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Aliso Canyon Marketing, Education and Outreach Effectiveness Study

California Public Utilities Commission
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Glossary

Stakeholder and Program Abbreviations

Abbreviation	Definition
CBO	Community-Based Organization
CPUC	California Public Utilities Commission
EM&V	Evaluation, Measurement, and Verification
IOU	Investor-Owned Utility
ME&O	Marketing, Education, and Outreach
ME&E	Marketing, Education, and Engagement
SCE	Southern California Edison
SCG	Southern California Gas Company
CAISO	California Independent Service Operator

Glossary of Marketing Terms

Throughout the report, we use a number of standard marketing terms to describe the goals or achievements of marketing, education, and outreach activities. The table below provides a brief definition of these terms.

Marketing Terms	Description
Click-Through (or "Click")	The number of users who clicked on a specific internet advertisement or link
Click-Through Rate (CTR)	The percentage of impressions that lead a user to click on an ad, causing a redirect to another web location
Cost per Click	The cost of each click on a link or advertisement (i.e., on a website, email, or social media post)
Cost Per Point (CPP)	CPP is a measure of the cost to purchase a rating point on television. (A rating point represents one percent of the population in a given area).
Self-contained content	Media content that stands on its own, without relying on other pieces of content to relay its meaning or call-to-action
Engagement	A direct interaction between an individual and a program; on social media specifically, this refers to such actions as a "like," a "re-tweet," a new social media follower, a comment, or a "share"
Engagement Rate	Most commonly used for social media, this refers to the percentage of people who reacted to a post or message (via some type of engagement, defined above) among all people who saw the post or message
Impression	A single view or display of an ad; total impressions indicates the number of times an ad was displayed
Cost per thousand impressions (CPM)	CPM is a measure of the advertising cost to achieve 1,000 impressions.
Metric	An indicator of an activity's success or performance
Success criteria	A predetermined target, typically numeric, that indicates success or failure
Channel	A mode of communication used to promote a campaign, for example radio or social media
Content	The messaging and material created for a campaign and promoted via campaign channels
Aided ad awareness	The number and percentage of customers that recall a specific marketing element or message with prompting.
Message knowledge	The number and percentage of customers who demonstrate specific knowledge about the marketing element message

Marketing Terms	Description
Aided message knowledge	The number and percentage of customers who demonstrate specific knowledge about the marketing element message with prompting
Net Reach	The number of people who receive the specific marketing element.
Effective reach	The number of customers that recall having seen an advertisement with a frequency greater than or equal to the number of times necessary for the message to resonate (i.e., effective frequency).
Page	An analyst-definable unit of content on a website.
Page views	Page reviews represent the total number of pages that visitors looked at on a site.
Visit	A visit represents the number of times the website was visited, without regard to repeat visitors.
Relevance	Rating scales to evaluate statements about factors such as applicability and appeal of particular elements and the marketing message. Results can be presented for each item as well as together in a composite scale.
Sentiment	An assessment of the emotion of a social media mention online.
Intentions	Individual's willingness to behave in certain ways, such as participate in Flex Alerts, commit to energy efficient behaviors or participate in an EE or DR program. Results can be presented for each item as well as together in a composite scale.
Targeted behaviors conversion	Actions that result directly from campaign calls to action, such as attending an event, signing up for an energy efficiency program, etc.

1. Executive Summary

This report presents findings from the evaluation of the Marketing, Education and Outreach (ME&O) Campaign following the natural gas leak at the Aliso Canyon Storage Facility near Porter Ranch, California. This study has two overarching goals: (1) to audit and verify Aliso Canyon ME&O activities; and (2) to assess the effectiveness of Aliso Canyon ME&O activities.

The evaluation team planned and executed this study concurrently with the Aliso Canyon ME&O Campaign, enabling the evaluation team to share many of these findings in near-real time to inform both the campaign as it was being implemented and future campaign efforts.

1.1 Overview of Aliso Canyon ME&O Activities

In the winter of 2015, a major natural gas leak occurred at the Aliso Canyon Natural Gas Storage Facility in the Los Angeles Basin. In the wake of the leak, there was concern that supplies of natural gas in the Los Angeles Basin might not meet periods of peak demand during the summer and winter following the leak. In response, The California Public Utilities Commission (CPUC), in Proposed Decision A.12-08-007, authorized Southern California Gas (SCG) to provide funding for ME&O activities in 2016 to reduce the risk of natural gas and electricity interruptions in the Los Angeles Basin. In response to the CPUC ruling, SCG, with feedback from an advisory group, developed a conservation campaign centered on four main goals:

1. To raise awareness of the need to conserve energy[1]
2. To raise awareness of the interdependency of natural gas and electricity
3. To offer strategies and tips for saving energy, and
4. To drive energy conservation activities

A central component of the campaign was the creation of the "Conserve Energy SoCal" brand. The campaign sought to raise awareness of the brand, and in addition, to promote "Flex Alerts," or calls to conserve energy during times of peak demand. The campaign included: digital video ads, social media posts, children's books, and paid media searches to drive traffic to the campaign's website, among other strategies. The campaign also utilized television, radio, newspaper, billboards, movie theater advertisements, and email to communicate with the greater Los Angeles area population. Notably, social media (e.g., Facebook, Twitter, and Snapchat) played a key role in the campaign, as it was leveraged to raise awareness of Flex Alerts and the need to conserve energy. The campaign ran from June to December, 2016.

1.2 Research Approach

The evaluation team used a range of research methods to assess the Aliso Canyon ME&O efforts. These included a secondary data review of ME&O activities, interviews with campaign stakeholders, a three-wave split panel survey of the general population in the Los Angeles basin, a consumption analysis of energy billing data during Flex Alert events, and a usability study of the Conserve Energy SoCal website. We provide a brief synopsis of the research performed in Table 1.

[1] Objectives 1 and 2 were originally combined as one objective in campaign materials and we present them as separate objectives for reporting purposes.

Table 1. Evaluation Activities

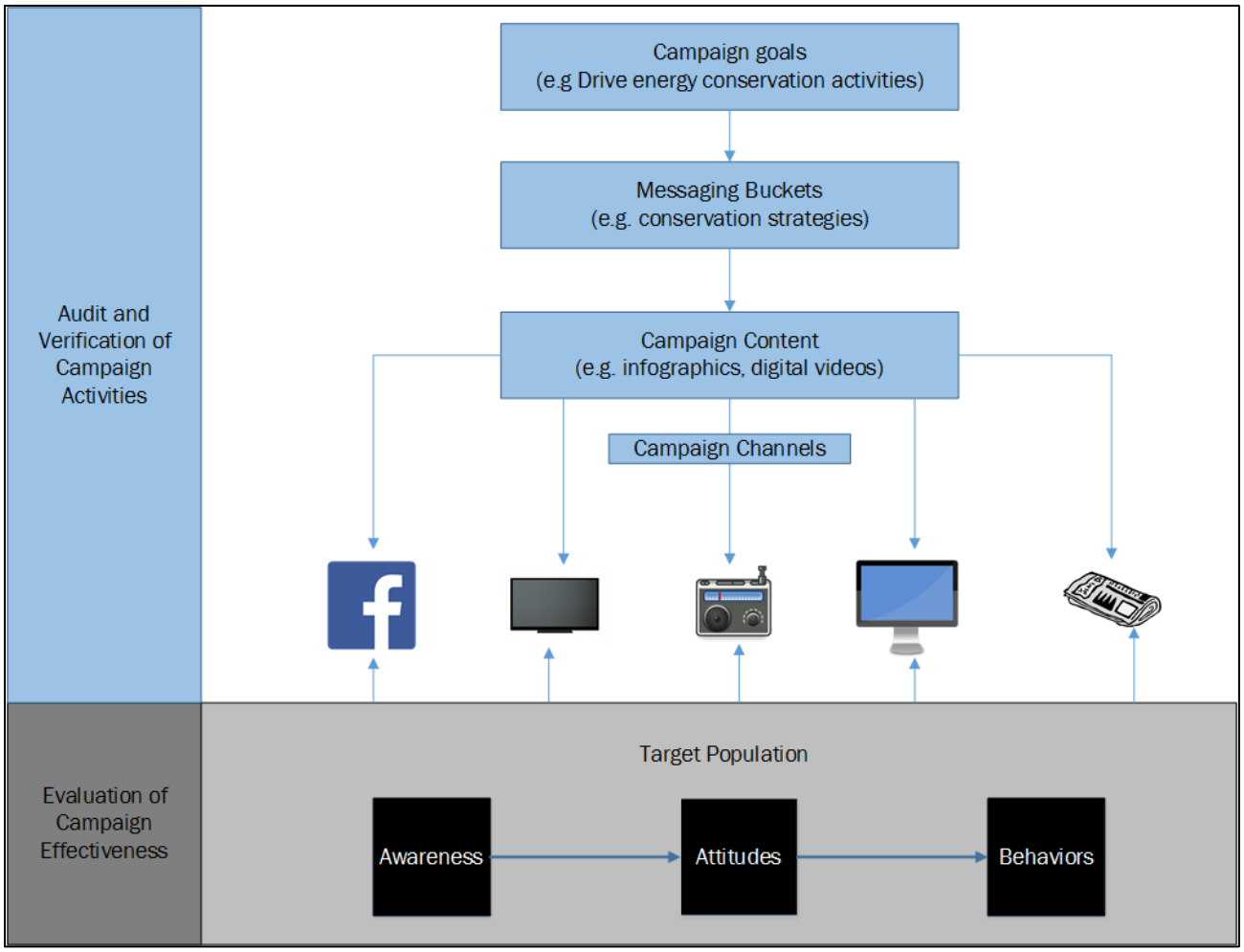
Evaluation Activity	Description
Stakeholder Interviews and Advisory Group Calls	Conducted five interviews with stakeholders to learn about campaign objectives, progress, and successes in addition to attending weekly advisory group calls to track campaign progress.
Review of Campaign Marketing Materials	Reviewed 90 unique pieces of campaign content generated by PulsePoint (the campaign implementer) and verified the number of impressions for each campaign channel.
Split Panel Survey	Completed surveys with the public in SCG territory at three different points during the campaign to assess campaign effectiveness over the duration of the campaign.
Consumption Analysis	Conducted a consumption analysis with AMI billing data for SCE customers during the periods when Flex Alerts were called.
Web Usability Study	Conducted fifteen remote interviews in which participants completed a suite of tasks on the campaign website while sharing their impressions and thoughts about the web interface experience.

