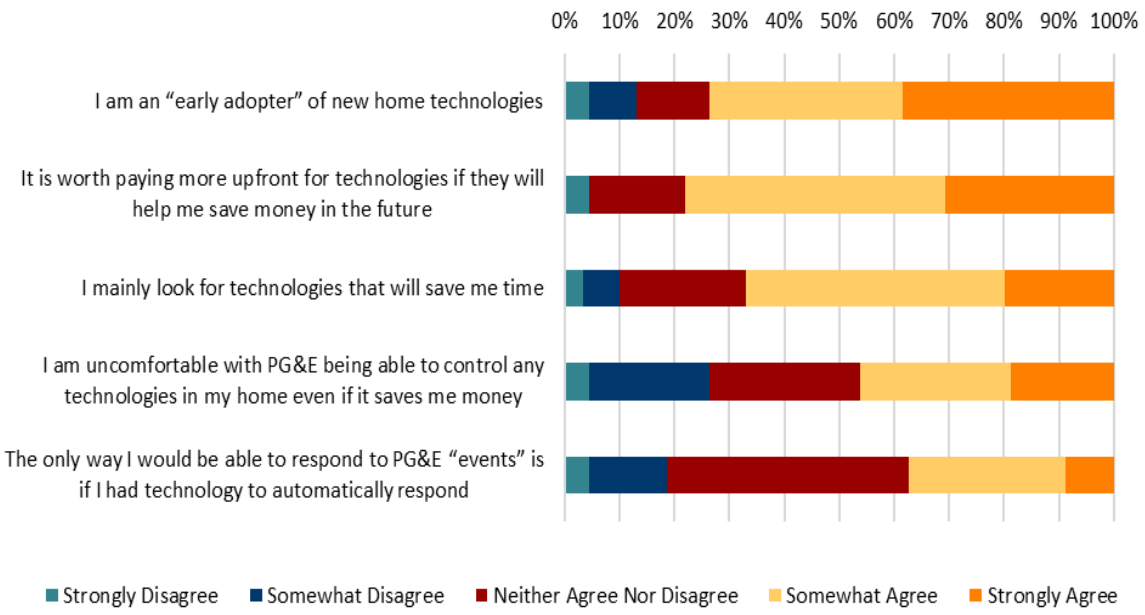
Figure 4-5 Use of Smart Phone Apps for Social Media



In addition to better understanding their experience with new technology, participants were asked their level of agreement with several attitudinal statements regarding technology. Most participants agree that they are early adopters of new technology and are looking for technologies that save

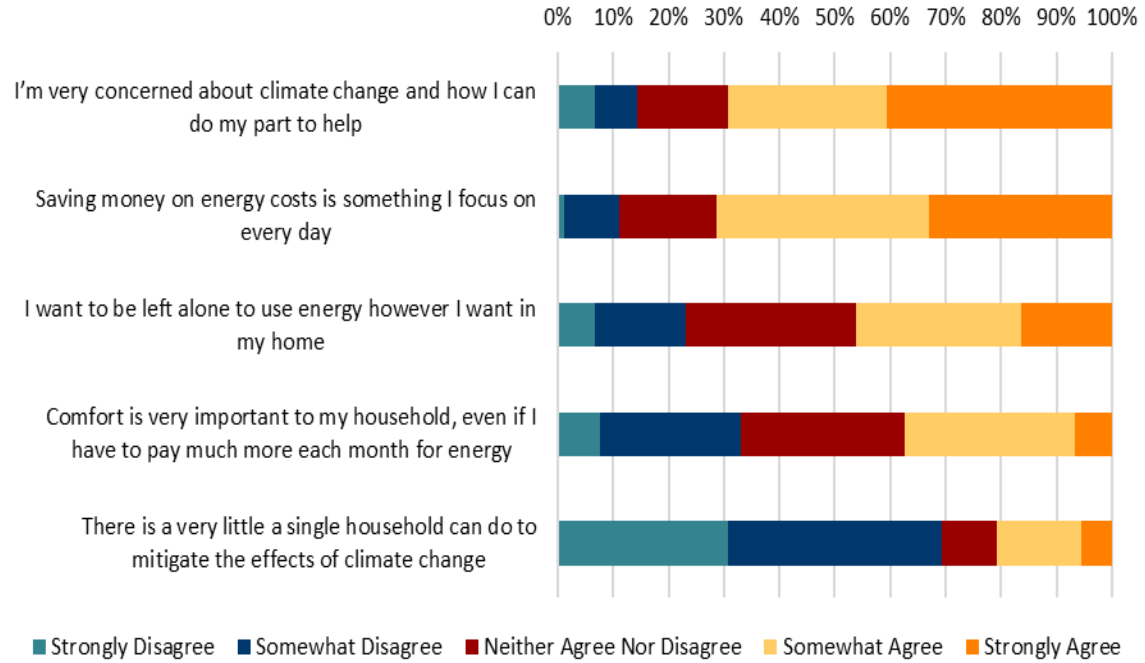
them money and time. A significant portion of this group (46%) at least somewhat agrees that the idea of PG&E taking direct control of devices in their home makes them uncomfortable.

Figure 4-6 Participant Agreement with Attitudinal Statements Regarding Technology



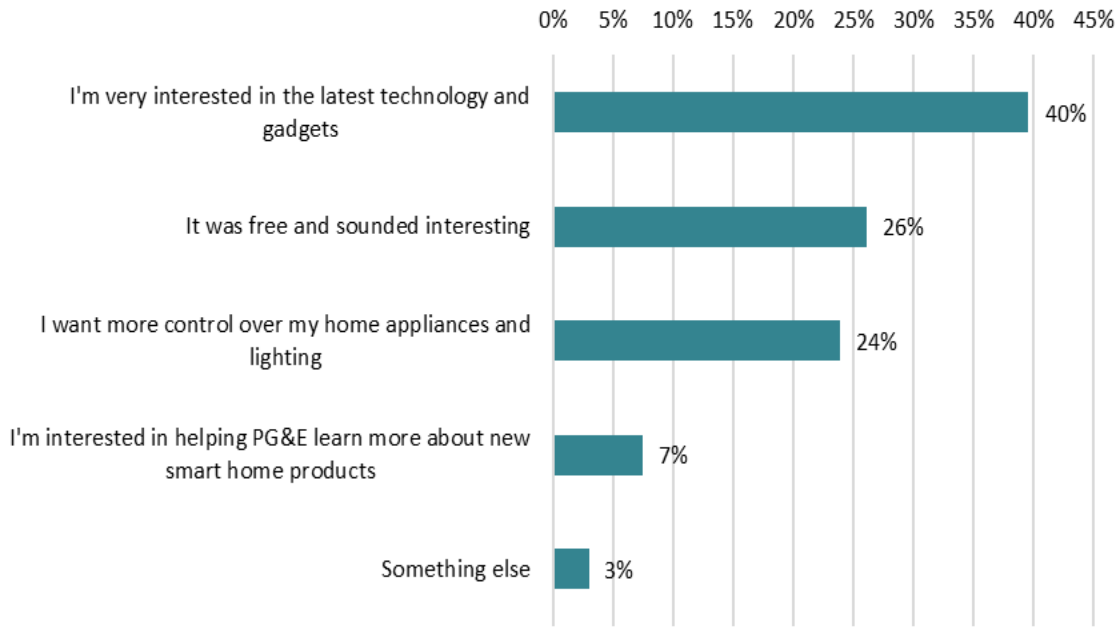
Most (69%) participants at least somewhat agree that they are very concerned about climate change and how they can do their part to help. Most participants also at least somewhat agreed that saving money on energy costs is something they focus on daily.

Figure 4-7 Participant Agreement with Attitudinal Statements Regarding Energy and Climate Change



Interest in the latest technology was cited as the biggest driver of participation in the Connected Home Bundle study.

Figure 4-8 Statement Which Best Describes the Reason for Participating

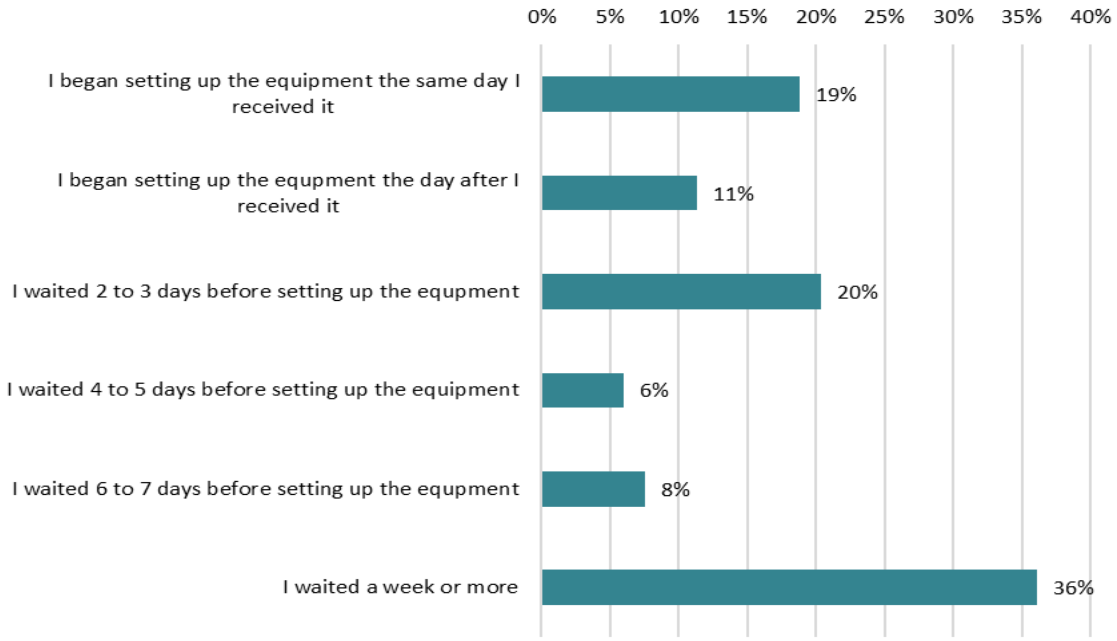


Connected Home Bundle Installation

The installation survey explored participants experience receiving and setting up the Connected Home Bundle equipment. While the majority of customers said installation with most of the components was fairly easy there was some significant difficulty with connecting the hub/gateway to the PG&E Smart Meter. Half of customers report contacting customer service during installation, but according to CLEAResult most of the initial calls involved minor issues and handholding.

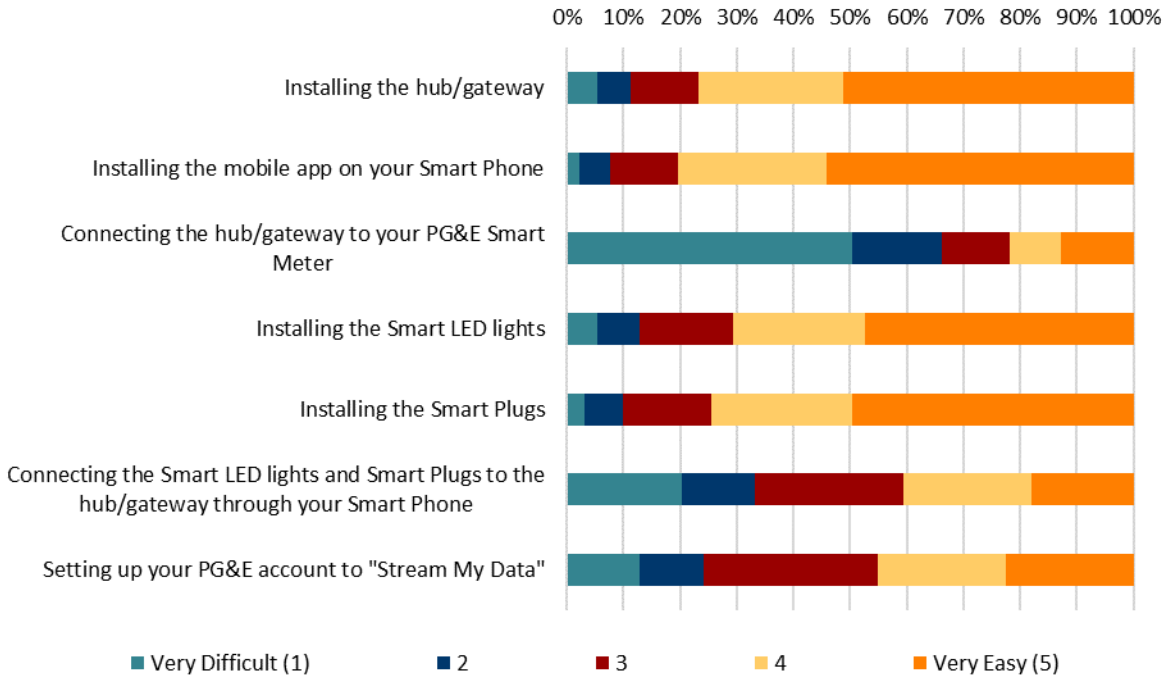
Most participants (50%) indicated that they set up their equipment within 2-3 days of receiving it, but about a third (36%) waited for a week or more.

Figure 4-9 Number of Days Between Receiving the Bundle and Installation



While installing the various components of the bundle was reported to be fairly easy, connecting the Vendor's hub/gateway to the PG&E Smart Meter (and, to a lesser degree, the other smart devices included in the bundle) jumps out as a major pain point for most participants.

Figure 4-10 Ease of Installing Connected Home Bundle Components



A little less than a third (29%) of participants spent more than two hours on Home Bundle setup. More than half of participants required customer service assistance while setting up their equipment, and of those, most (83%) were at least somewhat satisfied with their service experience, with 88% eventually getting a solution from the customer service representative.