1.3 Key Findings and Recommendations

The study sought to (1) audit and verify Aliso Canyon ME&O activities; and (2) to assess the effectiveness of Aliso Canyon ME&O activities.

Figure 1 illustrates the campaign strategy as interpreted by the evaluation team. The campaign goals were organized into five different "messaging buckets," or messaging themes, which provided an organized framework for presenting key information to the public. Each piece of campaign content, which included infographics, books, digital videos, etc., addressed at least one messaging bucket. For example, a video narrative that first explained the Aliso Canyon gas leak, then called on residents to conserve energy, and finally offered specific tools to do so, addressed the "Need to Conserve," "How Energy Conservation Works," and "Conservation Strategies" buckets. The campaign content was disseminated via eight channels, or media outlets. The public gained exposure to the campaign content and messages by engaging with the campaign channels (Figure 1).

Figure 1. Campaign Strategy and Evaluation Overview



1.3.1 Description of Findings: Audit and Verification of ME&O Activities

The evaluation team uncovered several insights through the audit and verification study and developed recommendations to address each finding. The findings and recommendations are as follows:

- **Finding: The Conserve Energy SoCal ME&O Activities aligned with the CPUC's direction.** Analysis of the related policy documents, SCG's monthly ME&E Reports to the CPUC, participation in weekly Advisory Group Meetings, and review of campaign goals, messaging buckets, content and channels, all provide evidence that ME&O activities were planned, executed, and launched in alignment with CPUC's direction.

- **Finding: The Conserve Energy SoCal Campaign utilized 5 key messaging buckets, developed 90 unique pieces of campaign content, and disseminated content via seven channels, or media outlets.**

- **Finding: The Conserve Energy SoCal Campaign targeted individuals residing in 299 zip codes that are directly impacted by the closure of the Aliso Canyon Storage Facility near Porter Ranch, California. No additional targeting was undertaken.**

  - **Recommendation: While the timing of this campaign did not allow for additional targeting, if the campaign continues, the implementer should consider segmenting the target audience to develop more precise targeted marketing.** Market segmentation provides a powerful method to align strategy, positioning, and messaging with customer's interests and needs. This maximizes marketing spend and increases customer's motivation to act.

- **Finding: The Conserve Energy SoCal Facebook posts grew in popularity throughout the campaign.** Recall of Facebook posts increased throughout the Conserve Energy SoCal campaign. Respondents' preference for Facebook as a source of energy conservation information showed the largest increase throughout the campaign as compared to other channels. The historical Facebook memes proved especially popular with respondents. Despite the popularity of the Facebook postings, the review of campaign marketing materials showed that the majority of the social media stand-alone content did not offer calls to action, relied on the accompanying text of the post to provide critical information; or, if they included a call to action, it was to visit the Conserve Energy SoCal website.

  - **Recommendation: Future energy conservation campaigns should feature Facebook as a key campaign channel, and social media content should effectively leverage the platform to make calls to action**. Consider changing the content of Facebook and other social media posts so that the content directly provides substantial tips about how to save energy (i.e., calls to action).

- **Finding: Flex Alerts were not explicitly mentioned in the stated campaign goals.** From the existing documentation and through participation in weekly meetings there was limited evidence of integration between Flex Alerts and the Conserve Energy SoCal campaign. Flex Alerts often appeared to be an "add-on," despite Flex Alert spending accounting for nearly half of the total campaign budget. Interviews with the implementer indicated that the goal of Flex Alerts in was to raise awareness. A secondary goal of Flex Alert marketing was to trigger action during Flex Alert events, with the latter representing a small percentage of the Flex Alert marketing spend.

  - **Recommendation: Future energy conservation campaigns should feature a strategic marketing plan where all components of the campaign are addressed**. A strategic marketing plan maps overarching campaign objectives to campaign activities and associated outcomes. Strategic marketing plans help to ensure that appropriate resources are devoted to achieving campaign objectives. Furthermore, strategic marketing plans provide a framework for the evaluation of campaign effectiveness.

  - **Recommendation: Future energy conservation campaigns should consider different funding priorities for Flex Alerts.** Given that this study and past studies indicate that awareness of Flex Alerts is high and that this study found no increase in awareness throughout the campaign, spending less on ME&O activities to promote awareness may be prudent.

- **Finding: The Conserve Energy SoCal Campaign re-used Flex Alert content broadcast on TV and radio channels from previous years. As such, high levels of awareness of TV and radio content can't be directly attributed to the Aliso Canyon ME&O campaign in 2016, because respondents may have seen or heard this content prior to the Aliso Canyon ME&O campaign.**

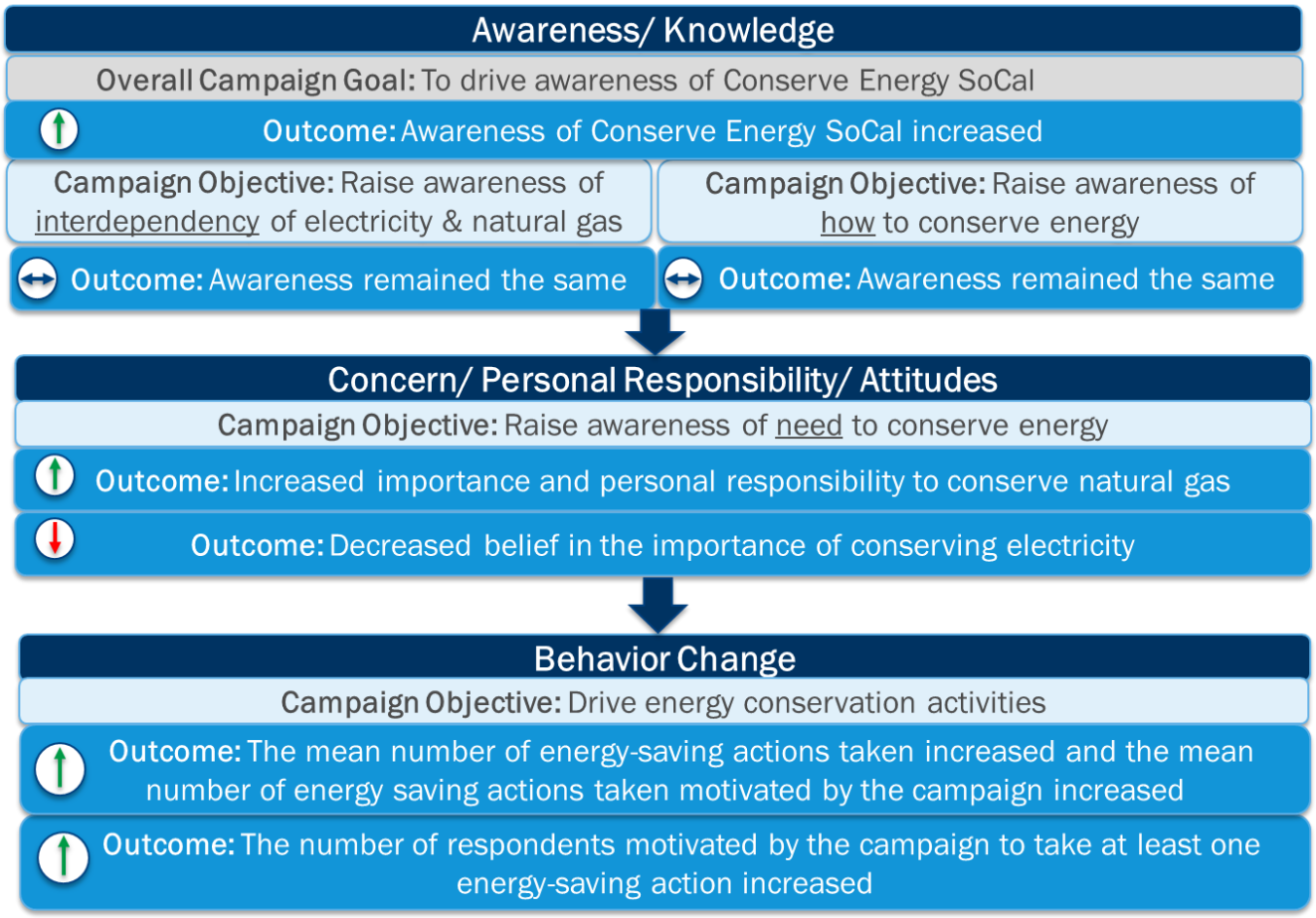
  - **Recommendation: Future campaigns utilizing Flex Alerts should consider developing fresh content to potentially increase awareness, concern, and behavior change related to Flex Alerts.** Consider changing the calls to action utilized in this content.