Figure 4-11 Total Set Up Time Required

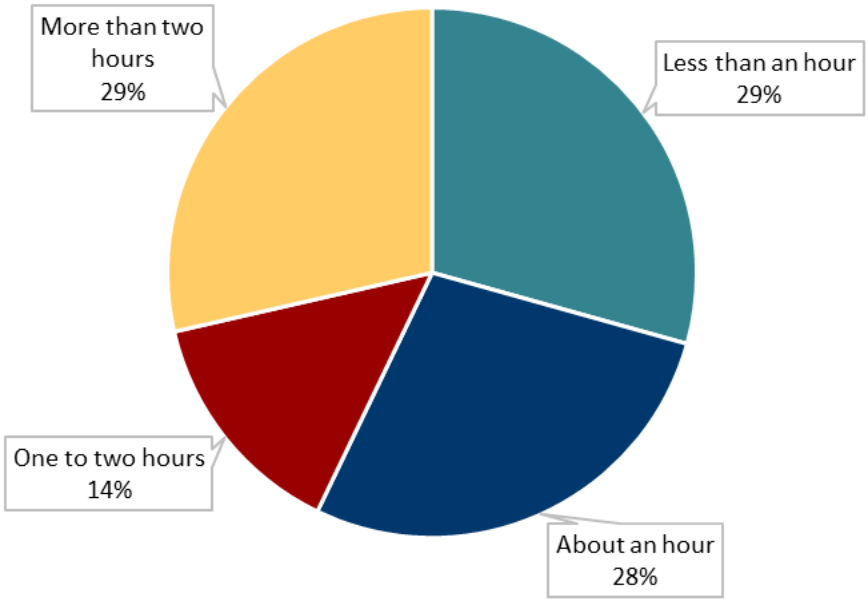
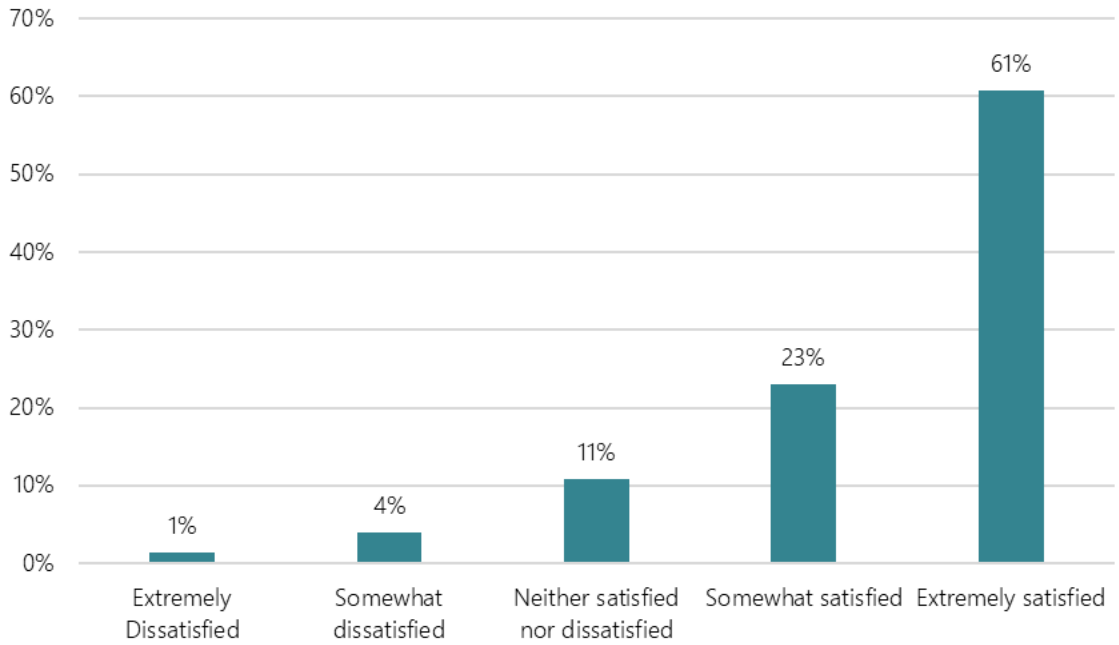
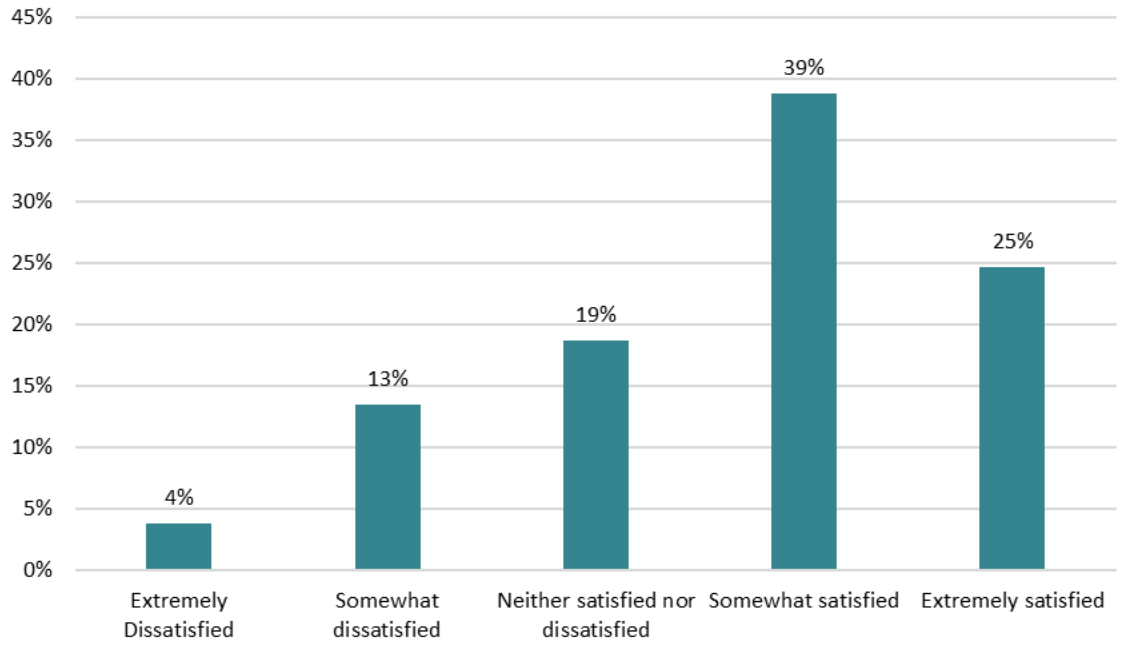


Figure 4-12 Satisfaction with Customer Service



In addition, despite some difficulties with the initial set up, sixty-four percent of participants were at least somewhat satisfied with the step-by-step installation guide.

Figure 4-13 Satisfaction with Step-by-Step Installation Guide



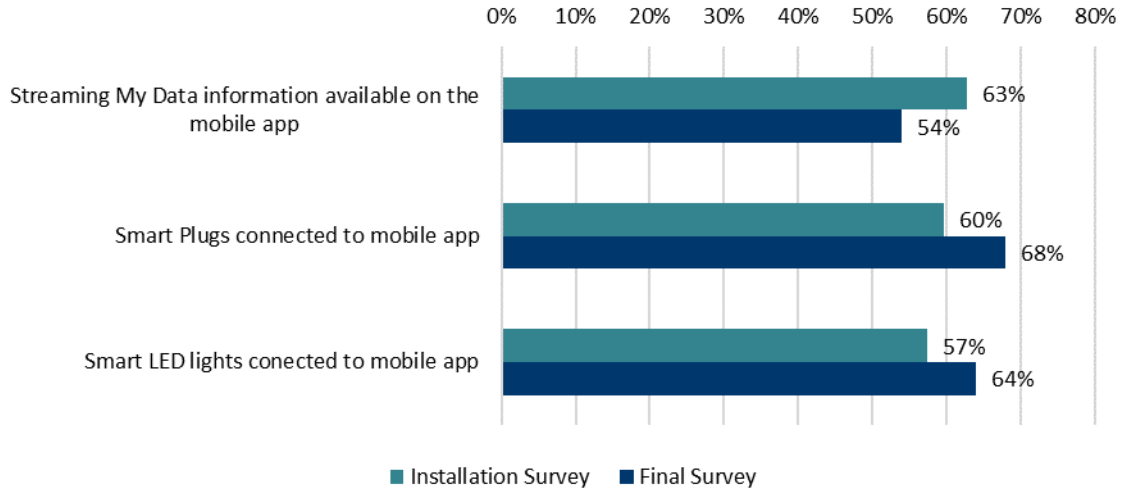
Technology Issues

According to CLEAResult's staff the main technology issue encountered in the Field Study was with the Stream My Data feature which required the hub/gateway to communicate with the PG&E smart meter. Stream My Data allows participants to see their real time data usage on the Vendor's App. This feature worked correctly during the testing period and at the project initiation. But shortly after the Study began PG&E replaced some smart meters as part of their normal maintenance operation. This caused the smart meters and the hub to lose original bindings, and the PG&E meters and the hub/gateway were not communicating. Since the Vendor was not aware of the change, they could no longer get the binding to work automatically. CLEAResult and PG&E developed a work-around for this study which involved PG&E staff manually reconnecting each system individually. This was very time consuming for both PG&E and CLEAResult.

Although all the participants' systems were manually fixed after the initial unbinding, spontaneous unbinding of the smart meters and the hub continued throughout the Study period. This issue happened often enough that it was clear it was not an isolated incident but a system wide problem. The team was never able to identify one specific cause for the problem resulting in participants often unable to use the Stream My Data feature. According to CLEAResult the chief complaint from participants was that they were not getting their real time usage information.

The survey data support the conclusion that there were material problems associated with Stream My Data and also show that there were additional technical difficulties with the Smart LED lights and the Smart plugs. A significant minority (32 - 46%) of participants have difficulties with each of the intended Connected Home Bundle functions. Problems associated with Stream My Data got worse from the installation to the final survey, while problems with Smart plugs and LED lights improved.

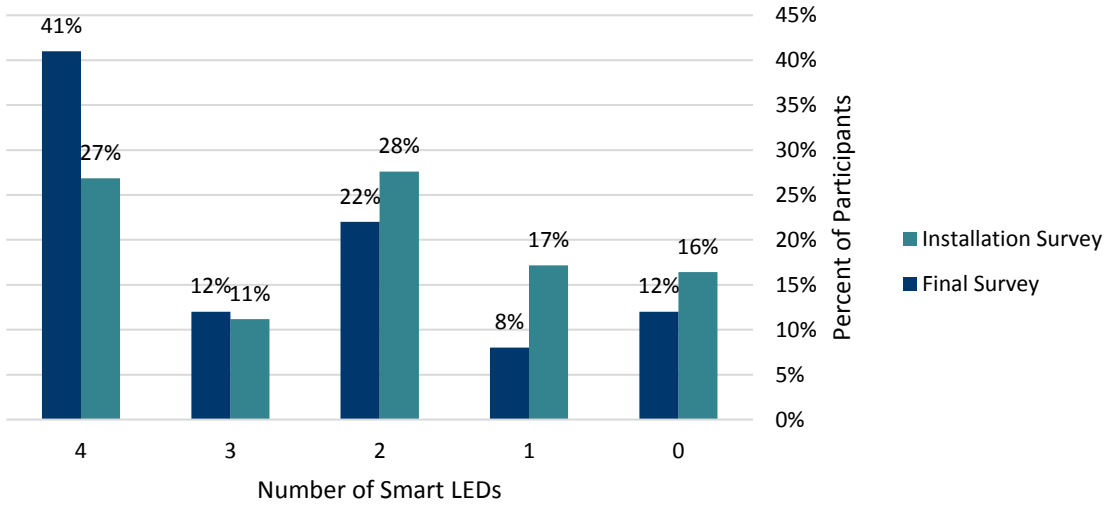
Figure 4-14 Functions of the Bundle that Appear to be Working Properly (Installation and Final Survey



Equipment Use

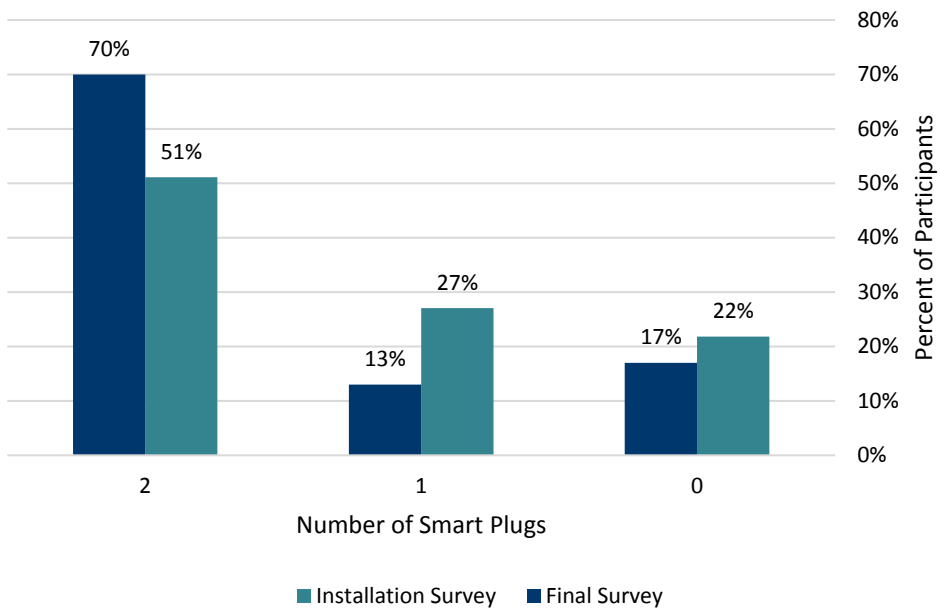
The number of Smart LED lights installed increased from the beginning to the end of the study, although the majority of customers did not install all 4 bulbs. At the time of the installation survey only 27% had all 4 lights from the bundle installed while 41% had all 4 installed at the time of the final survey.

Figure 4-15 Number of Smart LED Lights Installed – Beginning vs. End of Study



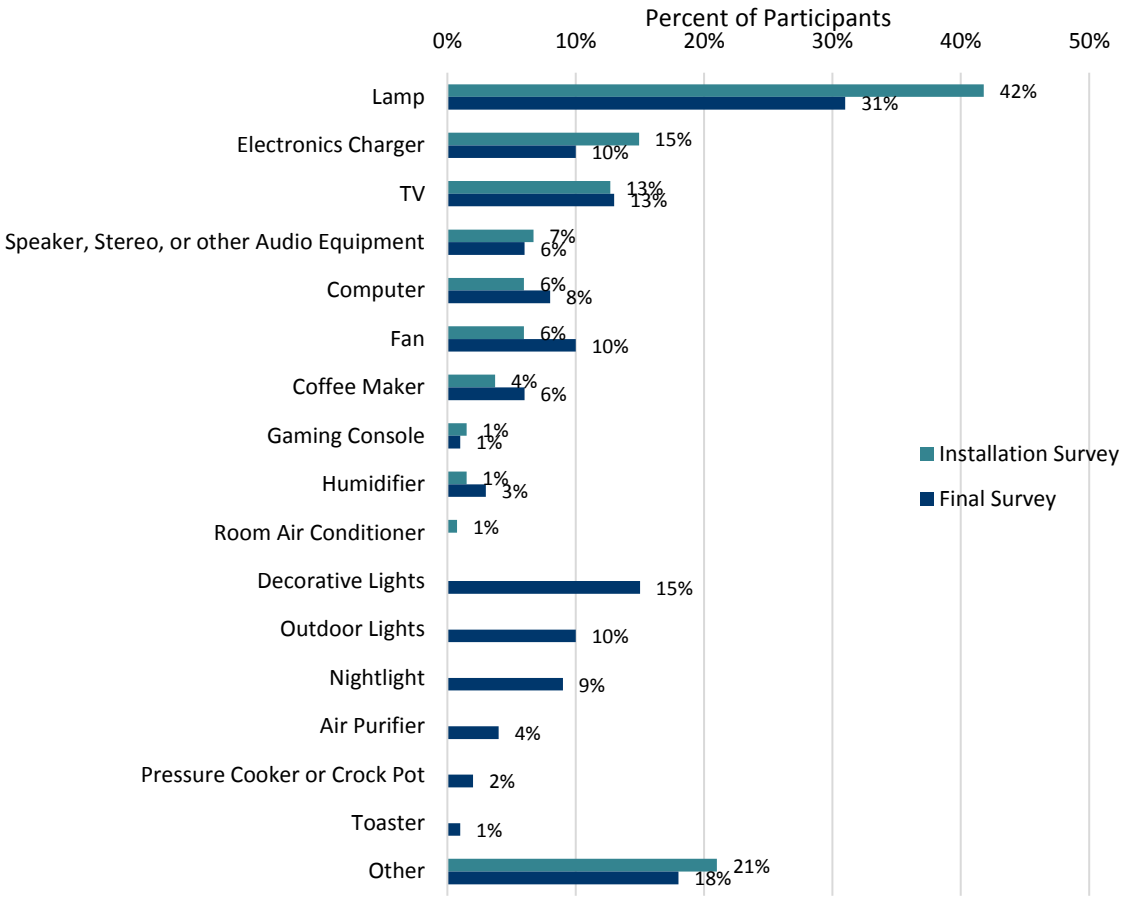
The number of Smart plugs installed also increased during the Study. At the time of the installation survey 51% of participants had both Smart plugs from the bundle installed, but that jumped to 70% by the final survey.

Figure 4-16 Number of Smart Plugs Installed – Beginning vs. End of Study



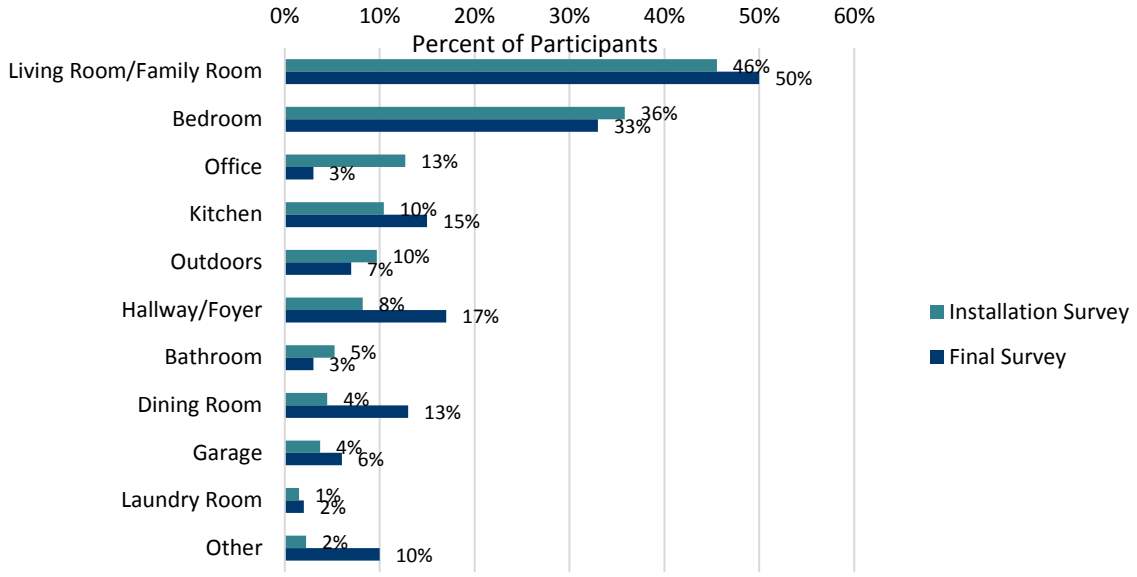
Participants used the Smart Plugs in a variety of locations in their home, with the most popular being using them for indoor lighting. About 34% of participants left their Smart Plugs in their original installation locations, with about 39% moving them once or twice, and 6% moving them more frequently. In most cases, these adjustments were made in search of superior energy savings ("better power saving", "better and more frequent usage", "finding the best use for them"). Some were also in response to seasonal changes ("Different holiday location", "Change in the weather") or purely experimental ("Just to try it out", "wanted to see the power usage of various appliances").