1.3.2 Description of Findings: Evaluation of ME&O Effectiveness

To evaluate the effectiveness of the Conserve Energy SoCal campaign, we utilized a type of popular marketing conceptual model, referred to as a hierarchy of effects model. The hierarchy of effects model posits that audiences go through a variety of changes in responding to advertising and other persuasive marketing messages (Lavidge and Steiner, 1961; Vakratsas and Ambler, 1999; Hoang Sinh, 2013). The basic assumptions are that customers first become aware of an offering, they then develop attitudes and beliefs about the offering, and as a result are prompted to take action.

We present overview of campaign performance, key findings, and recommendations in light of the specified Conserve Energy SoCal campaign objectives below (Figure 2).

Figure 2. Conserve Energy SoCal Campaign Effectiveness Overview



- **Finding: Respondent awareness of the Conserve Energy SoCal brand increased throughout the campaign.** Overall, the campaign succeeded in raising awareness of the Conserve Energy SoCal brand. Respondent awareness of the brand increased from 55% shortly after the campaign began to 61% at the close of the campaign.
    - **Recommendation: Because the Conserve Energy SoCal brand has gained traction in Southern California, ongoing and future campaign should leverage this success, which**

in turn maximizes ratepayer investment. As the Conserve Energy SoCal campaign generated a high level of awareness in a short time period, the energy providers in Southern California should continue to leverage this brand during energy shortages. As the risk of energy shortages decline, emphasis should be placed on using the Conserve Energy SoCal brand equity to increase the reach of the state-wide energy conservation brand, Energy Upgrade California.

- **Finding: Survey and web usability respondents did not make the connection between natural gas and electricity, even after exploring campaign content.** Results from both the surveys and the web usability study showed that few people made the connection between natural gas and electricity.

- **Finding: The campaign influenced respondents' attitudes towards energy conservation**. Survey respondents increasingly believed there was a limited supply of natural gas in Southern California and that they had a personal responsibility to conserve natural gas. Though respondents' beliefs in the importance of natural gas conservation increased throughout the campaign, their beliefs in the importance of electricity conservation decreased. In addition, the evaluation team asked web usability participants to explore content explaining why it was important to conserve energy. Some participants did not uncover the message in the website videos or text. Others did not demonstrate understanding of why energy conservation is important even after having read the materials. This further indicates that not all respondents understood the connection between natural gas and electricity.

  - **Recommendation: Future campaigns should continue to address the interdependency of electricity and natural gas as well as develop new tactics to educate residents on this topic, especially if this topic remains a conservation campaign goal.**

- **Finding: Web usability participants were not able to find utility energy efficiency programs via the Conserve Energy SoCal website.** Participants needed to navigate through several pages and search the website to find incentives and programs for energy efficiency upgrades. It is likely that individuals casually browsing the website would not find this topic if not directed to it.

  - **Recommendation: Future energy conservation campaigns should explore how to drive customers to energy efficiency programs**. Given the frequent importance of websites in campaigns and that energy efficiency programs are a key way to drive energy conservation, it is essential for campaigns to help customers make this important connection.

- **Finding: Overall, the campaign influenced more people to take energy saving actions**. When we surveyed respondents two months after the campaign began, 22% of respondents reported taking at least one new energy-saving action directly as a result of the campaign. The share of respondents who took at least one energy-saving action directly because of the campaign increased slightly throughout the campaign (a 4 percentage point increase from second survey to the third survey).

- **Finding: Using the Aliso Canyon emergency appeared to be an effective campaign strategy and self-reported conservation behaviors increased two and a half months into the campaign as compared to pre-campaign levels. However, incremental effects on behavior were not observed four months and six months into the campaign.** The mean number of energy saving actions taken by survey respondents jumped from 5 actions before the campaign began to 9 actions at the time the first survey was sent out, two and a half months after the campaign began. Furthermore, respondents were influenced by the campaign to take several new

actions between the start of the campaign and the time the first survey was sent out (mean=4.74). However, the mean number of actions taken overall and the mean number of actions taken motivated by the Conserve Energy SoCal campaign stayed constant throughout the rest of the campaign period.

  - **Recommendation: Future energy conservation campaign calls to action should feature new and novel behaviors as the campaign progresses.** This will give customers the opportunity to increase their conservation behaviors.

- **Finding: Overall, respondents' level of knowledge about how to save energy in their homes was high and stayed constant throughout the campaign.** We asked respondents about their level of knowledge regarding energy saving actions in the home. Respondents reported a high level of knowledge when we conducted our first survey two and a half months after the start of the campaign (4.01 on a five-point scale where one is "not at all knowledgeable" and five is "very knowledgeable"). This indicated that the campaign had little room for influence on respondents' knowledge about energy conservation behaviors in the home. Since the energy tip calls to action remained similar throughout the campaign, it is not surprising that the mean knowledge level stayed constant in subsequent surveys.

  - **Recommendation: Consider recommending innovative energy-saving tips that are less likely to be a part of customers' current daily habits.** For example, the website might educate people about deeper home energy efficiency retrofits that they can complete with the help of utility-run programs.

- **Finding: We estimate that Flex Alert customers reduced electricity demand by 0.024 kWh/hr on average during Flex Alert events.** This resulted in a total reduction of 5.5 MWh/hr across the total population of 223,378 residential customers in the targeted zip code areas (this figure excludes residential customers participating in other demand response and net energy metering programs). Demand reduction estimates for the July events are statistically significant at a 95% confidence level. However, given the awareness of Flex Alerts stayed constant throughout the campaign, it is unclear how much of this reduction is due to the Flex Alert brand equity and how much is due to the Conserve Energy SoCal Campaign.

2. Introduction

This chapter first summarizes the impetus for this study and provides an overview of the Aliso Canyon ME&O Campaign. This is followed by a summary of the research objectives, questions, and activities.