Figure 4-17 Location of Smart Plugs – Beginning vs. End of Study



The most popular place for installing the LED lights is in the living room/family room followed by bedrooms. Only 25% of participants said they moved their Smart LED lights during the study. Those that moved their Smart LED lights maybe did so to experiment and see what location was most useful for the technology.

Figure 4-18 Location of Smart LED Lights – Beginning vs. End of Study



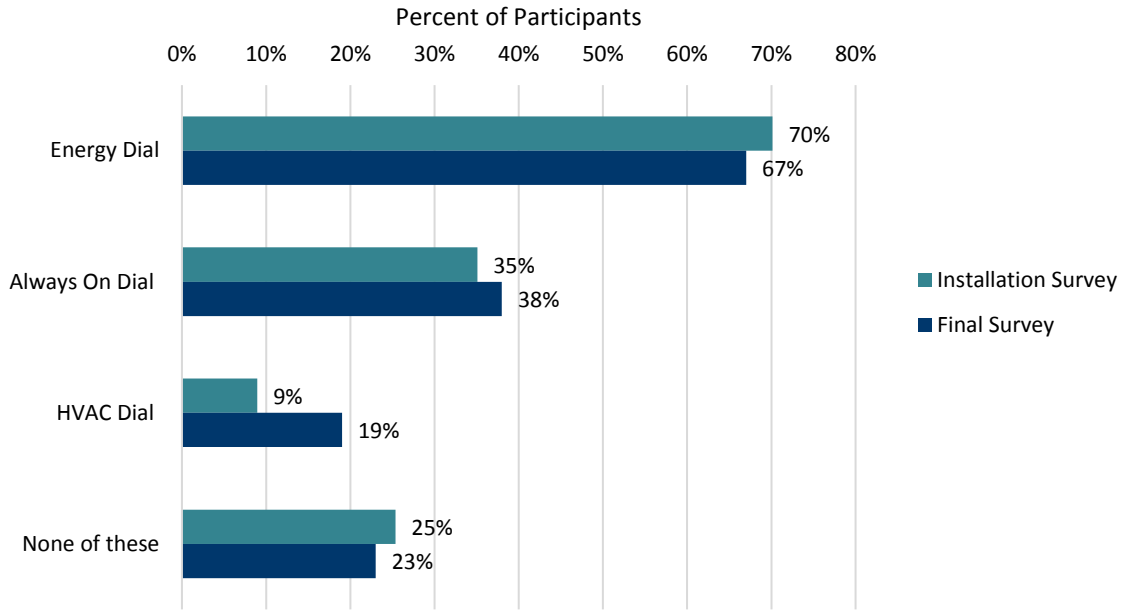
According to summary data from the Vendor, participants interacted with the Smart Devices (LEDs and plugs) a total of 99,220 times during the Study with an average of 1,012 interactions per participant. Participants used the mobile app a total of 423,905 times for an average of 2,633 per participant and set up smart actions a total of 1,218 times for an average of 12.4 per participant.

Table 4-1 Summary of Vendor's Mobile App Data

Interactions	Smart Devices	Mobile App	Smart Actions
Total During Study	99,220	423,905	1,218
Average Per Participants	1,012	2,633	12.4

According to the survey, Energy Dial is the most-used energy monitoring feature of the the Vendor's app, while a quarter of participants (25%) reported that they have not used any of these energy monitoring features.

Figure 4-19 Use of Mobile App Energy Monitoring Features – Beginning vs. End of Study



Outside of basic on/off operations, only a third or less of participants report using any of the Smart LED Light or Smart plug control features of the Vendor's app. These results indicate that 29% of participants are responsible for the 1,218 smart actions recorded by the Vendor.

Figure 4-20 Use of Mobile App for Smart LED Lighting Control – Beginning vs. End of Study

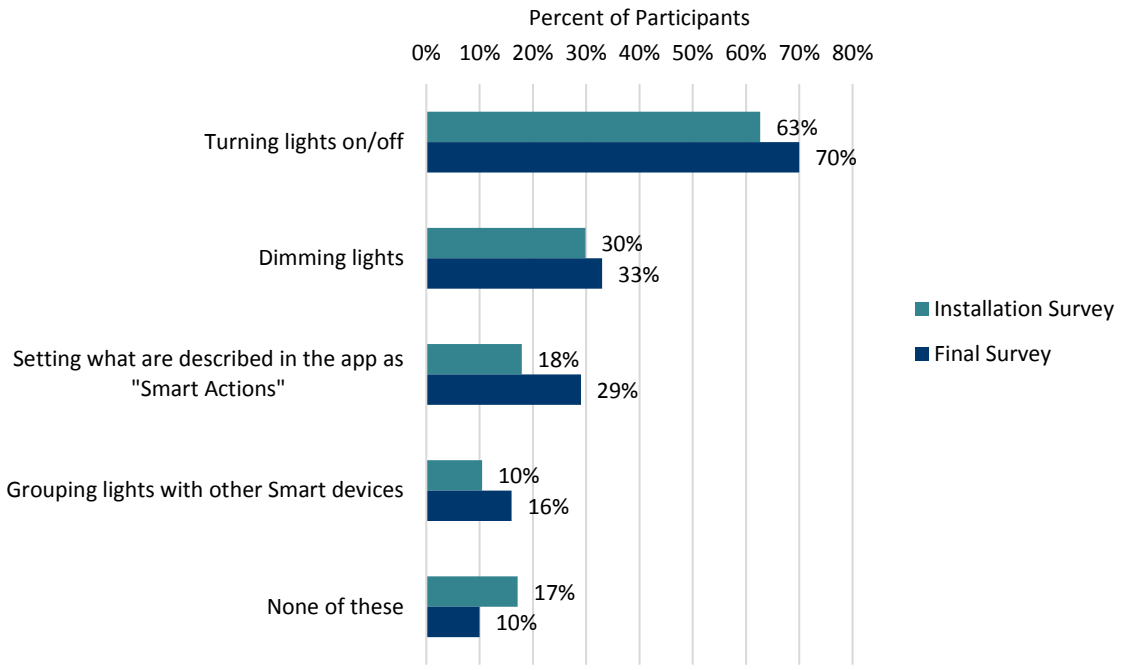
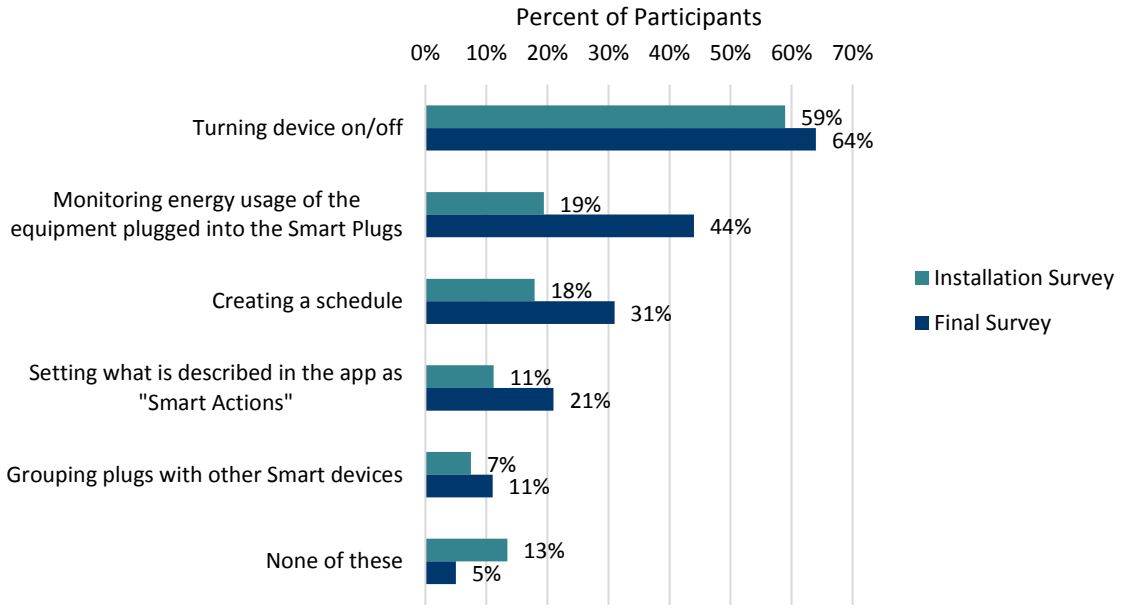


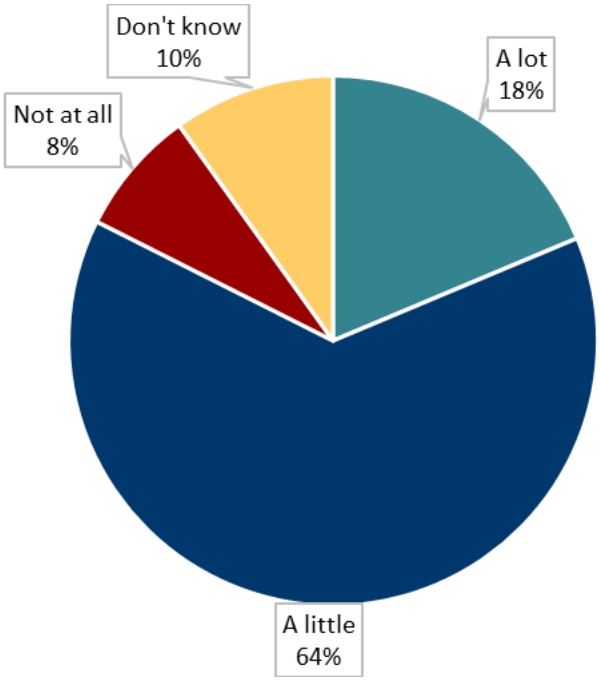
Figure 4-21 Use of Mobile App for Smart Plug Control – Beginning vs. End of Study



Using the Bundle for Energy Efficiency

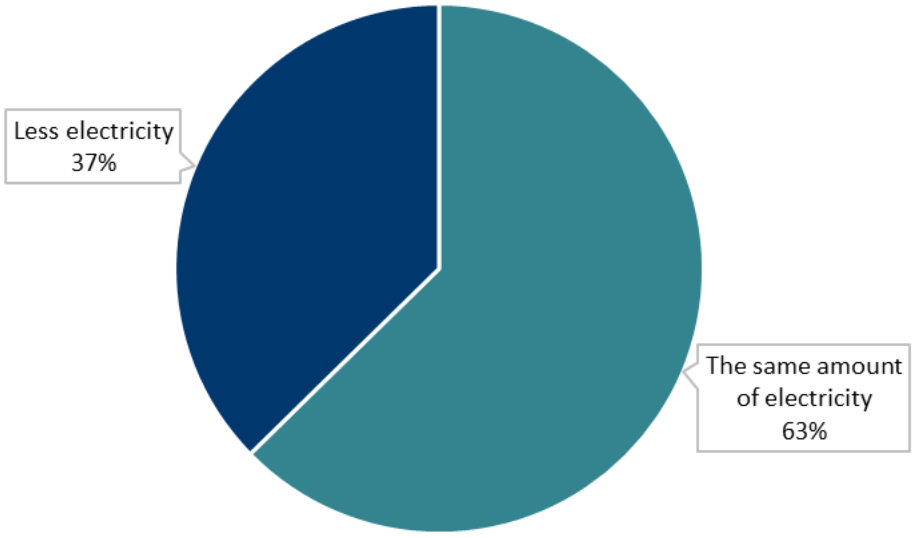
During the installation survey, the bulk of participants (82%) believed that Smart LED lights and Smart Plugs would lower their energy bill at least a little bit, but only around one fifth (19%) believed that the devices would reduce their bill "a lot".

Figure 4-22 How Much Participants Think Smart Lights and Plugs Can Lower Their Electricity Bill



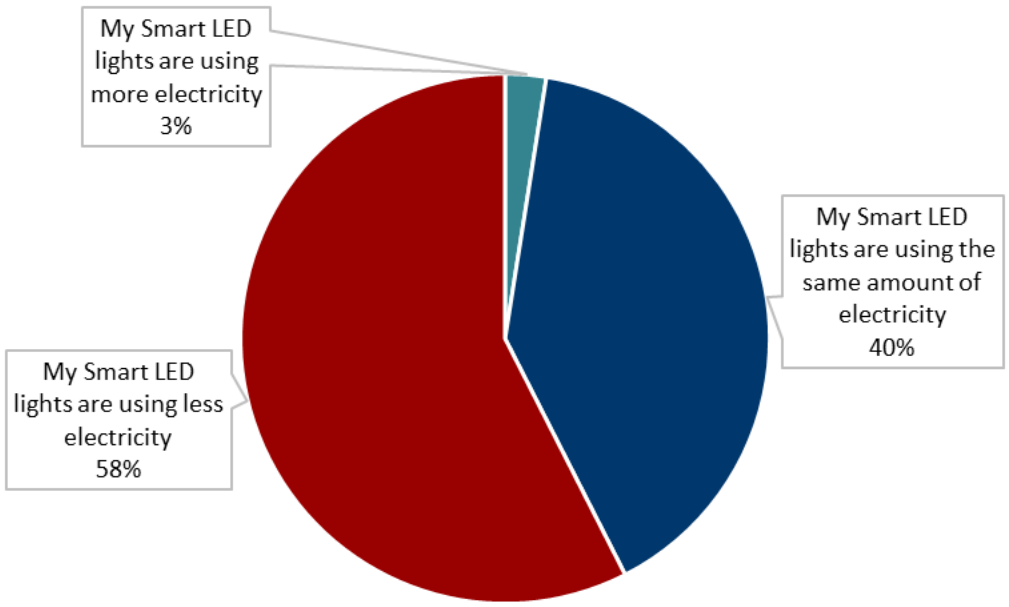
At the time of the Final survey, however, 63% of those who used their Smart plug felt the appliances connected are using the same amount of electricity than they were before, while the remainder felt they were using less electricity. No participants believed the Smart plug had increased the amount of electricity used.

Figure 4-23 Impression of Smart Plugs Impact on Electricity Use



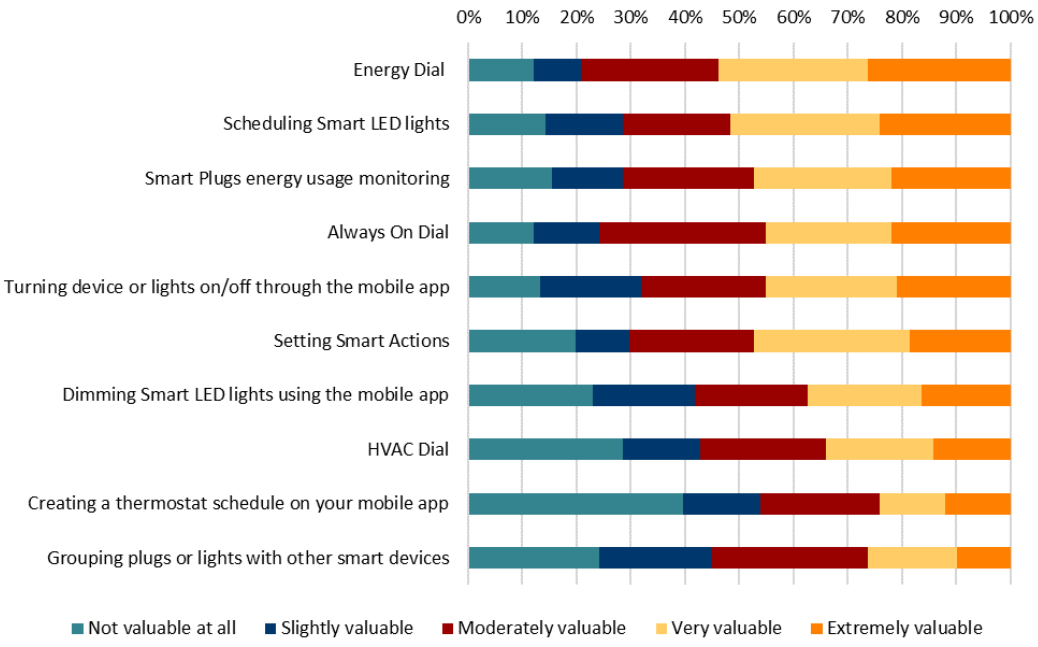
Participants are more optimistic about Smart LEDs saving energy. More than half (58%) of those who have installed Smart LED lights believe that they are using less electricity than they were before they received the bundle. A small number (3%) believed the Smart LEDs had increased the amount of electricity used.

Figure 4-24 Impression of Smart LED Bulbs Impact on Electricity Use



Energy Dial was the most frequently rated as an "Extremely valuable" app feature (26%) while creating a thermostat schedule was most frequently rated as "Not valuable at all" (40%). Half of participants (55%) found the ability to group lights and plugs at least moderately valuable.

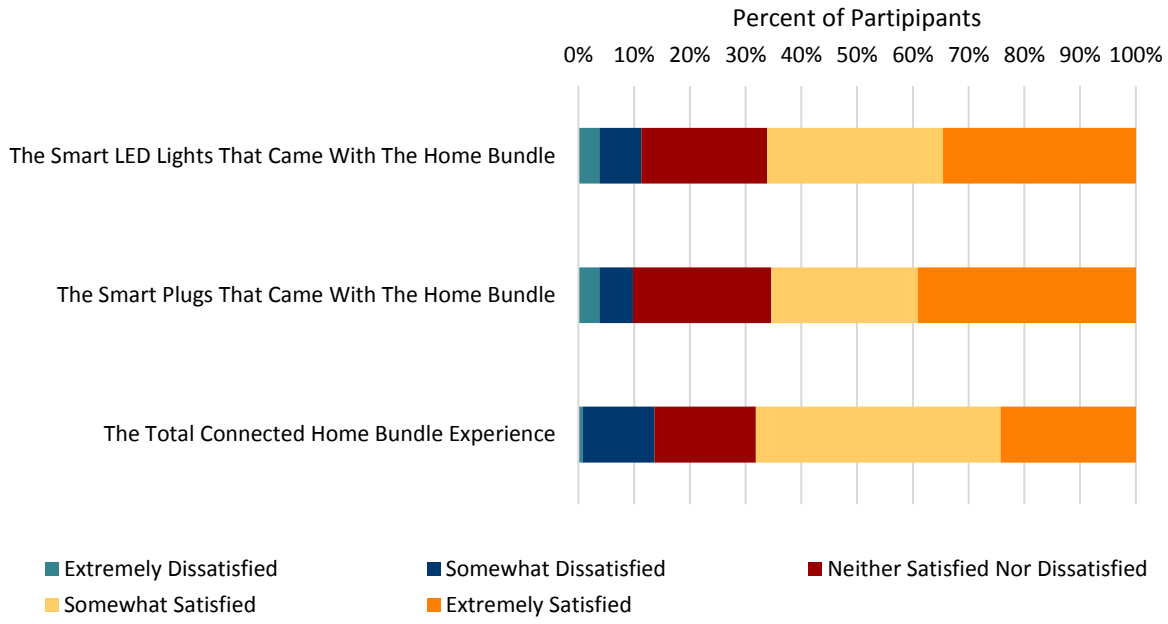
Figure 4-25 Value of Various App Features for Controlling/Managing Energy Usage



Customer Satisfaction

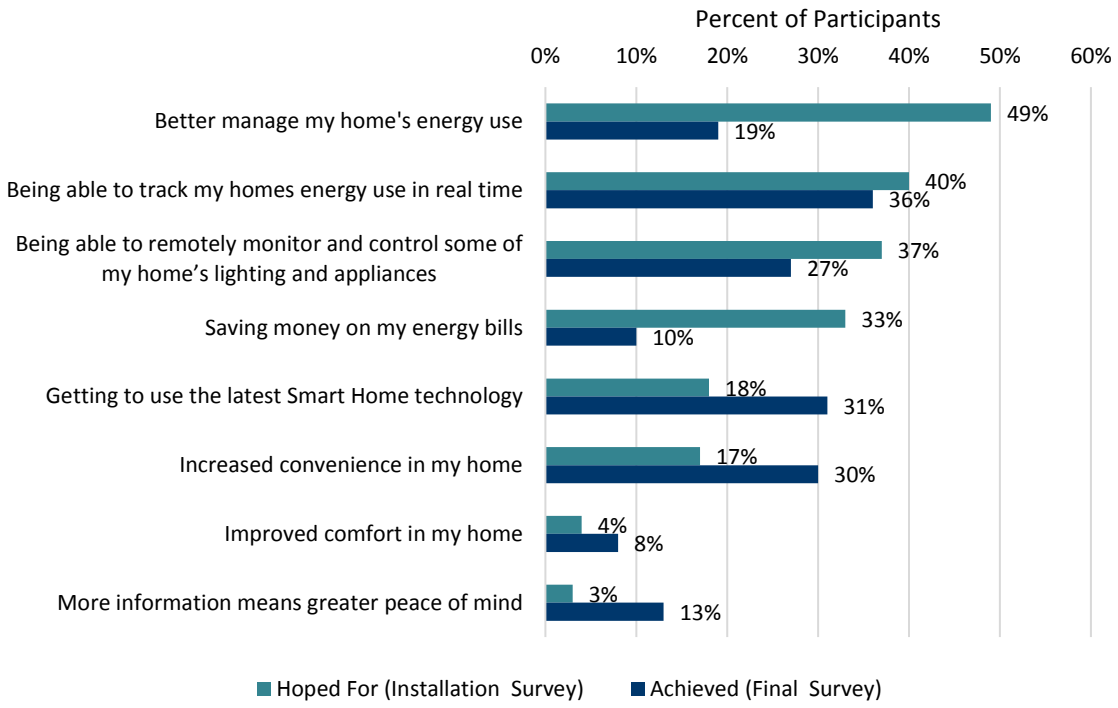
Over 65% of participants were at least somewhat satisfied with the lights, plugs, and overall experience with the Connected Home Bundle, while less than 10% were "Extremely dissatisfied".

Figure 4-26 Overall Satisfaction with Connected Home Bundle Program Features



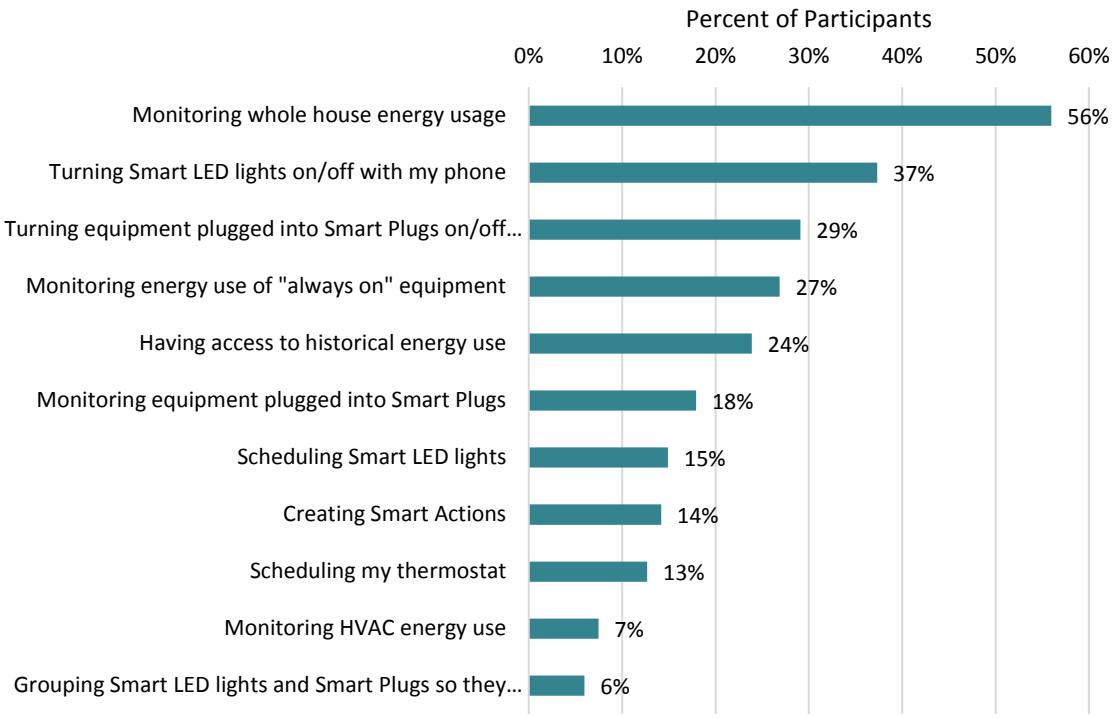
The most hoped-for benefits of participating in the Connected Home Bundle Study were better management of (and information about) their home's energy use, remote control, and reduced energy bills. The most realized benefits, however, were being able to use the latest technology and increased convenience.

Figure 4-27 Most Hoped for Versus Most Realized Benefits of Participation



At the end of the Study participants felt that the ability to monitor whole-house energy usage was the most valuable feature of the Connected Home Bundle.

Figure 4-28 Most Valued Feature of the Connected Home Bundle at the end of the Study



Plans for the Future

In general, participants see themselves as fairly likely to purchase additional Smart devices – specifically in regard to Smart plugs and LED Lights, and even more so general "Smart Technologies".

Figure 4-29 Likelihood of Purchasing Additional Smart LED Lights or Smart Plugs

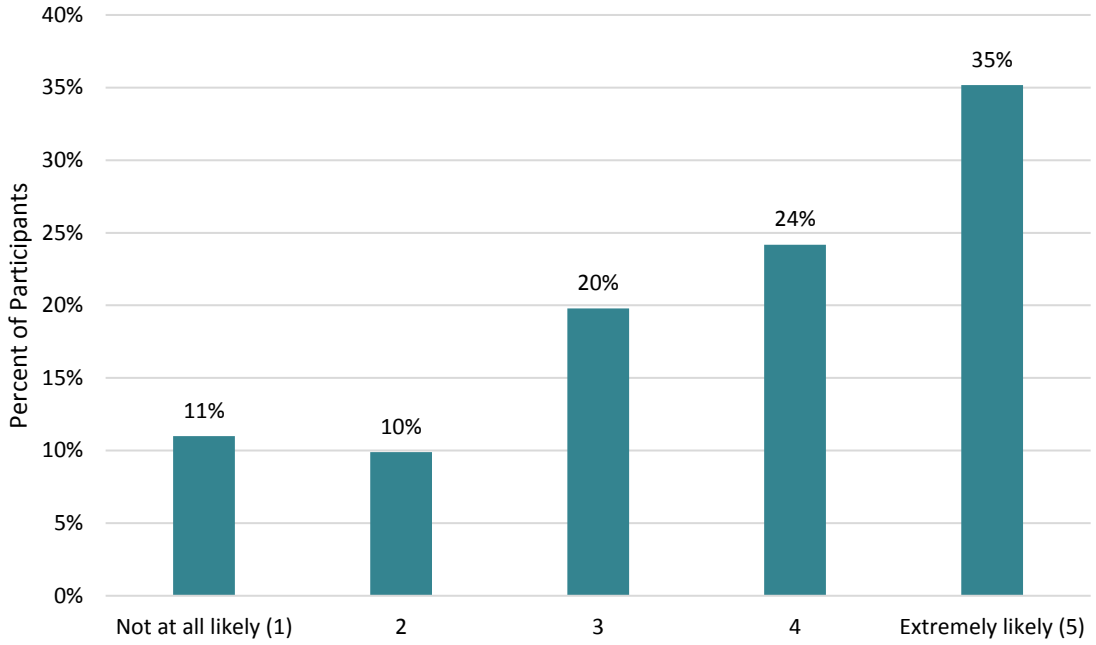
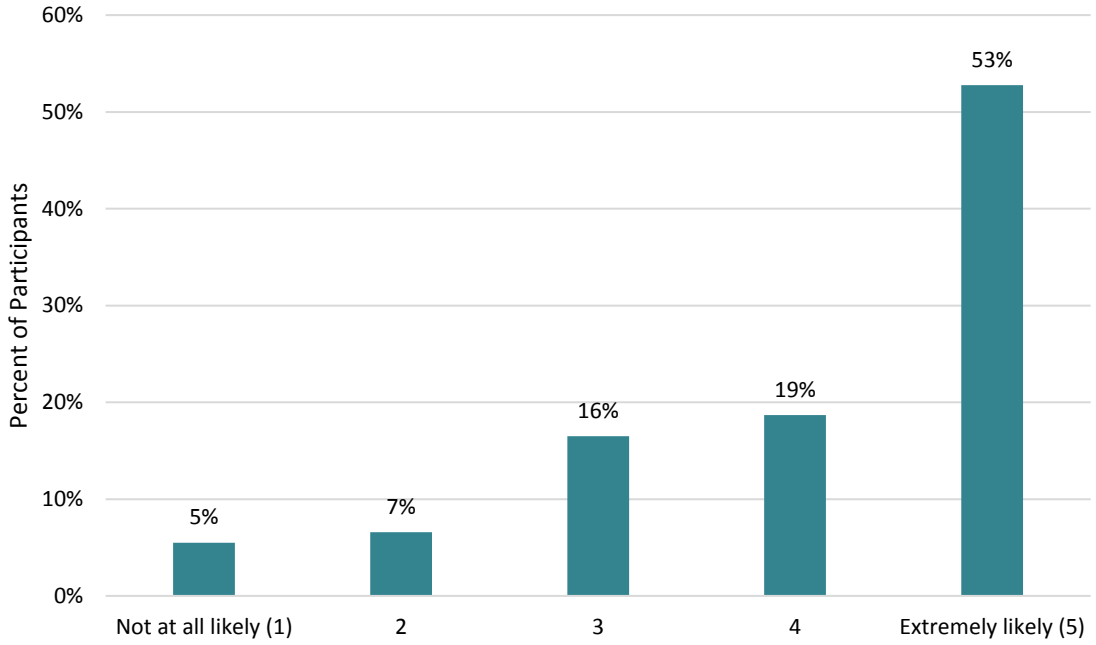
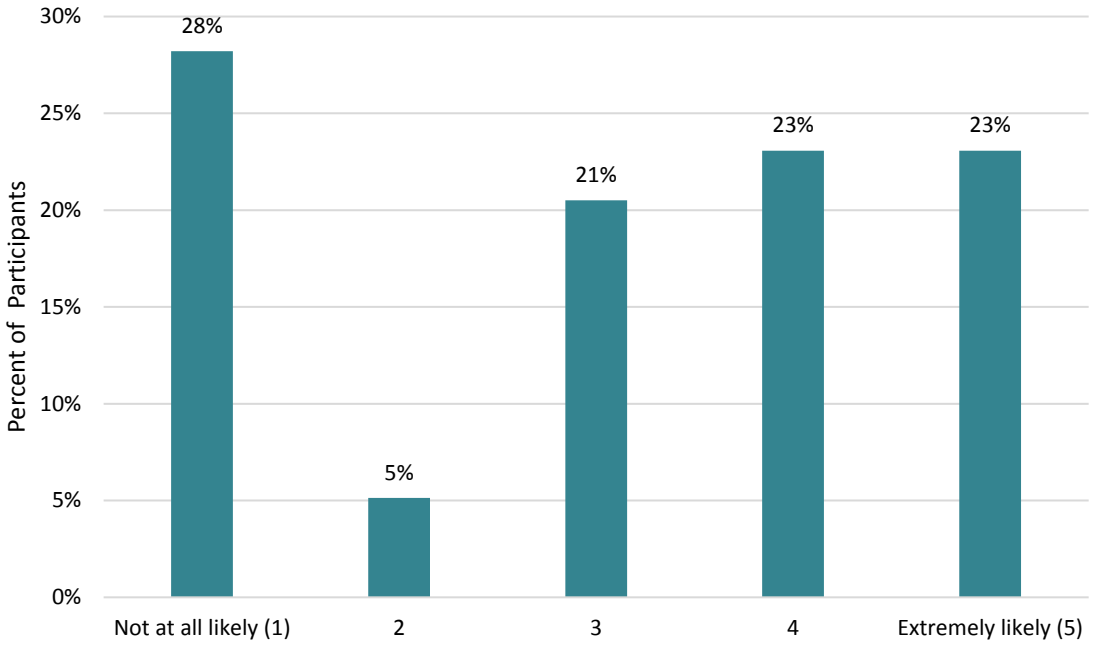


Figure 4-30 Likelihood of Purchasing Other Smart Technologies



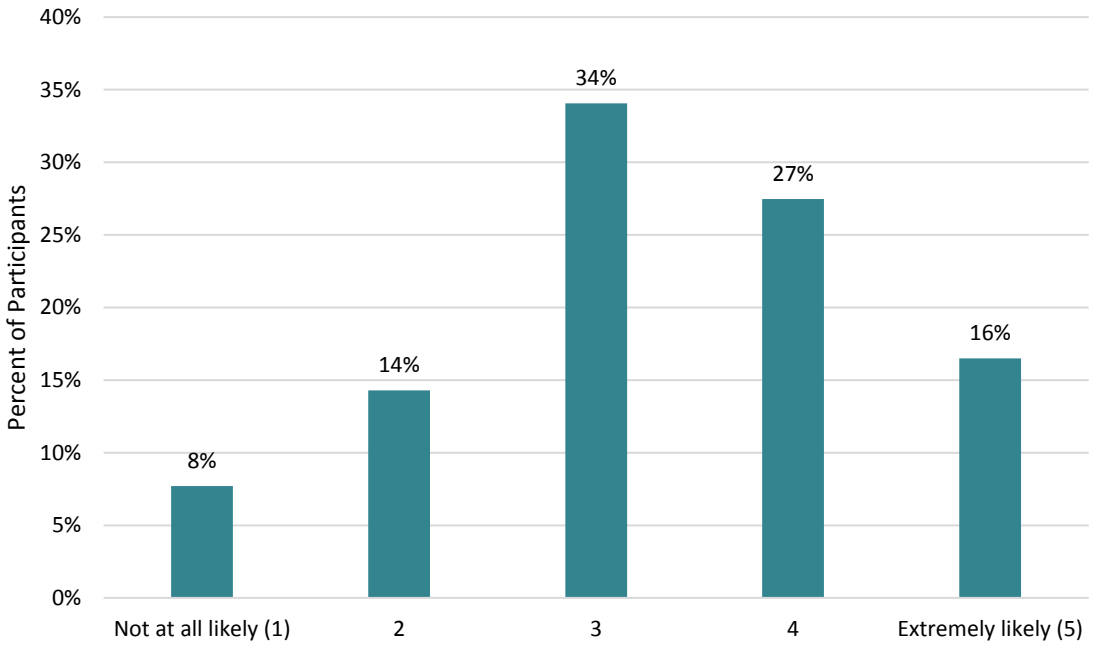
When asked how likely they would be to participate in a study that would allow a third party to control or adjust their plugs or lights, participants were divided, with only 23% saying that they were "Extremely Likely" to do so.