2.1 Aliso Canyon Overview

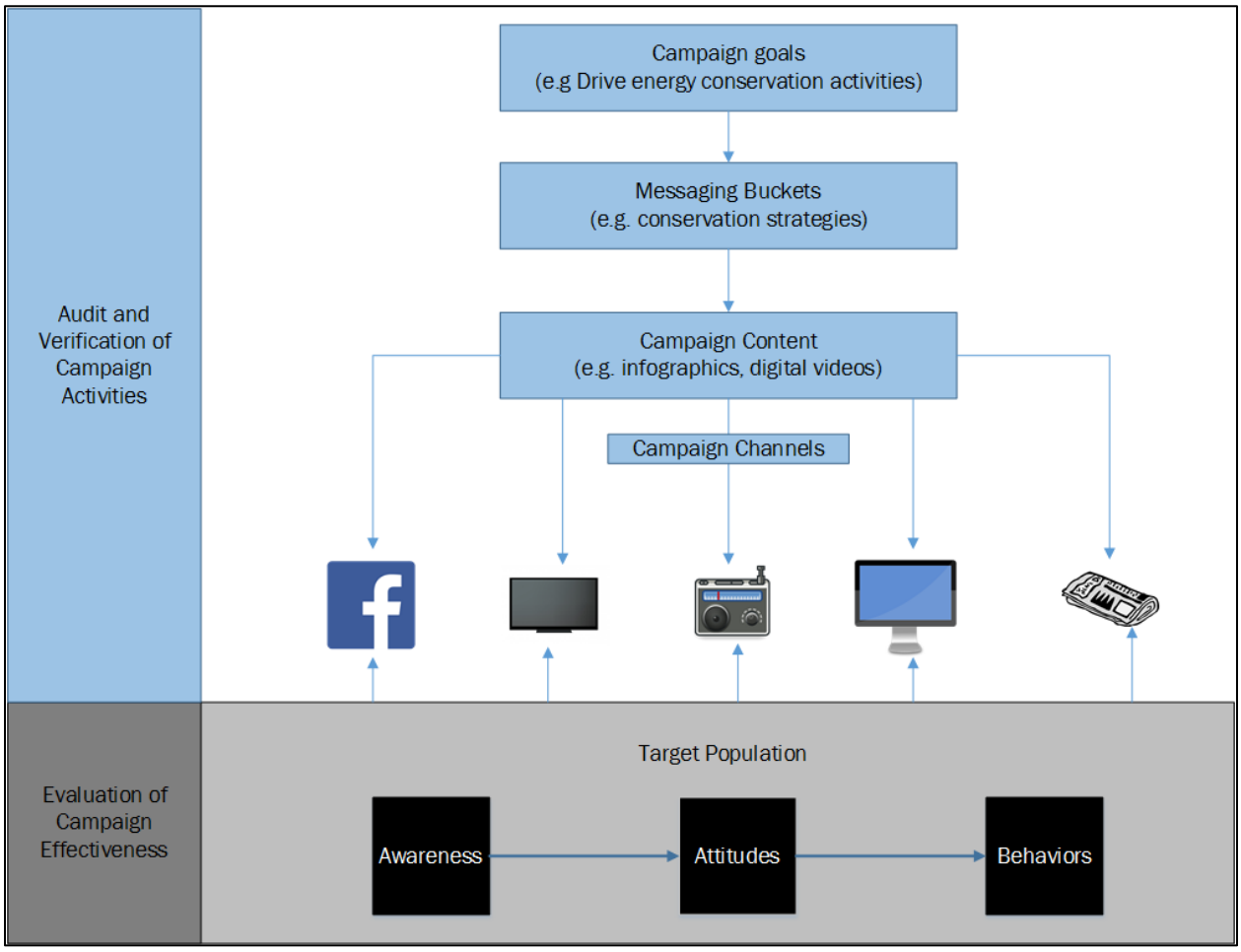
Aliso Canyon, a natural gas storage facility in the SCG system, is essential to providing a reliable supply of natural gas for space heating, hot water, cooking and other essential uses in the Los Angeles Basin. The Aliso Canyon Storage Facility is also the only source of gas supply for gas-fired electric generators in the area, which is integral to meeting peak electrical demand on hot summer or cold winter days. On October 23, 2015, a massive gas leak was discovered at one of the gas wells in Aliso Canyon. Governor Brown declared a state of emergency on January 6, 2016. On February 18, 2016, California state officials announced the gas leak was permanently sealed. Given this situation, there was concern that it may be difficult for SCG to respond to increases in electricity demand. In particular, there was concern that electric generation in the Los Angeles Basin relying on gas from Aliso Canyon might fall short on days of high peak demand for electricity. Given this situation, officials directed attention towards encouraging customer conservation of electricity and natural gas to ensure system reliability in the area.

The California Public Utilities Commission (CPUC), in Proposed Decision A.12-08-007, authorized SCG to provide funding for ME&O activities in 2016 to reduce the risk of natural gas and electricity interruptions in the Los Angeles Basin. Of the total $11 million sanctioned, the CPUC directed $5 million for Flex Alerts focused on customers in the Los Angeles area. The CPUC authorized the remaining $6 million to be spent on implementing the targeted Marketing, Education and Engagement (ME&E) campaign that SCG proposed in its March 25, 2016 comments in the aforementioned proceeding. The Aliso Canyon ME&O Campaign ran from June to December, 2016.

2.2 Campaign Overview

Our description of the Aliso Canyon ME&O Campaign presented herein is based on our audit and verification of ME&O activities in addition to the campaign strategies as stated by PulsePoint. Figure 3 illustrates the campaign strategy as interpreted by the evaluation team. The campaign goals were organized into five different “messaging buckets,” or messaging themes, which provided an organizing framework for presenting key information to the public. Each piece of campaign content, which included infographics, books, digital videos, etc., addressed at least one messaging bucket. For example, a video narrative that first explained the Aliso Canyon gas leak, then called on residents to conserve energy, and finally offered specific tools to do so, addressed the “Need to Conserve,” “How Energy Conservation Works,” and “Conservation Strategies” buckets. The campaign content was disseminated via seven channels, or media outlets. The public gained exposure to the campaign content and messages by engaging with the campaign channels (Figure 3). We talk about each of these elements in more detail below.

Figure 3. Campaign Strategy and Evaluation Overview



2.2.1 Campaign Goals

In response to the CPUC ruling, SCG, with feedback from an advisory group, developed a conservation campaign centered on four main goals:

1. To raise awareness of the need to conserve energy[2]
2. To raise awareness of the interdependency of natural gas and electricity
3. To raise awareness of how to conserve energy in terms of strategies and tips
4. To drive energy conservation activities.

SCG hired PulsePoint group, a division of ICF International, to implement the campaign. The campaign strategy centered on driving cross-channel performance to achieve campaign effectiveness, with a focus on maximizing impressions with self-contained content. Self-contained content is content that stands on its own, without relying on other pieces of content to relay its meaning or call-to-action. A

[2] Objectives 1 and 2 were originally combined as one objective in campaign materials and we present them as separate objectives for reporting purposes

central component of the campaign was creating the "Conserve Energy SoCal" brand and driving awareness of this brand. The campaign also focused on the promotion of "Flex Alerts." Authorized by the CPUC, Flex Alerts are "part of an educational and emergency alert program that informs customers about how and when to conserve energy."[3] The Flex Alert program was created during the energy crisis of 2001 to encourage consumers in California to conserve electricity during times energy supply shortages and high peak demand through simple actions such as turning up the thermostat and postponing the use of appliances until after peak periods. In 2016, the Flex Alert program was solely funded by appropriations from the Aliso Canyon ME&O campaign as there was a concern that supplies of natural gas and electricity would not be adequate to meet periods of high peak demand after the Aliso Canyon gas leak. Flex Alerts were used as a tool to reduce demand during these peak periods and mitigate the threat of blackouts and brownouts.

As authorized in Proposed Decision A.12-08-007, 45% of funds for ME&O efforts were allocated to supporting Flex Alerts. Similar to the Conserve Energy SoCal conservation strategy, the focus of Flex Alert funding was on generating impressions and engagements. The campaign aimed to promote awareness of Flex Alerts and educate customers about how to take action on event days, through television ads, radio ads, online media, and digital billboards. The campaign did not promote Flex Alert sign-ups, with the exception of one call to action on the Conserve Energy SoCal website, which directed users to the sign up page for Flex Alerts.[4] During Flex Alert events, the campaign released "trigger advertisements" which notified customers when Flex Alerts were in effect through radio ads, social media, and digital billboards. In addition to the campaign Flex Alert efforts, CAISO also released bulletins to the news media to inform customers when a Flex Alert was in effect.

2.2.2 Messaging Buckets

The campaign leveraged five distinct messaging buckets to organize and deliver key information. Table 2 presents the messaging buckets with their intended content and corresponding campaign goals.

Table 2. Campaign Messaging Buckets and Respective Content

Message Bucket	Detailed Message Description	Campaign Goal
The Need to Conserve This Year	Due to the limited availability of natural gas from the Aliso Canyon Storage Facility, there is less natural gas available locally to produce electricity during peak times.	To raise awareness of the need to conserve energy To raise awareness of the interdependency of natural gas and electricity
How Energy Conservation Works	About 60% of electricity generated in California comes from natural gas. During the hottest times, people use more electricity to cool their homes. During the coldest months, more natural gas is used to heat homes.	To raise awareness of the interdependency of natural gas and electricity
Conservation Strategies	How to reduce energy consumption, especially during peak times – focusing mostly on efforts to save electricity and/or	To raise awareness of how to conserve energy in terms of strategies and tips To drive energy conservation activities.

[3] California ISO Website: http://www.caiso.com/informed/Pages/Notifications/Flex-Alerts.aspx

[4] As part of the Flex Alert program, customers can sign up to receive Flex Alert event notices via email or text on their cell phone. A goal for many previous marketing campaigns related to Flex Alerts was to encourage customers to sign up for these notices. This was not the case in this campaign.

Message Bucket	Detailed Message Description	Campaign Goal
	reduce energy use during extreme temperatures.	
Outage Preparation	Strategies for how to respond should there be an outage. Focus on safety and staying cool during the summer or warm in the winter.	To raise awareness of how to conserve energy in terms of strategies and tips To drive energy conservation activities.
Making a Difference	Demonstrates the impact everyone can have by working together; includes thank you messaging. Will especially emphasize this content after flex alerts	To drive energy conservation activities.

The summer and winter messaging for the buckets differed. Summer messaging generally focused on energy availability for home cooling, while winter messaging focused on home heating and energy use around the holidays. "Making a Difference" messaging did not vary throughout the campaign.

The website, which served as the hub for all campaign content, was organized by the messaging buckets. According to stakeholder interviews, the headline banner of the website offered easy navigation to the different topics in order to facilitate learning under each major campaign area (Figure 4). The web usability study confirmed that most participants looked to the headline banner to find needed information.

Figure 4. Main Website Banner Featuring Campaign Messaging Buckets

2.2.3 Campaign Content

The PulsePoint group designed campaign content to communicate the five messaging buckets. Campaign content included videos, animations, social media advertisements and memes, infographics, events, children's books, emails, mobile modules, a brochure and a display banner. The implementer used individual pieces of content in multiple channels. For example, customers could view videos on social media and the website; and see animations on social media and in emails. In total, we documented 90 unique campaign pieces of content utilized in the multi-channel campaign strategy.

While videos presented more complex issues and touched on several campaign goals per piece, such as the need to conserve energy and calls to action, animations tended to pitch one simple conservation idea. Table 3 summarizes all campaign materials and reports the percent of each category that presented key campaign messages. While some campaign materials consistently touched on several goals of the campaign, such as including calls to action and directed viewers to the website (e.g. children's books), other content formats, such as social media posts did not convey knowledge, action, and responsibility together in each campaign piece but would instead offer more simple messages that aligned with one campaign goal or call to action per post.

Table 3. Campaign Content Summary and Messaging

Content Type	Number of Unique Pieces	Percent of Content that Expressed Key Campaign Messages		
		Drives Awareness, Behavior, and Action	Calls to Action	Included Link to Website
Videos	13	92%	31%	85%
Animations	13	8%	38%	62%
Social Media Advertisements/Memes	45	27%	18%	40%
Infographics	9	78%	44%	78%
Events	3	NA	NA	NA
Children's Books	3	100%	100%	100%
Emails	5	80%	20%	60%
Mobile Module and Brochure	2	33%	67%	100%

Because the campaign strategy centered on maximizing impressions of self-contained content, our evaluation of campaign materials also focused on whether individual pieces of content communicated key campaign messages. In some cases, the content only presented the link to the website as text, and the overall message was not readily clear from the stand-alone graphic content. In the context of social media posts, the meaning of the post was often reliant on the accompanying text. In some cases, the accompanying text offered key information and calls to action, which, together with the graphic, created a piece of self-contained content. However, in other cases, the message of the post was not clear because the accompanying text did not explain the graphic well. Overall, this strategy puts reliance on the person writing the social media post to convey a clear and comprehensive message, regardless of the campaign assets that were created by PulsePoint.

Introduction

The LED sunset animation[5] offers an example of the finding that not all campaign pieces were self-contained: the graphic depicts a light bulb rising in the sky as the moon, but a viewer likely would not know that the bulb shown is an energy efficient LED (Figure 5; full animation link included below the screenshot). The accompanying Facebook text read: "As the sun goes down, the lights go on. Make sure all the lights in your home are energy-efficient." In this example, the message was presented in the accompanying text, and the efficacy of the post relied on the wording and style of the person writing the social media post as much as it relied on the campaign content itself.

Figure 5. Screenshot and Video of Campaign Animation: LED Sunset

2.2.4 Campaign Channels and Goals

The campaign utilized seven channels to deliver campaign content Table 4. Each channel had specific goals. The campaign strategy was that cross-channel performance would result in campaign effectiveness. The evaluation team evaluated all channels with the exception of movie theater pre-rolls (OOH), which comprised a very small portion of the campaign budget (1%).

[5] https://www.facebook.com/ConserveEnergySoCal/videos/1815229188759142/

Table 4. Conservation Campaign and Flex Alert Channels and Goals

Channel	Goal	Metrics	Flight Plan	Examples
Website	Educate and engage customers	Page views Visits Usability data Aided & unaided messaging knowledge Relevance Conversions Sentiment	June – Dec. 2016	N/A
Social Media	Drive passive awareness of conservation and engagement with content	Impressions Engagements Net reach Aided & unaided messaging knowledge Channel specific traffic Relevance Shares (Engagements) Conversion	June – Dec. 2016	Facebook, Twitter, Snapchat Filters
Outreach	Increase media coverage of the campaign	Event attendance Media coverage Net reach	June – Dec 2016	Cinespia Sponsorship, "Hot Day, Hot Deals,"
Digital Media	Educate and engage customers, Drive highly-relevant traffic to site	Impressions Website traffic Aided ad awareness Net reach Aided & unaided messaging knowledge Relevance Video Completion Rate (VCR) Net Reach Click Thru Rate (CTR)	July – Dec. 2016	Clearstream
Broadcast (TV/Radio)	Increase awareness and drive conservation activity if Flex Alert is issued	Impressions Outage avoidance Aided ad awareness Net reach Aided & unaided messaging knowledge Conversion Cost Per Point (CPP)	TV: July – Sept. 2016 Radio: July – Dec. 2016	Digital Radio: Pandora, LA MSA, LA DMA, Riverside San Bernardino MSA

Channel	Goal	Metrics	Flight Plan	Examples
		CPM		
Newspaper	Reach diverse audiences and drive traffic to the website	Impressions Net reach CPM	Weeks of June 27, July 25, Aug 29, Oct 10, Nov 21, and Dec 19	Inland Community Newspapers, La Prensa, IE Voice, San Bernardino American, Inland Valley News, Yes We Can Newspaper, Hoy Los Angeles, La Opinion, Eastern Group Publications
Digital OOH and OOH	Increase awareness and exposure to Flex Alerts	Impressions Aided & unaided messaging knowledge Net reach Event attendance CPM	June – Sept. 2016	Los Angeles, Riverside San Bernadino, Movie theater pre-rolls,

2.2.5 Hierarchy of Effects Model

To evaluate the effectiveness of the Conserve Energy SoCal campaign, we utilized a type of popular marketing conceptual model, referred to as a hierarchy of effects model. The hierarchy of effects model posits that audiences go through a variety of stages (cognitive -> affective -> conative) in responding to advertising and other persuasive marketing messages (Lavidge and Steiner, 1961; Vakratsas and Ambler, 1999; Hoang Sinh, 2013). The basic assumptions are that customers first become aware of an offering, they then develop attitudes and beliefs about the offering, and as a result are prompted to take action. The most cited hierarchy response models include AIDA and the Lavidge-Steiner Hierarchy of Effects Model. Table 5 shows these models side by side and also includes the akAB model of behavior change, a hierarchy of effects model, developed specifically for energy-efficiency related behavior change.

Table 5. Hierarchy of Effects Model

Stages	AIDA	Lavidge-Steiner Model	akAB
Cognitive (Thoughts)	Attention	Awareness Knowledge	Awareness/Knowledge
Affective (Feelings)	Interest Desire	Liking Preference	Concern Personal Responsibility
Conative (Behaviors)	Action	Conviction Purpose	Intention Behavior Change Maintenance

Note: The framework presented in the table is adapted from Belch & Belch, 2009[6]

Response hierarchy models provide a useful practical framework for driving advertising and communications assessment. "Marketers should focus on cognition, affect and experience, as critical variables that advertising may affect. However, they should not assume a particular sequence of responses" (Hoang Sinh, 2013). Using the model without requiring a specific sequence takes advantage of the usefulness of the model while allowing for the fact that neuroscience research indicates that emotion often operates independently of the rational brain to drive behavior. The goals of the marketing campaign align with the three stages of the Hierarchy of Effects model as shown in Table 6. Table 3 also crosswalks traditional marketing metrics, relevant to the Aliso Canyon ME&O activities, by stage.

Table 6. Campaign Goals and Marketing Metrics by Hierarchy of Effects Model

Stages	Campaign Goals	Marketing Metrics
Cognitive (Thoughts)	• Raise awareness of the interdependency of natural gas and electricity • Increase knowledge of how to conserve energy	• Aided ad awareness • Message knowledge • Aided message knowledge • Net reach • Effective reach • Impressions • Open rate • Page • Page views • Visit • Channel-specific traffic • Visit Duration
Affective (Feelings)	• To raise awareness of the need to conserve energy	• Relevance • Sentiment • New sessions
Conative (Behaviors)	• Drive energy conservation activities	• Engagements • Content shareability (shares) • Abandonment rate • Intentions • Targeted behaviors/conversion

[6] Belch, G.E. & Belch, M.A. (2009). *Advertising & Promotion: An Integrated Marketing Communications Perspective*. Irwin, Boston: The McGraw-Hill. p.159.