Figure 4-31 Likelihood of Participating in a Program Allowing a Third Party to Control or Adjust Smart Devices



Participants are uncertain about their likelihood to participate in a future PG&E program "that asked you to respond when the demand for electricity was the highest by using smart in-home devices to lower your household's energy usage" with 34% choosing the midpoint of the likelihood scale.

Figure 4-32 Likelihood of Participating in an Automated PG&E Demand Response Program

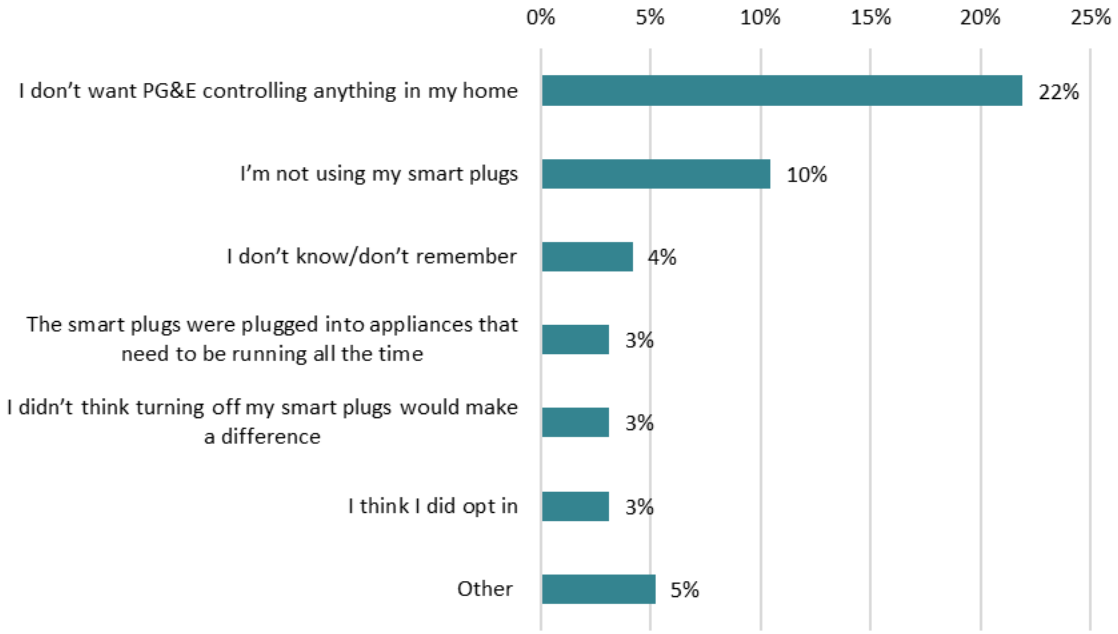


DR Events

At the time of the installation survey just over half (52%) of participants indicated that they were aware that the Connected Home Bundle Study would involve PG&E deactivating the Smart LEDs and Smart Plugs included in the bundle.

Sixty-three of the 156 participants chose not to participate in the DR phase of the Study. The most common reason to opt out was resistance to the idea of PG&E controlling anything in their home (22%). Most "Other" responses cited difficulties in maintaining a connection with the hub/gateway..

Figure 4-33 Reasons Why Participants Did Not Participate in DR Phase



Ninety-three participants opted into the DR event phase. The table below shows the percent of the devices that did not receive a signal, opted out of the individual event and/or were adjusted during each event to override the DR signal.

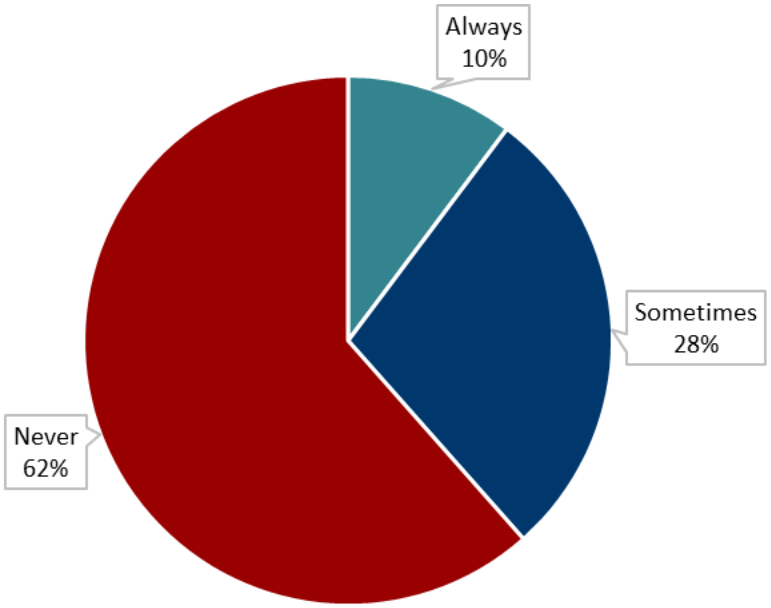
Table 4-2 Participant Response to DR Events

Event	Event Time	Notification	% of Devices that Did Not Receive a Signal	% of Devices Opted Out of Individual Event	% of Devices Adjusted During Event
June 19	9:00 to 11:00	DA	4.5%	0%	2.2%
June 20	9:00 to 11:00	DA	3.7%	1.9%	1.9%
June 25	12:00 to 18:00	DO	2.1%	0%	27.6%
June 26	12:00 to 18:00	DO	5.4%	0%	5.4%
July 1	19:00 to 20:00	DA	2.9%	0%	2.9%
July 2	19:00 to 20:00	DA	8.9%	0%	2.2%
July 17	15:00 to 17:00	DO	2.5	0%	7.5%
July 23	18:00 to 24:00	DO	2.6%	0%	20.5%

Event	Event Time	Notification	% of Devices that Did Not Receive a Signal	% of Devices Opted Out of Individual Event	% of Devices Adjusted During Event
July 24	18:00 to 24:00	DO	8.7%	0%	17.4%
July 31	7:00 to 8:00	DA	5%	2.5%	7.5%
August 1	7:00 to 8:00	DA	13.6%	0%	0%
August 8	19:00 to 21:00	DO	7.1%	0%	4.7%
August 9	19:00 to 21:00	DO	18.1%	0%	11.4%
August 14	9:00 to 11:00	DA	11.6%	1.2%	3.5%
August 22	12:00 to 18:00	DO	10.8%	1.2%	3.6%
August 27	19:00 to 20:00	DA	10%	2.5%	2.5%
September 5	6:00 to 12:00	DA	17.4%	2.3%	10.5%
September 11	15:00 to 17:00	DA	16.7%	1.2%	1.2%
September 18	18:00 to 24:00	DA	8.9%	1.3%	12.8%
September 24	7:00 to 8:00	DA	10.4%	1.3%	3.9%
October 2	19:00 to 21:00	DA	11.1%	1.2%	9.9%

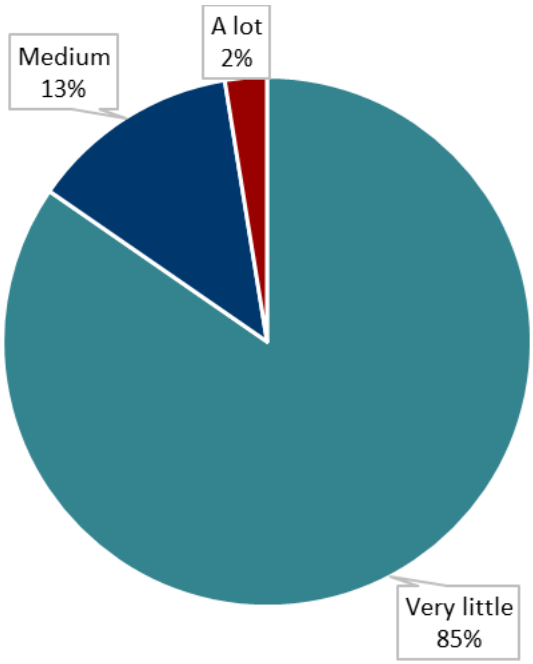
Across all events 38% of participants reported at least "sometimes" turning back on appliances deactivated through a Smart Plug during the event.

Figure 4-34 Frequency with Which Participants Turned Smart Plugs Back on During Events



Among those who opted in, 85% reported experiencing very little disruption to their daily life from event-driven Smart Plug deactivations

Figure 4-35 Level of Disruption to Daily Life from DR Events



Energy Analysis Results

Below we present the results of the energy analysis in two subsections, energy efficiency results, and demand response results.

Energy Efficiency Results

The results of the EE analysis were statistically insignificant. The point estimate on Participation indicated a small amount of daily savings, however the results were inconclusive. In addition, it is not unexpected to have insignificant point estimates given the small sample size, and the small impact.

Demand Response Results The results of the DR analysis indicate that there were likely reductions in energy consumption as a result of controlling the devices during events. It is important to note that only two out of fifteen response indicators were statistically significant (hours nine and ten). However, nearly all the impacts indicate reductions in usage relative to the control group during events for those participants that responded to the event. While we were not able to obtain statistically significant impacts for each event window, we do see consistent point estimates that suggest savings. In addition, it is not unexpected to have insignificant point estimates given the small sample size, and the small impact.

Table 3-3 below presents the point estimates for each event window tested during the event. The table includes the average number of customers that responded during that window, the average per customer impact, the maximum per customer impact, and the significance. Again note, that all but one of the point estimates are insignificant, however the direction, pattern and consistency of the estimates strongly suggests that savings are occurring. Point estimates range from 0.03 kW to 0.28 kW.

Table 4-3 Average Per Customer Impact Estimates by Event Window

Event Window	Avg Number of Sites	Avg Number of Devices	Avg Impact (kW)	Max Impact (kW)	Significant?
6:00 to 12:00	48	87	.04	.09	No
7:00 to 8:00	31	54	.09	.09	No
9:00 to 11:00	32	61	.03	.04	Yes
12:00 to 18:00	32	62	.13	.32	No
15:00 to 17:00	34	62	.18	.31	No
18:00 to 24:00	31	54	.15	.34	No
19:00 to 21:00	32	56	.28	.36	No

Recall also that one of the objectives was to test various attributes of the events including, time of day, duration, and notification. Keeping in mind that these estimates are only indicative of potential savings, and are in fact insignificant, some preliminary observations on each attribute follow:

- It appears that evening events seem to have the largest impacts, this would make sense in a residential setting given that most of the events took place on weekdays, and that lamps, chargers and TVs were the three most commonly controlled devices.
- Duration does not seem to have a large effect, although the shorter events did tend to have higher average impacts. Again, these results are logical in that participants were probably less likely to readjust their devices during shorter events, vs. longer events.

- Finally, there did not seem to be any strong correlation between impacts or opt-outs based on the notification or time of day of the events.

On the next page we present average daily load profiles for the three 2-hour event windows in Figure 3-36 to Figure 3-38. The load profiles for all seven event windows are included in Appendix B. In each of the three graphs we present three load shapes and an impact shape.

The blue dotted line represents the actual average load of the participants that responded on similar event window days. For example, if events were called from 9:00 to 11:00 on three days, the blue dotted line is the average responder load across those three days.

The dark blue line represents the model's estimate or prediction of the responder's load. Differences between the blue dotted line and the dark blue line represent modeling error.

The orange line represents the model's prediction of the reference load, or what responders would have done in absence of an event.

The difference between the orange and dark blue lines is the impact. The impact is also the value of the coefficients on the responder indicators in the model for each hour and is represented by the green dotted line on the graphs.

In looking at these three graphs two things are apparent.

- First while the modeled load and the actual load often follow a similar pattern, there is clearly a lot of statistical error not

Figure 4-36 9:00 – 11:00 Event Window

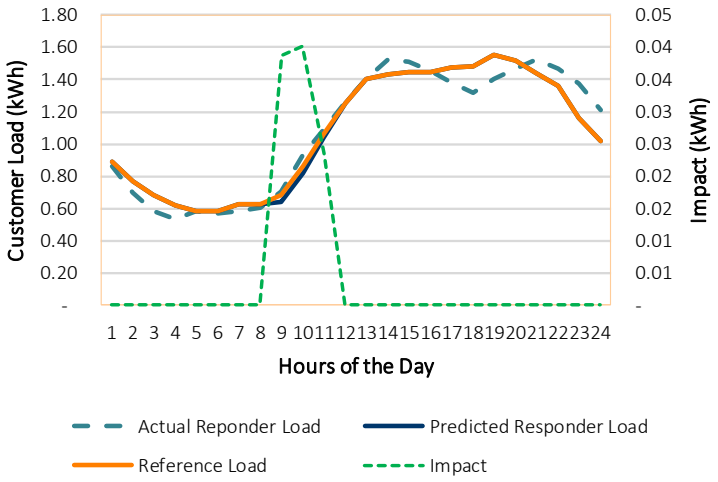


Figure 4-37 15:00 – 17:00 Event Window

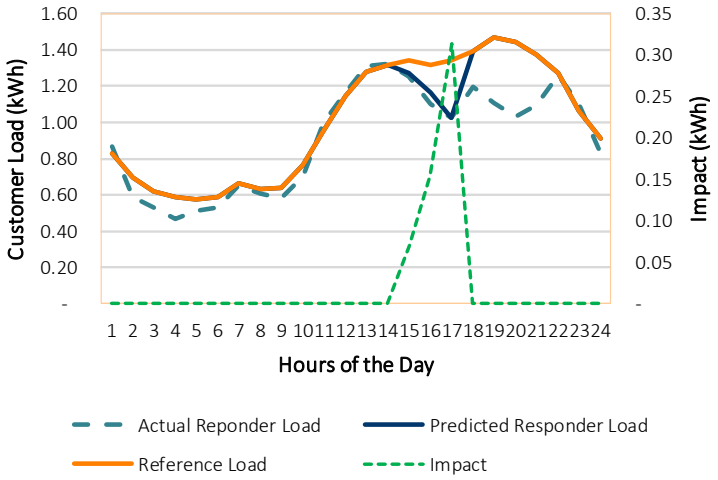
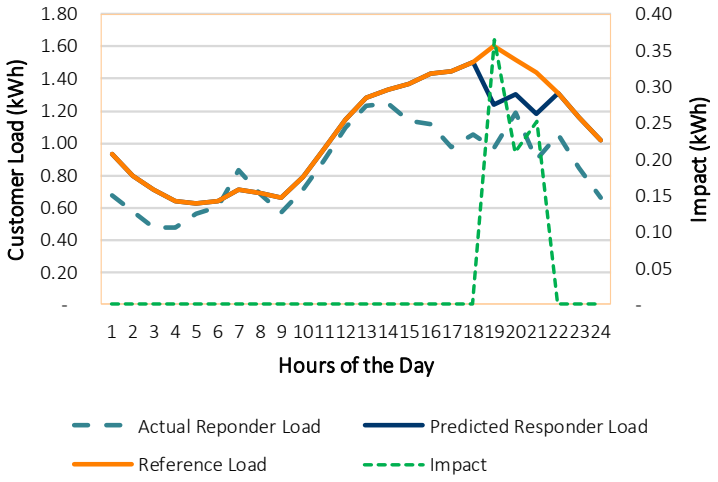


Figure 4-38 19:00 – 21:00 Event Window



accounted by the regression model. This is not unexpected given that we are often trying to model loads for only 22 to 86 responders.