The evaluation team utilized the hierarchy effects model as a practical framework for this study utilizing the marketing metrics described in the table above.

2.2.6 Budgets

SCG budgeted $6 million for the Conserve Energy SoCal Campaign and approximately $5 million of this budget went to direct campaign spending while the rest went to administrative fees. Actual campaign spending matched the campaign budget with the exception of paid search which under-delivered resulting in ad savings of $17,000. Social media represented the greatest share of channel-specific spending at 24% (Table 7). Digital media, which includes digital videos, paid search ads, and online ads also represented a significant share of budget spending at 19%.

Table 7. Conserve Energy SoCal Campaign Budget

Channel	Budget	Share of Budget
Channel-specific Spending		
Social Media	$1,250,000	24%
Digital Media	$968,625	19%
Radio	$711,797	14%
Outreach	$188,000	4%
Earned media	$150,000	3%
Website	$130,000	3%
Newspaper	$142,510	3%
Movie Theater (OOH)	$62,444	1%
General Campaign Spending		
Content Creation	$1,150,000	22%
Research & Campaign Development	$250,000	5%
Total	**$5,132,216**	**100%**

SCG also budgeted $5 million for Flex Alerts and spent $4 million of the total allocation on channels used to broadcast and advertise Flex Alerts (Table 8). Officials called fewer Flex Alerts than SCG budgeted for which resulted in a budget surplus of over $700,000[7]. SCG allocated the majority of Flex Alert budget funds to broadcast media channels including television (48% of the Flex Alert budget) and radio (27% of the Flex Alert budget) (Table 8). A small portion of the radio, digital billboard, and social media budgets ($120,000) was spent on "trigger events" during Flex Alert days.

Table 8. Flex Alert Campaign Budget

Channel	Budget	Share of Budget
Television	$1,917,353	48%
Radio	$1,069,512	27%
Digital Billboards (Digital OOH)	$682,755	17%
Online Media	$347,867	9%
Total	**$4,017,489**	**100%**

[7] Additional funds were dedicated to agency fees.

2.3 Research Objectives, Questions, and Activities

The Aliso Canyon ME&O Effectiveness Study focused on two umbrella research objectives, 11 key research questions and 5 primary research methods as cross-walked in Table 9.

Table 9. Methods by Objective and Research Questions

Research Objectives	Research Question	Review of Campaign Marketing Materials	Stakeholder Interviews & Advisory Group Calls	Web Usability Study	Split Panel Surveys	Consumption Analysis
Objective 1: Audit and Verification of ME&O Activities	1. What Aliso Canyon ME&O activities were implemented?	☑	☑			
	2. What audiences were identified and targeted with Aliso Canyon ME&O activities?	☑	☑			
	3. What channels were utilized to reach the Aliso Canyon target market?	☑	☑			
	4. What messages and calls to action were utilized in the campaign?	☑	☑			
	5. Do the ME&O activities and plans align with the CPUC's direction?	☑	☑			
Objective 2: Assessment of ME&O Impacts	6. Can users effectively navigate the website – www.ConserveEnergySoCal.com?			☑		
	7. How effective is each channel in reaching the target audience(s)?				☑	
	8. How effective were the messaging and calls to action in engaging customers?				☑	
	9. What are the demand reduction impacts associated with Flex Alerts?					☑
	10. Where feasible, are there any variations in energy or demand impacts by geographic area or target group?					☑
	11. Overall, was the investment in additional ME&O and Flex Alerts successful in increasing consumer conservation of both gas and electricity?	☑	☑	☑	☑	☑

3. Evaluation Methodology

This chapter provides a description of the methodology for the five different research tasks included in this study categorized by research objective.

3.1 Objective 1 Tasks: Audit and Verification of ME&O Activities

Objective 1 encompasses research Questions 1 - 5 as outlined in Table 9. To address this objective, we conducted a review of campaign marketing materials, stakeholder interviews, and participated in advisory group calls.

3.1.1 Review of Campaign Marketing Materials

The evaluation team completed a review of campaign materials generated through January 2017, in order to evaluate how well ME&O activities aligned with the CPUC's goals for the campaign and to determine if campaign materials achieve campaign objectives.

We categorized materials into content types including animations, infographics, videos, children's books, and events. The evaluation team assessed each piece of campaign material for components of the campaign goal, including generating awareness of the interdependency of gas and electricity, the need to conserve energy, and calls to action. We also noted other campaign messages that related to the need to conserve energy, interdependency of natural gas and electricity, and taking action, such as the message that "everyone can do their part" and "every little bit helps."

In addition to cataloguing campaign materials, we reviewed PulsePoint tracking data, communication plans, progress reports, and budget information. Section 4.1.2 presents findings on communication channels and respective tracking data for each campaign channel individually.

3.1.2 Stakeholder Interviews and Advisory Group Calls

We conducted five interviews with stakeholders representing Pulse Point and SCG in order to collect more contextual information around Aliso Canyon ME&O design and implementation. The interviews lasted approximately forty-five minutes and confirmed general campaign information, verified ME&O channels and activities, and assessed campaign effectiveness to date. Appendix 1a presents the implementer in-depth interview guide in full.

A campaign advisory group composed of energy provider representatives, utilities, the PulsePoint team and other stakeholders met weekly throughout the campaign period to discuss the campaign status, campaign effectiveness metrics, and new content for the campaign. The evaluation team attended each meeting and used information presented in these meetings to inform our research activities.

3.2 Objective 2 Tasks: Assessment of ME&O Effectiveness

Objective 2 encompasses research questions 6 - 11 as outlined in Table 9. To address this objective, we conducted a web usability study, a split panel survey, and a consumption analysis.

3.2.1 Web Usability Study

Given that the main campaign website – ConserveEnergySoCal.com – was the central hub of the conservation campaign, the evaluation team conducted a web usability study of the English-language version of the site. Website usability testing is a qualitative research method used to evaluate a user interface design by testing it on real users. While other research methods may reveal what customers think (e.g., surveys, focus groups), or what outcomes are achieved (e.g., "click-through rate" with website analytics), usability testing is a diagnostic method that identifies potential issues and improvements in a user interface, such as a website.

Sample Sources

We recruited participants using the "computer gigs" section of Craigslist. We chose to recruit on Craigslist after our research into best recruitment practices indicated Craigslist was an effective option. We also selected Craigslist because we were seeking situational, rather than demographic, representativeness in this qualitative study. We were concerned with selecting participants for their ability to provide information regarding the website and thus we were seeking individuals who use a computer and the internet in our target zip codes.

We considered participants in the order that we received their responses. To schedule the interview, we contacted the first 15 respondents who submitted valid zip codes, as per the list of eligible zip codes provided by SCG.

Approach

The evaluation team worked with the stakeholders to understand the goals and objectives of the website, as well as its intended audiences. We then tested the English language site on 15 English-speaking individuals. The web usability research literature indicates that sample size should range between 5 and 15 participants per audience segment to reach redundancy/saturation.

The goals of the web usability study were to:

- Determine how well the conservation strategy messages are conveyed through the website
- Measure how easily participants could navigate the website given specific tasks

For example, we asked:

- What is the message of this website?
- Have you learned anything from the site?
- Does the site provide value?
- Would you share it or revisit it?
- Are you likely to adopt any of these conservation strategies in your home?

Usability Interviews

A focal point of web usability studies is asking users to think aloud as they attempt to complete pre-selected tasks on a website. We conducted the web usability sessions remotely using the GoToMeeting Platform. The average interview length was 27 minutes and we recorded participants' screens and voices.

After answering eligibility and demographic questions, participants navigated from a Conserve Energy SoCal Facebook posting to the website. We strategically asked participants to navigate to the website on their own, given that the primary expected route to the website was via other pieces of stand-alone content posted in different channels. Once participants were on the website, they completed six tasks and answered open-ended questions about their experiences

Participant Demographics

The fifteen study participants represented a range of zip codes from across the LA Basin, and the length of residence in the LA area ranged from 6 months to lifetime. Most participants rented their homes and had SCG and LADWP as utility providers, and all participants were able to recall at least one of their utilities.

Other notable attributes of the population include:

- 93% of participants used social media, with Facebook and Instagram being the most popular
- Median age was 37
- 73% of participants were Caucasian. Other participants were Asian, African American, and Hispanic
- 67% of participants obtained a Bachelor's degree or higher
- Two out of 15 participants were professionals in web development. Other professions included entertainment, program administration, and event planning
- None of the participants had been to the Conserve Energy SoCal website before
- 67% of participants heard about the Aliso Canyon/Porter Ranch gas leak
- Social media, particularly Facebook, was the most common way for people to have heard about the gas leak
- 53% of participants had seen ads asking them to save energy at their home in 2016, and Facebook and emails from utility companies were the mechanisms by which people had heard about saving energy

3.2.2 Split Panel Survey

We employed a split panel survey of Southern California residents to measure changes in campaign effectiveness through the duration of the campaign. A split panel study is a type of prospective study that surveys a selected group of people over a period of time. The split panel study measured the same

sample of participants over time but also sampled groups of new survey participants at each survey date or "wave" during the specified study period (see Table 10). In addition, each wave of the survey included a battery of questions that remained consistent from wave to wave, as well as a set of questions that differed between waves. We selected the split-panel design as the campaign had a heavy emphasis on education and campaign element were designed to build on each other. The split-panel survey methodology enabled us to measure the campaign goals over time. In addition, the split-panel survey format provides specific research advantages and gave us the ability to:

- Make causal inferences and measure changes over time:

  There are three necessary conditions to make causal inferences; time order, association between the two variables under study, and alternative explanations must be ruled out. Panel studies often satisfy the first two necessary conditions (time order and association), given that panel studies represent measurement of variables over time, and are able to associate independent and dependent variables. Split panel surveys specifically offer advantages over traditional panel surveys, because the combination of comparing both all waves and one wave only helps to rule out alternative explanations. Because this split-panel study measures change at the individual level (new respondents), in addition to measuring different sets of potentially matched people at different times (repeat respondents). We were able to isolate individual differences between participants. This eliminates a key set of potential confounding variables.

- Collect data to inform formative and summative evaluation objectives concurrently:

  Given that panel studies include data collection at multiple time points, both continuous improvement and effectiveness data can be collected and analyzed.

- Track behavior changes and market trends:

  Panel studies can reveal shifting attitudes and patterns of behavior that might go unnoticed with other research approaches. This is particularly useful for tracking behavior changes and market trends

For a complete discussion of the benefits of split-panel surveys please see Appendix C.

Sample Sources

This data collection effort utilized a sample from the general population of residents living in the LA Basin within SCG service territory provided by YouGov. YouGov uses opt-in non-probability methods to recruit their panel; however, they rely on sample matching techniques to draw representative samples from the target population and post-stratification techniques to adjust the final sample after the survey is complete. Both of these methods have been tested and produced accurate results that stand up to both public and scientific scrutiny.[8] We selected the YouGov panel due to the low survey response rates associated with general population telephone surveys, which results in high survey costs.

[8] The New York Times, the Cooperative Congressional Election Study (CCES), The Economist, and The Huffington Post use YouGov.

Approach

The evaluation team developed survey instruments for three waves of the panel with three launch dates in 2016 -- August, October, and December, utilizing YouGov's internet panel. The surveys addressed the following campaign elements shown in Table 10.

Table 10. Split Panel Survey Fielding Dates and Campaign Elements Evaluated by Wave

Survey Wave Number	Survey Fielding Dates	Campaign Elements Evaluated
Wave 1	August 27 - September 14, 2016	Website, Social Media, Digital Video Ads, "Hot Days, Hot Deals," Cinespia, TV
Wave 2	October 5 - October 17, 2016	Website, Social Media, Digital Video Ads, TV, Newspaper, "Hot Days, Hot Deals," Radio, Pacific Wheel Event, Children's Book
Wave 3	December 28, 2016 - January 17, 2016	Website, Social Media, Email, Digital Video Ads, "Cold Days, Cool Deals"

We chose to administer the surveys online to capitalize on the ease of tracking different respondents and the lower cost of fielding web surveys.[9] In addition, web surveys lent themselves especially well to the evaluation of ME&O activities given the ability for web surveys to display text and images to facilitate respondents' comprehension of questions and to answer aided and unaided recall questions.

The survey questions addressed knowledge, awareness, engagement, and self-reporting of conservation behaviors and the metrics outlined in Table 4.

Sampling

YouGov implemented a sample selection matching strategy for the split panel survey. Sample selection via matching is a two-stage process. First, YouGov drew a random sample from the target population. Once complete, YouGov drew a second sample where each member of the target sample was matched (via a distance algorithm) to one or more members from the internet panel managed by YouGov using age, education, gender, and ethnicity as matching criteria. The goal of matching was to find an available respondent (in the internet panel) who was as similar as possible to the selected member of the target sample. The outcome of this procedure was to produce a matched sample that most accurately mimicked the target sample, which in turn was a representative sample of the target population. YouGov used opt-in non-probability methods to recruit their panel. To maintain a sufficient sample size for statistical inference, the sampling strategy for each wave of the survey included re-contacting respondents from all prior waves of the survey. In other words, for each wave of the survey, YouGov re-contacted panelists who had taken the survey in previous waves.

Analysis Design and Weighting

To account for potential coverage biases, YouGov provided panel weights to ensure that all groups of interest were representative of the target population. We selected four different groups of survey

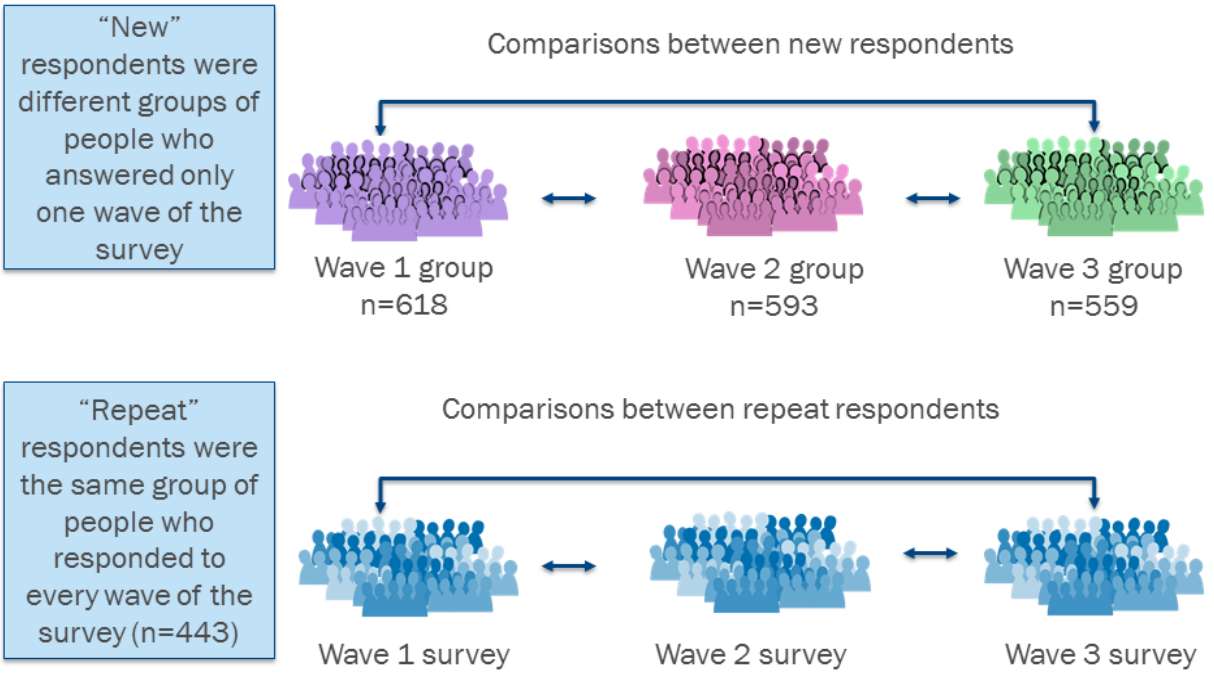
[9] Given the focus of the Aliso Canyon ME&O activities on social media marketing, the evaluation team does not think adding a phone option is worth the investment. The Pew Research Center in 2015 found that 85% of American Adults use the internet. (*http://www.pewinternet.org/2015/06/26/americans-internet-access-2000-2015/)*

respondents for weighting and analysis: (1) respondents who took wave 1 only, (2) respondents who took wave 2 only (3) respondents who took wave 3 only, and (4) respondents who took all 3 waves of the survey (see Figure 6). YouGov weighted each group separately to be representative of Southern California residents based on age, gender, race and education using the same census criteria. For results to questions of interest, we made comparisons between each wave of the survey for respondents who took only one wave of the survey and respondents who took all waves of the survey using the four groups described above and illustrated in Figure 6[10].