- Even though the models have a lot of statistical error, the model's point estimates of the impact do demonstrate an expected pattern.

So, while the estimates are not statistically significant, the pattern and direction of the estimates indicate that participants are likely reducing load during events.

5
CONCLUSIONS

PG&E conducted this Field Study to determine if the currently available EMTs, specifically Smart plugs and Smart LED bulbs connected to an energy hub/platform, could provide customers the opportunity to better manage and control their home's energy usage and respond to DR events. Analyses of customer surveys, device level summary data, and energy data as well as an interview with implementation staff revealed the following key findings related to the Study objectives.

Findings and Recommendations

While the Field Study faced numerous challenges, it also demonstrated many successes not the least of which is a wealth of lessons learned and areas for improvement. In addition, the Study validated the technical DR capability along with feasibility of achieving real DR impacts. With very few connected home studies completed in the industry, the information contributed by this Field Study about what works and what needs improvement is incredibly valuable for future program designs and implementations.

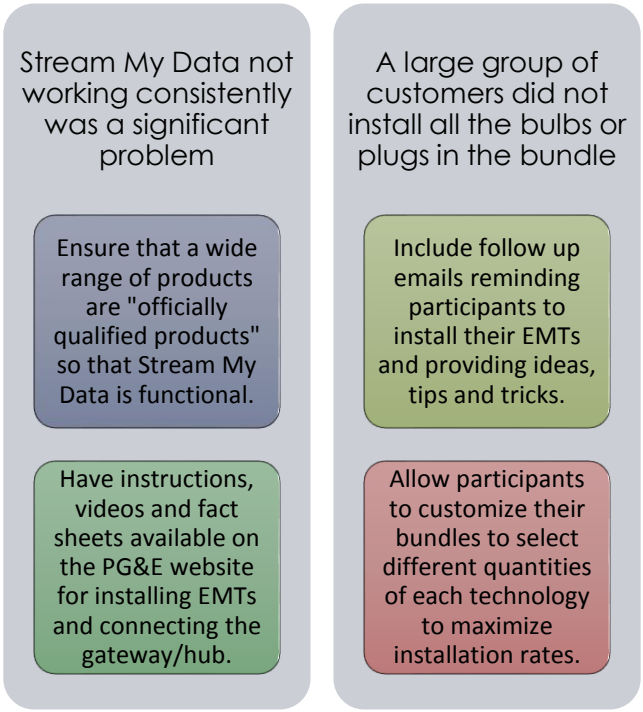
Below is a summary of the overarching findings and recommendations surrounding the challenges and successes of the Field Study.

- Achieving full connectivity was challenging. There were both minor and major challenges throughout the study regarding connecting the bundles, hub/gateway, and PG&E meter. Most minor challenges were easily and readily resolved by participants or through customer service calls, however achieving, a continual wireless connection enabling data to be sent from the PG&E meter to the hub/gateway was an unforeseen challenge of the Study. For future work, it will be very important to expect the unexpected and attempt to anticipate such challenges by ensuring the product and process compatibility are maintained by the manufacturer and the utility.
- Energy shifting potential is real. Analysis of AMI data from the DR events indicates that the bundle has the potential to affect load shifting and load shaping with specific, targeted customer education and messaging. For example, future studies could craft and test messages that enhance a customer's ability to take action on climate change, support grid infrastructure, or provide emergency curtailment.
- Utilities can build new partnerships. These products will likely be tied into the home security market since many of the other types of common Smart Devices include items such as smart doorbells, alarms and sensors that can be tied into control strategies. In the future, utilities will have an opportunity to establish relationships with home security vendors to bundle energy management with home safety.
- Customer satisfaction was mixed. While customers were satisfied with the Connected Home Bundle overall, they were less likely to say they planned on investing in additional smart devices or participate in a similar pilot in the future.
- A larger sample is needed. To see significant impacts and to meaningfully affect customers' lives. Future work should strive to include more data points and a larger number of customers. More data points such as sensors, triggers, messaging, and control strategies provide the opportunity to impact customer convenience, comfort and safety. Larger numbers of participants will help impact analyses to detect statistically significant changes in consumption. Based on our experience and the expected effect size (impact), AEG recommends a between 300 and 500 participants.

In the subsections that follow, we elaborate on the findings and recommendations for improvement as they relate to installation and connectivity, DR events, managing and/or reducing energy use, and customer satisfaction.

Installation and Connectivity

The Vendor's hub/gateway not being able to consistently connect with the P&GE smart meters was a major disappointment for the Study. This technical difficulty increased customer service requirements and decreased customer satisfaction.



- While the majority of participants said installation with most of the components was fairly easy there was some significant difficulty with connecting the hub/gateway to the PG&E Smart Meter.
- Half of customers reported contacting customer service, but according to CLEAResult most of the initial calls involved minor issues and handholding.
- Participants systems became unbound from the smart meters when PG&E performed a security upgrade. Although all the participants' systems were manually fixed after the initial unbinding, spontaneous unbinding of the smart meters and the hub continued throughout the Study period. The team was never able to identify one specific cause for the problem and participants were often unable to use the Stream My Data feature.
- A significant minority (32 - 46%) of participants had difficulties with each of the intended Connected Home Bundle functions. Problems associated with Stream My Data got worse from the installation to the final survey, while problems with Smart Plugs and LED lights improved.
- A lesser minority (2 – 19% depending on the event) did not receive event signals and could not respond to events.

A sizeable portion of participants did not use all the EMTs.

- Only 41% of participants installed all four Smart LED bulbs.
- While 70% installed both Smart plugs.

Suggestions for improvement include:

- Ensure that a wide range of products can communicate with their smart meters so the Stream My Data feature is functional.
- Have instructions, videos and fact sheets available on the PG&E website for installing EMTs.

- Include follow up emails reminding participants to install their EMTs and providing ideas, tips and tricks on how to use the EMTs and what participants might want to control with them.
- Allow participants to customize their bundles to select different quantities of each technology to maximize installation rates.

DR Events

Despite the fact that a significant portion of participants stated concerns with PG&E taking control of their devices, a majority opted into the DR phase of the Field Study.

- Forty-six percent somewhat or strongly agrees that the idea of PG&E taking direct control of devices in their home makes them uncomfortable.
- The most common reason for not opting into the DR phase of the Study was resistance to PG&E controlling anything in their home.
- Those who opted in reported very little disruption to their daily lives.
- A significant minority of customers (38%) reported adjusting their EMTs during events at least some of the time.

Analysis of AMI data suggests that there were likely small reductions in energy consumption as a result of controlling the devices during events.

- While the estimates are not statistically significant, the pattern and direction of the estimates indicate that participants are likely reducing load during events.

AMI data suggests reductions in usage during DR events

Reductions were not statistically significant, however, the pattern and direction of estimates indicate savings.

Evening events and shorter duration events seem to have the most potential for load reduction.

- Evening events seem to have the largest potential to reduce load, likely as a result of higher occupancy.
- Shorter events seem to be more effective than longer events, perhaps because participants were less likely to adjust their EMTs during shorter events.
- The current set up of existing Connected Home devices does not lend itself to controlling a large amount of household load.

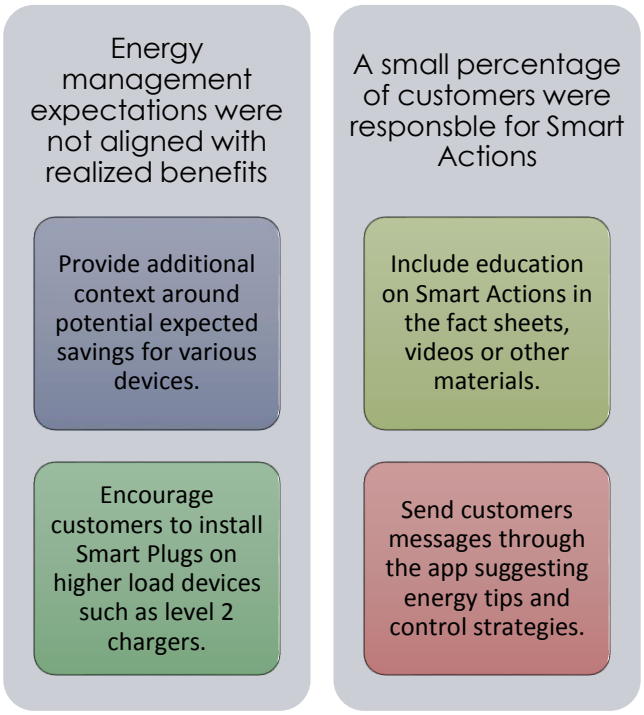
Suggestions for improvement include:

- Develop options for those customers who are uncomfortable with direct third party control of their devices. For example, customers could receive an event signal through the app which would provide an opportunity to respond to events on their own without utility controls. The marketing message should also focus on achieving energy usage optimization through the bundled devices and sensors. The message should emphasize "cloud automation" versus "utility control".
- Enhance messaging requests to encourage customers to turn off additional items (e.g., Smart LEDs and manual lighting) during events. This might help increase impacts for participants when they are home during events.
- Smart Plugs are a relatively low cost EMT, they could be bundled Smart Plugs with Smart Thermostat rebates and DR programs to help enhance response and potentially improve customer satisfaction. Messaging for DR event notifications could also remind participants to turn off their smart plugs during events.

Managing/Reducing Energy Use

Based on the survey results the ability to control lights and equipment remotely was a popular feature among program participants but it did not necessarily translate to more sophisticated energy management practices. While there were a seemingly large number of smart actions taken by participants throughout the study, further investigation indicates that 29% of the participants were responsible for those actions while 71% did not engage in any smart actions.

- Seventy-five percent of participants reported using an energy management features on the mobile app but that was primarily Energy Dial which allowed participants to see their real time usage data. Since this feature did not work consistently it's difficult to draw any conclusions.
- Outside of basic on/off operations, only a third or less of participants report using any of the Smart LED Light or Smart Plug control features on the Vendor's app.



Participants had high expectations for energy management/savings at the outset of the Study, however, most participants felt that the devices did not save as much as expected. The realized benefits of the study were also different than those participants expected at the outset.

- At the beginning of the Study most participants felt these type of devices would reduce their energy usage "a little bit", but at the end only 37% of participants thought the appliances connected to the Smart Plugs used less electricity and 58% felt the Smart LEDs used less.
- The most hoped-for benefits of participating in the Connected Home Bundle Study were better management of (and information about) their home's energy use, remote controls, and reduced energy bills. The most realized benefits, however, were being able to use the latest technology and increased convenience.

Suggestions for improvement include:

- Send customers messages through the app communicating energy tips and control strategies that can help them manage/save energy.
- Consider encouraging customers to install Smart plugs for higher load devices such as Level 1[1] electric vehicle chargers.
- Provide customers with some context around potential expected savings, for example, replacing four CFLs with LEDs is not likely to have a significant impact on electricity bills, however, using

[1] 120v

Smart Plugs to control and schedule higher load devices along with smart occupancy censors might..

Plans for the Future

Most participants were somewhat or very satisfied with the lights, plugs, and overall experience with the Connected Home Bundle however, customers are mixed about participating in similar programs in the future.

- In general, participants see themselves as likely to purchase additional Smart devices – specifically in regard to Smart Plugs and LED Lights, and even more so general "Smart Technologies".
- When asked how likely they would be to participate in a study that would allow a third party to control or adjust their plugs or lights, participants were divided, with 23% saying that they were "Extremely Likely" and another 23% saying they were "Somewhat Likely" to do so..
- Customers views are mixed about the possibility of participating in a similar DR program in the future. More customers say they would participate in a third-party program than say they would participate in a PG&E program.

A (NOTE: THE SURVEY BELOW HAS BEEN 'ANONYMIZED'. REFERENCES TO THE VENDOR NAME OR VENDOR'S PRODUCT NAMES HAVE BEEN REPLACED WITH NON-SPECIFIC NAMES, PLACED IN QUOTES.)

SURVEY INSTRUMENTS

LANDING PAGE

Welcome!

Thank you for volunteering for the Connected Home Bundle study. The feedback you provide will help PG&E define future customer programs for connected home products.

We'd like to start by having you answer a few questions about your experience setting up your Connected Home Bundle equipment and your initial experiences using the equipment. If you would like to talk with someone from PG&E about this study, feel free to contact:

Phil Broaddus

p1b8@pge.com | 415-973-5678

BACKGROUND

First, we would like to get a better understanding of how you use technology in your home.

0. Which of the following social media apps do you use on your Smart Phone?

    Facebook
    Twitter
    Instagram
    WhatsApp
    Messenger
    SnapChat
    Other (specify)
    None

1. *Before receiving the Connected Home Bundle,* which of the following Smart Home/Home Automation technologies did you already have in your home? (Check all that apply) [PROGRAMMER: RANDOMIZE AND ROTATE LIST EXCLUDING NONE OF THE ABOVE WHICH IS ALWAYS LAST; "NONE OF THE ABOVE" IS EXCLUSIVE]

   Smart Door Locks
   Smart Lighting
   Smart Plugs
   A smart thermostat that allows you to create settings for different days, events, or occasions
   Motorized Shutters or Blinds
   Smart Speakers (allows you to listen to music in various areas of your home simultaneously and independently)
   Smart Home Surveillance (monitoring of indoor and/or outdoor areas of your home from your smart device and/or television)
   Home Alarm/Security System
   Remote Front Door Monitoring/Smart Door Bell
   Smart Water Heater Controller
   None of the above
   Other (Please specify)

[IF Q1 NE 'NONE OF THE ABOVE," CONTINUE; OTHERWISE SKIP TO Q4]

2. Do you use your Smart Phone and/or an App to control, monitor or schedule any of these technologies?

   Yes
   No

3. How frequently would you say that you monitor or adjust the schedule of these technologies?

	(LIST 1st Item from Q1)	(LIST 2nd Item from Q1)	(LIST 3rd Item from Q1)
Once a day or more	○	○	○
Once every few days	○	○	○
Once a week or more	○	○	○
I set them once and forget them	○	○	○

4. Do you have a Voice Assistant in your home that you can use to access information or to control lighting systems or thermostats? Examples of units like this include the Amazon Alexa, Google Home and the Apple Homekit with Siri.

    Yes
    No

[IF Q4 = YES CONTINUE; OTHERWISE SKIP TO Q6]

5. Which of the following do you use your Voice Assistant (e.g., Alexa / Echo, Apple Homekit) to control? (Check all that apply) [PROGRAMMER: "NONE OF THESE THINGS" IS EXCLUSIVE]

    Controlling music and entertainment
    Calling and texting
    Receiving news, weather and sports updates
    Answering questions
    Setting timers and alarms
    Creating shopping and to do lists
    Updating and tracking calendars and events
    Controlling smart home devices
    Playing games
    Making online purchases
    Something else (Please specify _____)
    None of these things

6. Do you currently control and monitor your Ecobee thermostat using an app on your Smart phone?

    Yes
    No

[IF Q6 = YES CONTINUE; OTHERWISE SKIP TO Q8]

7. Which of the following features do you use on your Ecobee smart phone app? (Check all that apply)

    Adjust temperature and comfort settings
    Make an event setting that can be used regularly (e.g., Daytime, Evening, Vacation, etc.)
    Make a unique event scenario (e.g., Party, Overnight guests, Movie Night, etc.)
    Receive alerts and reminders

8. Which of the following statements best describes why you participated in the Connected Home Bundle study?

   I'm very interested in the latest technology and gadgets
   I want more control over my home appliances and lighting
   I'm interested in helping PG&E learn more about new Smart home products
   It was free and sounded interesting
   Something else (Please specify _____)

9. What are the main benefits you hope to achieve from participating in the Connected Home Bundle study? (Please select the two benefits below that represent the most important benefits you hope to achieve)

   [PROGRAMMER: RANDOMIZE AND ROTATE LIST, EXCLUDING "SOMETHING ELSE," WHICH SHOULD ALWAYS BE LAST]
   Getting to use the latest Smart home technology
   Increased convenience in my home
   Better manage my home's energy use
   Being able to remotely monitor and control some of my home's lighting and appliances
   Saving money on my energy bills
   Being able to track my homes energy use in real time
   Improved comfort in my home
   More information means greater peace of mind
   Something else (Please specify _____)

Device Set Up

Now, we would like to ask you some questions about setting up your Connected Home Bundle equipment.

10. After receiving the Connected Home Bundle equipment in the mail, how many days did you wait before you started setting up the equipment?

    I began setting up the equipment the same day I received it
    I began setting up the equipment the day after I received it
    I waited 2 to 3 days before setting up the equipment
    I waited 4 to 5 days before setting up the equipment
    I waited 6 or 7 days before setting up the equipment
    I waited a week or more

Q10b. Approximately how far is the "hub/gateway" from your Smart Meter?

_____Feet

On a scale of 1 to 5, with 1 meaning "Very Difficult" and 5 meaning "Very Easy" please rate how easy it was for you to accomplish each of the following steps for setting up your

	1 Very Difficult	2	3	4	5 Very Easy
Installing the "hub/gateway"	○	○	○	○	○
Installing the "Vendor's app" on your smart phone	○	○	○	○	○
Pairing your Smart Phone with the "Vendor's hub/gateway"	○	○	○	○	○
Connecting the "hub/gateway" to your PG&E Smart Meter	○	○	○	○	○
Installing the Smart LED lights	○	○	○	○	○
Installing the Smart Plugs	○	○	○	○	○
Connecting the Smart LED lights and Smart Plugs to the "hub/gateway" through your Smart Phone	○	○	○	○	○
Setting up your PG&E account to "Stream My Data"	○	○	○	○	○

12. How long did it take you to set up your equipment?

    Less than an hour
    About an hour
    One to two hours
    More than two hours

13. On a scale of 1 to 5, with one meaning "Not at all Satisfied" and 5 meaning "Very Satisfied" how satisfied were you with the Step-By-Step Set Up guide provided with your Connected Home Bundle equipment?

    1 Not at all satisfied
    2
    3
    4
    5 Very satisfied

14. Did you need to contact your customer service representative for assistance while setting up your equipment?

    Yes
    No

[IF Q14 = YES CONTINUE; OTHERWISE SKIP TO Q18]

15. On a scale of 1 to 5, how would you rate your satisfaction with your customer service experience?

    1 Not at all satisfied
    2
    3
    4
    5 Very satisfied

16. Did contacting the customer service representative solve your problem/answer your question?

    Yes
    No

[IF Q16 = NO CONTINUE; OTHERWISE SKIP TO Q18]

17. What problems/questions are you still having with the Connected Home Bundle equipment?

    [OPEN ENDED]

Controlling Devices

18. As best you can tell, are the following functions of your Connected Home Bundle currently working correctly? (Please select all of the functions below that are working)

    "Hub/gateway" paired with Smart Phone and Smart Meter
    Smart Lights connected to the "Vendor's app"
    Smart Plugs connected to the "Vendor's app"
    Streaming my Data information available on the "Vendor's app"

19. How many of the 4 Smart LED lights you received with the kit are currently installed?

    _____Number of Smart LED lights installed [Range = 0 -4]

[IF Q19 < 4 CONTINUE; OTHERWISE SKIP TO Q20]

Q19a: Why are not all of your Smart LED Lights installed?

    [OPEN ENDED]

20. How many of the two Smart Plugs you received with the kit are currently installed?

    _____Number of Smart Plugs installed [Range = 0 -2]

[IF Q20 < 2 CONTINUE; OTHERWISE SKIP TO Q21]
Q20a. Why are not all of your Smart Plugs installed?

[OPEN ENDED]

[IF Q20=1 OR 2, CONTINUE, OTHERWISE SKIP TO Q22]
21. What appliances do you have plugged into your Smart Plugs? (Check all that apply)

TV
Computer
Speaker, Stereo, or other Audio Equipment
Gaming Console
Coffee Maker
Toaster
Humidifier
Fan
Other (Please specify _____)

[IF Q19=1 TO 4, CONTINUE, OTHERWISE SKIP TO Q23]
22. Where did you install your Smart LED Lights? (Check all that apply)

Kitchen
Dining Room
Living Room/Family Room
Bedroom
Bathroom
Hallway/Foyer
Garage
Unfinished basement
Laundry Room
Office
Outdoors
Other (specify)

23. Which of the following *energy monitoring features* have you used on "Vendor's app" on your Smart Phone? (Please check all that apply) [PROGRAMMER: "NONE OF THESE" IS EXCLUSIVE]

Energy Dial (real time and historical whole house energy usage)
Always On Dial (real time and historical energy usage for items continuously using power)
HVAC Dial (real time and historical usage for HVAC)
Thermostat Schedule
None of these

[IF Q19=1 TO 4, CONTINUE, OTHERWISE SKIP TO Q25]

24. Which of the following features have you used on "the Vendor's" app to control your *Smart LED lights* using your Smart phone? (Please check all that apply [PROGRAMMER: "NONE OF THESE" IS EXCLUSIVE]

    Turning lights on/off
    Dimming lights
    Grouping lights with other smart devices
    Setting what are described in the app as "Smart Actions"
    None of these

[IF Q20=1 OR 2, CONTINUE, OTHERWISE SKIP TO Q26]

25. of the following features have you used on your "the Vendor's" app to control your *Smart Plugs* using your Smart phone? (Please check all that apply) [PROGRAMMER: "NONE OF THESE" IS EXCLUSIVE]

    Turning device on/off
    Creating a schedule
    Grouping plugs with other smart devices
    Setting Smart Actions
    Monitoring energy usage of the equipment plugged into the Smart Plugs
    None of these

SATISFACTION

26. Overall, how satisfied are you with the Smart LED lights that came with the Connected Home Bundle?

    1 Not at all satisfied
    2
    3
    4
    5 Very satisfied

26b. Overall, how satisfied are you with the Smart Plugs that came with the Connected Home Bundle?

    1 Not at all satisfied
    2
    3
    4
    5 Very satisfied

26c. Overall, how satisfied are you with the total Connected Home Bundle experience?

1 Not at all satisfied
2
3
4
5 Very satisfied

27. Which of the following features of the Connected Home Bundle do you find most valuable (Select up to 3 features that you find most valuable)

[PROGRAMMER: RANDOMIZE AND ROTATE LIST EXCLUDING "NOTHING ELSE"]
Monitoring whole house energy usage
Monitoring energy use of "always on" equipment
Monitoring HVAC energy use
Monitoring equipment plugged into Smart Plugs
Having access to historical energy use
Scheduling my thermostat
Turning Smart LED lights on/off with my phone
Turning equipment plugged into Smart Plugs on/off with my phone
Scheduling Smart LED lights
Grouping SMART LED lights and Smart Plugs so they work together
Dimming Smart LED lights with my phone
Creating Smart Actions
Nothing else

28. On a scale of 1 to 5, with one meaning "Not at all Likely" and 5 meaning "Very Likely" how likely do you think it is that these devices will help you to better manage energy use in your home?

1 Not at all likely
2
3
4
5 Very likely

29. On the same scale how likely do you think it is that you will save money on your PG&E bill using the devices?

1 Not at all likely
2
3
4
5 Very likely

DEMOGRAPHICS

Finally, I would like to ask you a few questions about your household.

30. Are there any individuals living in your home that regularly stay at home all or most *weekdays during the winter (heating season) between 8 am and 6 pm.*?

    Yes
    No

31. Are there any individuals living in your home that regularly stay at home all or most *weekdays during the summer (cooling season) between 8 am and 6 pm*?

    Yes
    No

32. What is the approximate size of your home?

    Less than 1,000 sq. ft.
    1,000 to less than 1,500 sq. ft.
    1,500 to less than 2,000 sq. ft.
    2,000 to less than 2,500 sq. ft.
    2,500 to less than 3,000 sq. ft.
    3,000 to less than 3,500 sq. ft.
    3,500 to less than 4,000 sq. ft.
    4,000 sq. ft. or larger

33. Which of the following best describes your home?

    Single Family Detached Unit
    Single Family unit attached to other homes

34. How many stories does your home have not including the basement?

    One – ranch style home
    Two
    Three

35. Which of the following categories represents your current age?

    18-24
    25-34
    35-44
    45-54
    55-64
    65 or more years old

36. Which of the following categories includes your household's total annual income before taxes in 2017?

Less than $10,000
$10,000 – $14,999
$15,000 – $19,999
$20,000 – $29,999
$30,000 – $39,999
$40,000 –$49,999
$50,000 – $59,999
$60,000 – $74,999
$75,000 – $99,999
$100,000 – $124,999
$125,000 – $149,999
$150,000 -- $249,999
$250, 000 or more
Prefer not to say

Sample Variables

DR = OPTOUT (Opted out of DR events)

OPTIN (Opted into DR events)

Landing Page

Thank you for volunteering for the Connected Home Bundle study. Your feedback will help PG&E to develop future customer programs for connected home products.

As our pilot study period is ending, we would like to ask you a few questions about your experience using the Connected Home Bundle equipment. This will be the last survey you will receive from us and should take less than 20 minutes to complete.

If you would like to talk with someone from PG&E about this study, feel free to contact:

Phil Broaddus

p1b8@pge.com | 415-973-5678

CONTROLLING DEVICES

37. As best as you can tell, are the following functions of your Connected Home Bundle currently working properly? (Please select all of the functions from the list below that are working properly now)

    "Hub/gateway" paired with "the Vendor's" Smart Phone App
    "Hub/gateway" paired with Smart Meter (Smart Phone shows real time energy usage information)
    Smart Lights connected to the "Vendor's" Smart Phone App
    Smart Plugs connected to the "Vendor's" Smart Phone App
    "Streaming my Data" information available on the "Vendor's" Smart Phone App

2. How many of the 4 Smart LED lights you received with the kit are currently installed in your home?

    _____Number of Smart LED lights installed [Range = 0 -4]

[IF Q2 < 4 CONTINUE; OTHERWISE SKIP TO Q4]

3. Why are not all of your Smart LED Lights installed?

    [OPEN ENDED]

4. How many of the two Smart Plugs you received with the kit are currently installed in your home?

    _____Number of Smart Plugs installed [Range = 0 -2]

[IF Q4 < 2 CONTINUE; OTHERWISE SKIP TO Q6]

5. Why are not all of your Smart Plugs installed?

    [OPEN ENDED]

[IF Q4=1 OR 2, CONTINUE, OTHERWISE SKIP TO Q10]

6. What appliances do you currently have plugged into your Smart Plugs? (Check all that apply)

   TV
   Computer
   Speaker, Stereo, or other Audio Equipment
   Gaming Console
   Coffee Maker
   Toaster
   Pressure Cooker or Crock Pot
   Humidifier
   Air Purifier
   Fan
   Room Air Conditioner
   Electronics charger (e.g., phone, tablet, etc.)
   Nightlight
   Decorative lights
   Indoor lights
   Outdoor lights
   Other (Please specify _____)

7. How many times have you moved any of your Smart Plugs to different appliances since you first installed them?

   0
   1
   2
   3
   4 or more

[ASK IF Q7 GE 2]

7a. Why did you move your Smart Plugs to different appliances?

   [OPEN ENDED]

8. Which of the following features have you used on "the Vendor's"app to control your *Smart Plugs* using your Smart phone? (Please check all that apply) [PROGRAMMER: "NONE OF THESE" IS EXCLUSIVE]

   Turning device on/off
   Creating a schedule
   Grouping plugs with other smart devices
   Setting Smart Actions
   Monitoring energy usage of the equipment plugged into the Smart Plugs
   None of these

[ASK IF Q8 = SCHEDULE, GROUP OR SET SMART ACTIONS; OTHERWISE SKIP TO Q10]

9. How frequently would you say that you have c*hanged the settings, groupings or schedule* of the appliances plugged into your Smart Plugs?

    Once a day or more
    Once very few days
    Once a week or more
    I set them once and then forget them

[ASK IF Q8 = MONITOR; OTHERWISE SKIP TO Q11]

10. How frequently would you say that you have *monitored the energy usage* of the appliances plugged into your Smart Plugs?

    Once a day or more
    Once very few days
    Once a week or more
    I set them once and then forget them

11. Do you feel that the appliances plugged into your Smart Plugs are using more electricity, the same amount of electricity, or less electricity since you installed the Smart Plugs?

    More electricity
    The same amount of electricity
    Less electricity

[IF Q2=1 TO 4, CONTINUE, OTHERWISE SKIP TO Q17]

12. Where do you currently have Smart LED Lights installed? (Check all that apply)

    Kitchen
    Dining Room
    Living Room/Family Room
    Bedroom
    Bathroom
    Hallway/Foyer
    Garage
    Unfinished basement
    Laundry Room
    Office
    Outdoors
    Other (specify)

13. How many times have you changed the location of your Smart LED lights since you first installed them?

    0
    1
    2
    3
    4 or more

[ASK IF Q13 GE 1]

13a. Why did you move your Smart LED lights to a different location?

    [OPEN ENDED]

14. Which of the following features have you used on "the Vendor's" app to control your *Smart LED lights* using your Smart phone? (Please check all that apply [PROGRAMMER: "NONE OF THESE" IS EXCLUSIVE]

    Turning lights on/off
    Dimming lights
    Grouping lights with other smart devices
    Setting what are described in the app as "Smart Actions"
    None of these

[IF Q14 NE NONE OF THESE CONTINUE; OTHERWISE SKIP TO Q16]

15. How frequently would you say that you use the "the Vendor's" app to control your Smart LED lights?

    Once a day or more
    Once very few days
    Once a week or more
    I set them once and then forget them

16. Do you feel that your Smart LED lights are using more electricity, the same amount of electricity or less electricity than your previous bulbs?

    My Smart LED lights are using more electricity
    My Smart LED lights are using the same amount of electricity
    My Smart LED lights are using less electricity

17. Which of the following *energy monitoring features* have you used on your app on your Smart Phone? (Please check all that apply) [PROGRAMMER: "NONE OF THESE" IS EXCLUSIVE]

Energy Dial (real time and historical whole house energy usage)
Always On Dial (real time and historical energy usage for items continuously using power)
HVAC Dial (real time and historical usage for heating and cooling)
None of these

18. How valuable do you feel each of the following features are to you in terms of their ability to help you control and manage your household's electricity usage?

	Not valuable at all	Slightly valuable	Moderately valuable	Very valuable	Extremely valuable
Turning device or lights on/off through the "Vendor's" app	○	○	○	○	○
Creating a thermostat schedule on "the Vendor's" app	○	○	○	○	○
Grouping plugs or lights with other smart devices	○	○	○	○	○
Setting Smart Actions	○	○	○	○	○
Monitoring energy usage of the equipment plugged into Smart Plugs	○	○	○	○	○
Energy Dial (real time and historic whole house energy usage)	○	○	○	○	○
Always On Dial (real time and historical energy usage for items continuously using power)	○	○	○	○	○
HVAC Dial (real time and historical energy usage for heating and cooling)	○	○	○	○	○
Scheduling Smart LED lights	○	○	○	○	○
Dimming Smart LED lights using the "Vendor's" app	○	○	○	○	○

19. Do you think connected technologies like the Smart LED lights and the Smart Plugs can helped you lower your PG&E bill?

Yes, a lot
Yes, a little
No, not at all
Don't know

EVENTS

During the study period you received an email asking you to participate in the next phase of the Pilot study. This Phase involved scheduled energy events during which your connected smart plugs would have been remotely turned off by PG&E for specified periods of time. The next set of questions is about that phase of the pilot.

[IF DR = OPTOUT CONTINUE; ELSE SKIP TO Q21]

20. Our records show that you opted out of this Phase of the study. Why did you choose to opt out? (Please check all that apply)

    I don't want PG&E controlling anything in my home
    The smart plugs were plugged into appliances that need to be running all the time
    I'm not using my smart plugs
    I didn't think turning off my smart plugs would make a difference
    I think I did opt in
    I don't know/don't remember [EXCLUSIVE]
    Other (specify)

[IF DR = OPTOUT SKIP TO ATTITUDES SECTION]

[ASK IF DR = OPTIN; ELSE SKIP TO ATTITUDES SECTION]

21. Our records indicate that you chose to opt-in to this Phase of the study. Did you participate in all of the events or did you opt out of some of the individual events through the "Vendor's" app?

    I participated in every event
    I opted out of some events
    I never received a notification of events
    I don't know/don't remember

[IF Q21 = NEVER RECEIVED NOTIFICATON SKIP TO ATTITUDES SECTION]
[IF Q21 = I OPTED OUT CONTINUE; ELSE SKIP TO Q24]

22. Did you have any problems opting out of the events?

    Yes
    No

[IF Q22 = YES CONTINUE; ELSE SKIP TO Q24]

23. What problems did you have?

    [OPEN ENDED]

24. How often did you proactively turn back on the appliance(s) after an event that were turned off by your smart plugs?

    Always
    Sometimes
    Never

25. How much disruption to your daily life did allowing PG&E to turn off your Smart Plugs have?

    Very little
    Medium
    A lot

26. Based on your experience with this phase, how likely are you to participate in a study that would allow a third party to control or adjust your Smart Plugs or lights?

    1 Not at all likely
    2
    3
    4
    5 Extremely likely

ATTITUDES

Now we would like to understand how you and your household think about using and managing energy in your home.

27. Please rate how much you agree with the following statements about using energy in your home.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Comfort is very important to my household, even if I have to pay much more each month for energy	○	○	○	○	○
Saving money on energy costs is something I focus on every day	○	○	○	○	○
I want to be left alone to use energy however I want in my home	○	○	○	○	○
I'm very concerned about climate change and how I can do my part to help	○	○	○	○	○
There is a very little a single household can do to mitigate the effects of climate change	○	○	○	○	○

28. Now please rate how much you agree with the following statements about using technology to manage energy use in your home.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I am an "early adopter" of new home technologies	○	○	○	○	○
It is worth paying more upfront for technologies if they will help me save money in the future	○	○	○	○	○
I mainly look for technologies that will save me time	○	○	○	○	○
I am uncomfortable with PG&E being able to control any technologies in my home even if it saves me money	○	○	○	○	○
The only way I would be able to respond to PG&E "events" is if I had technology to automatically respond	○	○	○	○	○

29. Please assume that PG&E had a voluntary program that asked you to respond when the demand for electricity was the highest by using smart in-home devices – such as smart plugs and smart LED lights – to lower your household's energy usage. Using the scale below please rate how likely you would be to participate in such a program.

    1 Not at all likely
    2
    3
    4
    5 Extremely likely

30. Using the same scale how likely is it that you will buy additional Smart LED lights and/or Smart Plugs on your own?

    1 Not at all likely
    2
    3
    4
    5 Extremely likely

31. How likely is it that you will buy additional Smart technologies in the future?

    1 Not at all likely
    2
    3
    4
    5 Extremely likely

SATISFACTION

32. Overall, how satisfied are you with the quality and functionality of the Smart LED lights that came with the Connected Home Bundle?

    Extremely satisfied
    Somewhat satisfied
    Neither satisfied nor dissatisfied
    Somewhat dissatisfied
    Extremely dissatisfied

33. Overall, how satisfied are you with the quality and functionality of the Smart Plugs that came with the Connected Home Bundle?

    Extremely satisfied
    Somewhat satisfied
    Neither satisfied nor dissatisfied
    Somewhat dissatisfied
    Extremely dissatisfied

34. Overall, how satisfied are you with the total Connected Home Bundle experience?

    Extremely satisfied
    Somewhat satisfied
    Neither satisfied nor dissatisfied
    Somewhat dissatisfied
    Extremely dissatisfied

35. What are the main benefits you achieved from participating in the Connected Home Bundle study? (Please select the two benefits below that represent the most important benefits you achieved)

    [PROGRAMMER: RANDOMIZE AND ROTATE LIST, EXCLUDING "SOMETHING ELSE," WHICH SHOULD ALWAYS BE LAST]
    Getting to use the latest Smart home technology
    Increased convenience in my home
    Being able to better manage my home's energy use
    Being able to remotely monitor and control some of my home's lighting and appliances
    Saving money on my energy bills
    Being able to track my homes energy use in real time
    Improved comfort in my home
    More information means greater peace of mind
    Help to reduce GHG by reducing energy use
    Something else (Please specify _____)

Thank you for your time!

B

DR EVENT LOAD SHAPES

The following figures are load shapes for each event window.

Figure B-1 6-12 Event Window

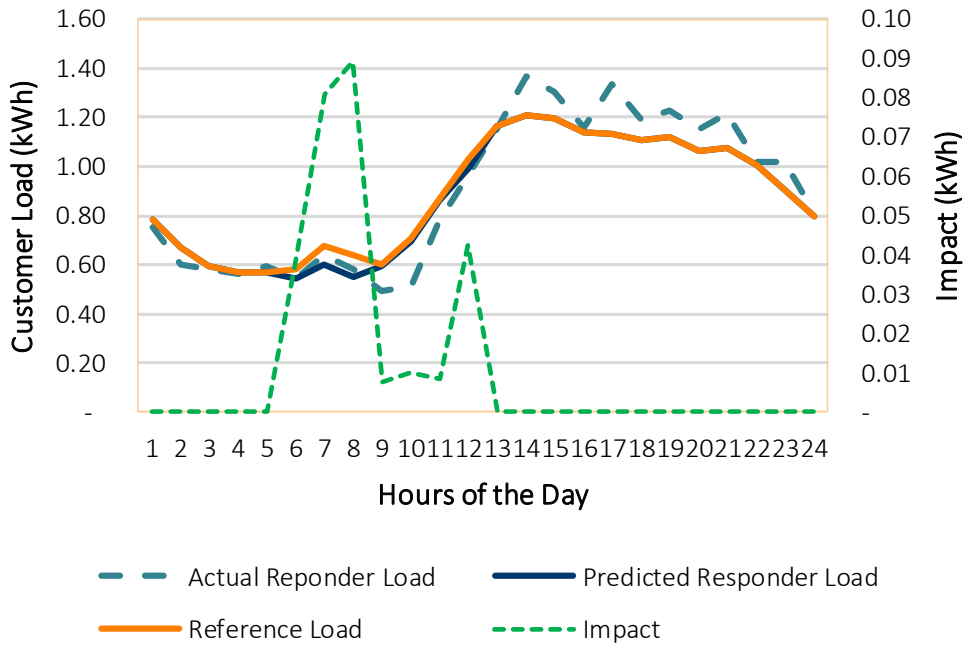


Figure B-2 7-8 Event Window

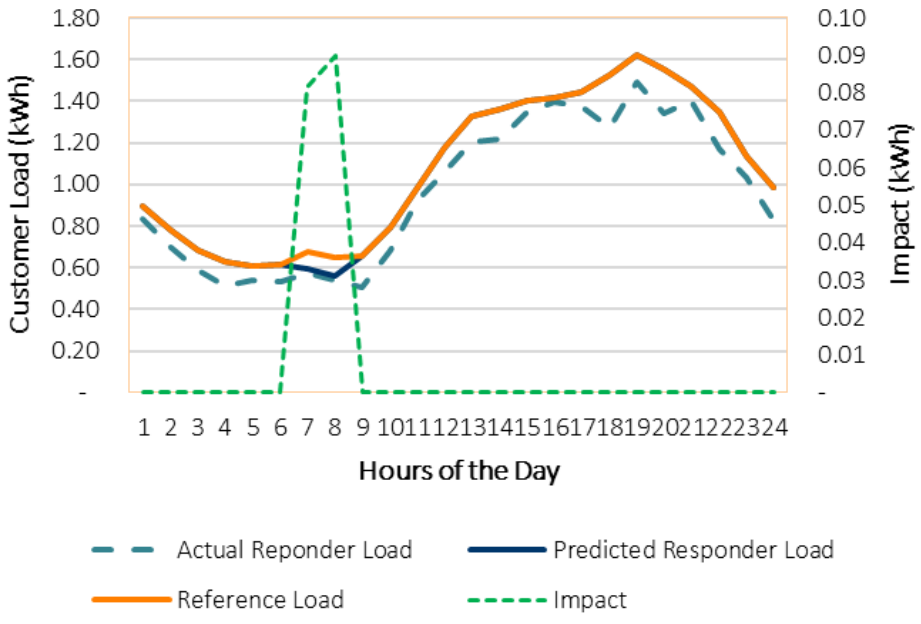


Figure B-3 9-11 Event Window

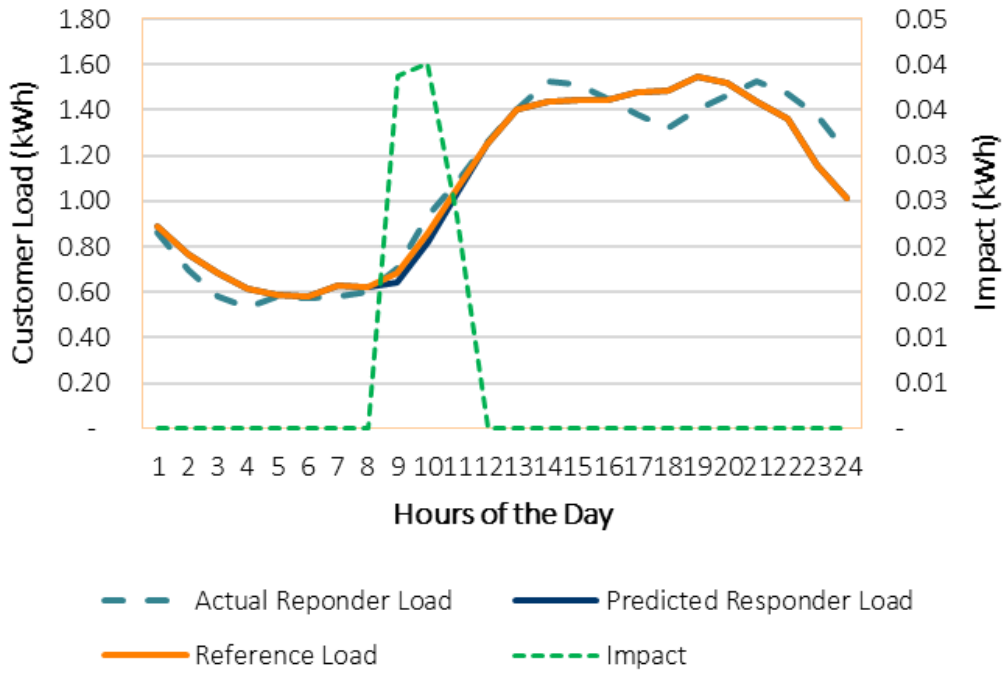


Figure B-4 12-18 Event Window

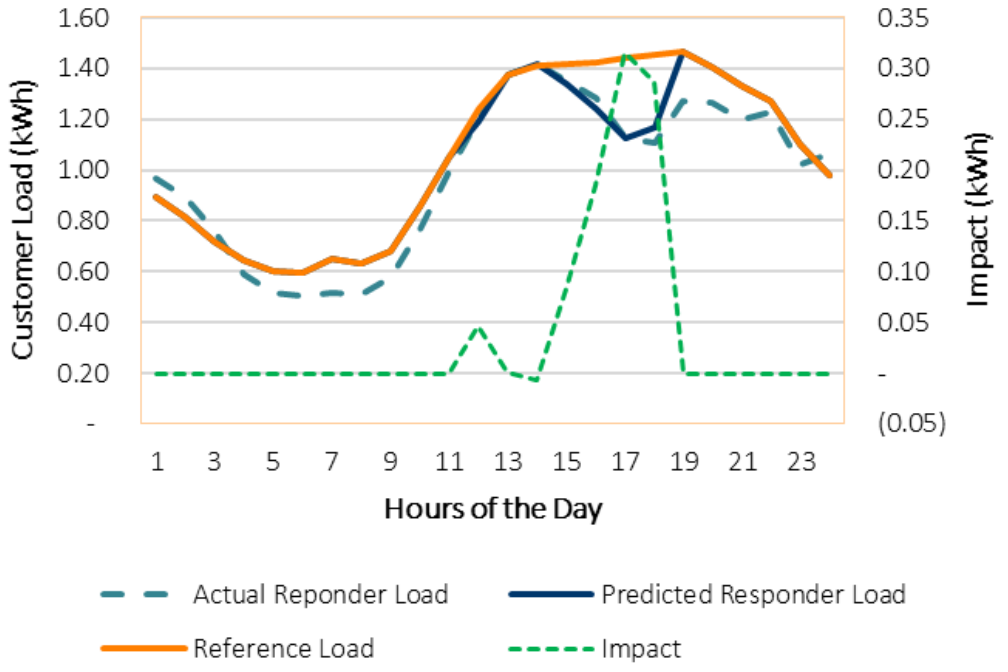


Figure B-5 15-17 Event Window

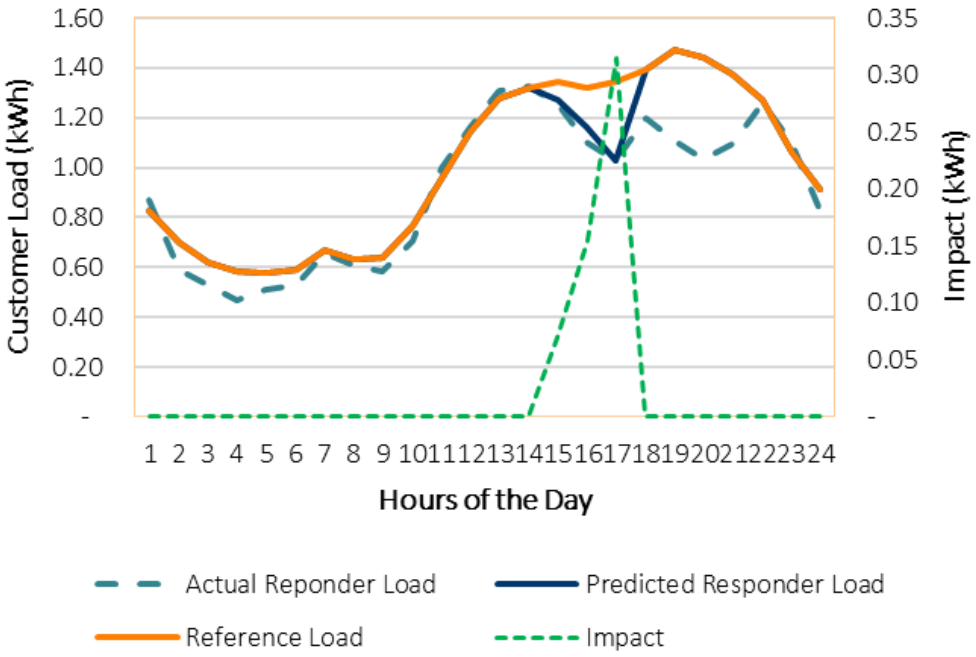


Figure B-6 18-24 Event Window

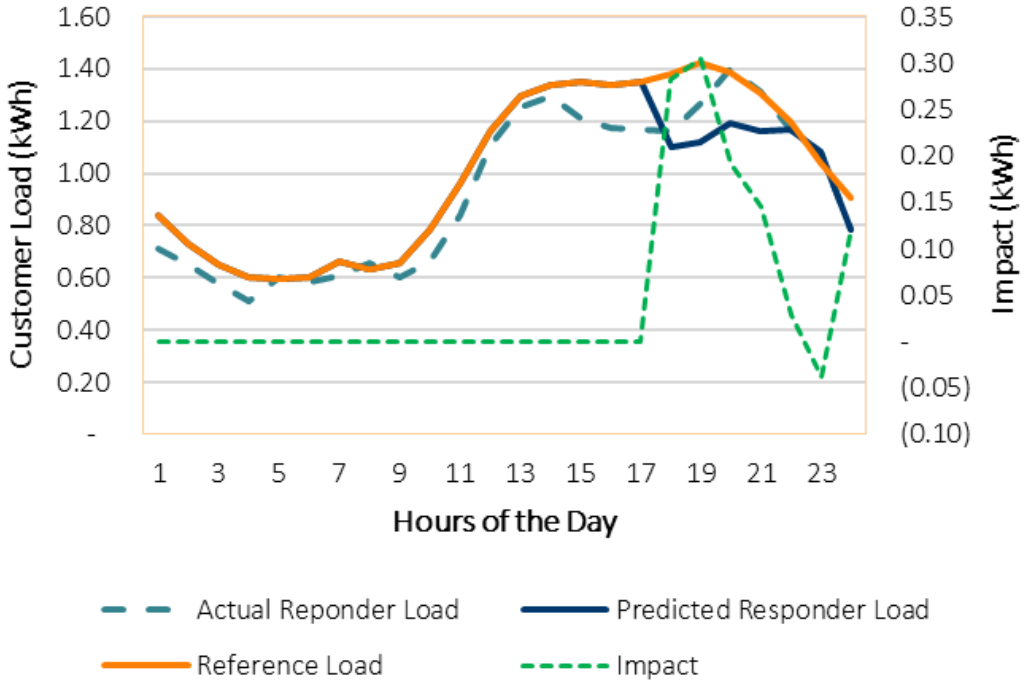


Figure B-7 19-21 Event Window