Although technically all respondents who took the Wave 1 survey were new respondents at the time, we split the Wave 1 group into respondents who took the Wave 1 survey only and respondents who took the Wave 1 survey and also continued taking surveys in later waves. We separated Wave 1 respondents into these groups to ensure that our significance testing did not violate assumptions of independence for comparisons between and within groups.

Some respondents only responded to two waves of the survey which presents challenges for making statistical comparisons. A total of 13 respondents took Wave 1 and Wave 3 surveys only and these respondents were excluded from the analysis. In addition, a total of 126 respondents took surveys in waves 1 and 2 (but not 3) and these respondents were also excluded from the analysis. A total of 272 respondents took surveys in Waves 2 and 3 only and the Wave 2 surveys for these respondents were retained and included in the Wave 2 new group due to concerns about small sample size.

Figure 6. Split Panel Survey Analysis Design



[10] All sample sizes reported (n's) are unweighted.

The split-panel survey design allowed us to: (1) make causal inferences, (2) measure change over time, (3) collect data to inform formative and summative evaluation objectives concurrently, and (4) track behavior changes and market trends. For a complete discussion of these benefits, see Appendix Appendix C.

3.2.3 Consumption Analysis

To assess ME&O effectiveness in encouraging conservation behavior, we conducted a consumption analysis to assess whether the additional investment in Flex Alerts—as part of the overall marketing campaign—was successful in decreasing consumer consumption of electricity during high capacity periods.

Data Sources

To conduct the analysis, we requested SCE[11] residential customer account data, including address, rate code, annual consumption, and customer geocodes (to allow us to identify customers in the targeted zip code areas). In addition, we requested and received electric Advanced Metering Interval (AMI) data for SCE customers within the targeted zip code areas. We received AMI data (at either hourly or sub-hourly increments) from April 2015 through September 2016. We also requested demand response (DR) event information for both Flex Alerts and other SCE DR Programs[12] as well as residential SCE DR program participation lists.

As part of the data cleaning effort, we removed residential customers who participated in other SCE DR programs (Other DR Programs) given that there was substantial overlap in event days with Flex Alerts. We also removed SCE residential customers participating in the Net Energy Metering (NEM) program. As a result, we conducted our analysis on the full population of SCE residential customers within the targeted zip codes, excluding participants in Other DR Programs and NEM participants, resulting in approximately 223,000 SCE customers.

Approach

We estimated demand reductions associated with Flex Alert campaigns (e.g., net demand reductions at a whole-house level including takeback) using a linear fixed-effects regression (LFER) modeling approach. The analysis produces demand reduction estimates associated with each Flex Alert day and hour, as well as an average demand reduction for all events called during the event season. To complete the analysis, we relied upon a statistical model of hourly electric AMI data for customers in targeted zip code areas. The model accounts for all time-invariant, household-level factors affecting energy use (i.e., fixed-effects) without measuring those (often immeasurable) factors and entering them explicitly in the model. These fixed-effects are contained in a household-specific intercept.

We selected the regression model specification to best predict reference load during event days. Reference load days provide insight into what participants' consumption would have been on event days if the event were not called. For this reason, it is important for reference days to be as similar—in terms of weather—as possible to the event days. To select reference days that are most similar to

[11] We also requested customer account data from SCG and this data was not available.

[12] We requested this data in order to fully understand when events for other residential SCE DR Programs were called and we found a substantial amount of overlap between these event periods and Flex Alerts.

event days, we use matching algorithms to select reference days with weather profiles that are closest to the event days.

The selected model incorporates weather variables (e.g., cooling degree hours (CDH)), as weather is one of the major predictors of energy consumption for air conditioning (AC) use. The model also includes the hour of the day, as time of day is highly predictive of customer load. We specified a large range of models to ensure that the chosen model accurately estimates reference load during events. We tested a range of models before selecting a final specification. Model selection is an iterative, two-part process, starting with thinking about the range of models to examine, looking at how well models fit the data with measures such as R-squared and Akaike's Information Criteria (AIC), then validating the models by predicting consumption on event mornings and non-event days and comparing to observed consumption. When observed and modeled load (e.g., reference load) are similar, especially on event day mornings and on non-event days with weather similar to event days, it shows that the model is effectively estimating the reference load. Of the models that predict consumption effectively, we choose the one with highest R-squared and lowest AIC.

3.2.4 Research Limitations

All research activities are subject to different sources of error. We discuss the potential for several different types of research errors below and our attempts to mitigate them.

Split Panel Surveys

There are a number of potential biases and threats to validity that can occur during survey development and fielding. We took many precautions during the split-panel survey design process to reduce possible sources of error. We reviewed questions to ensure that "double-barrel" questions (i.e., questions that ask about two subjects, but with only one response) and "loaded" questions (i.e., questions that are slanted one way or the other) were not asked. We randomly changed the order of answers in cases where we provided multiple answer items. The following list describes potential biases and threats to validity for panel surveys and discusses how the evaluation team addressed these threats in this study.

- Sampling Error: Occurs when we estimate statistical characteristics of a population from a subset or sample of that population. Standard convention is to use a 90/10 criteria in terms of sampling error. We used multiple strategies to minimize the biggest challenge to panel studies – attrition. These strategies included email reminders, persuasive messaging, incentives, and large sample designs. Despite our best efforts to maintain our panel study sample, some attrition occurred. In this study, respondents who took multiple waves of the survey were more likely to be more educated. When participants who dropped out of the study are different from those who remained in the study, external and internal validity threats are a concern. To address concerns about systematic differences in new and repeat respondents, we provide comparisons between new and repeat respondents.

- Non-Response Bias: To reduce potential non-response bias, YouGov implements a multiple matching strategy where multiple members of the internet panel are matched to a single respondent in the target sample. This minimizes potential differences between respondents and non-respondents. We applied a post-stratification weight for each wave based on age, education, ethnicity, and gender to

adjust for any remaining differences between our survey sample and the target population.

- **Self-Selection Bias:** The YouGov panel is an opt-in panel, which has its own limitations, mainly selection bias. One could argue this bias is similar to that of telephone surveys today given the small percentage of customers that will participate. To reduce the possibility of selection bias associated with observable demographic characteristics, YouGov employs a sample-matching approach to draw a representative sample of the target population from its panel members. The sample-matching before fielding reduces the need to apply large weights after fielding in which the responses of a handful of people must be dramatically inflated to match the survey to the population. As with all surveys, the sample-matching and post-stratification weighting processes do not address self-selection bias that results from differences in the people who choose to be part of the panel if those differences are associated with unobservable characteristics.

- **Panel Conditioning:** Panel conditioning arises if repeated questioning of panel members affects responses such that responses to questions differ for experienced panelists as compared to new panelists. Repeated questioning may affect respondents' views about the topic under study, especially with regard to topics participants do not have a well-developed view on prior to the survey. Panel studies can also affect respondents' actions if questions increase their awareness, interest, or information about the subject, or if the questions "shame" them into changing behavior. Panel studies may also change how respondents answer questions without changing their behavior. This could occur if: 1) the respondent learns how to answer questions to minimize their time spent on the survey; or 2) respondents get better at answering questions because they have learned the requirements of the response process, and thus adjust their responses accordingly. Research indicates that knowledge-related (cognitive) questions are more impacted by conditioning than behavior or attitudinal questions. Panel conditioning is less of a concern with a split panel design as compared to other panel designs given that panel conditioning can be tested at each wave by using the new sample for each wave as a control group. There is evidence that panel conditioning may have affected answers for repeat respondents in this study and for this reason, we suggest relying on comparisons between new respondents to measure changes in magnitude of variables of interest throughout the three waves of the survey. We further explored the magnitude of panel conditioning in this study by testing whether taking multiple waves of the survey affected campaign awareness through the use of a logit model and the effects were not statistically significant. For a complete assessment of the effects of panel conditioning in this study, please see Appendix B.

Web Usability Surveys

Potential sources of bias for the web usability study were related to the selection of individuals to include in the study group and we discuss these issues below.

- **Self-Selection Bias**: The study utilized the "computer gigs" section of Craigslist to recruit participants, which could have led to self-selection bias, given that individuals looking for work in this section could have had careers and/or specialized interest in

web design or web usability studies, specifically. Upon collecting demographic information, however, we confirmed that participants in the study represented a range of professional fields, including music, accounting, web development, entertainment, and event planning, among others. The population also ranged in age, from 24 to 60. Interestingly, though the "computer gig" section may suggest that it would only attract those who consider themselves -savvy, we recruited a number of participants that demonstrated more novice skills in navigating the website and participating in a remote interview.

- **Generalizability**: This study utilized a small sample and thus results may not generalize to other individuals, times, settings, or context.
- **Social Desirability Bias:** Given the one-on-one nature of web usability sessions, participants may respond more favorably to stimuli thus not representing their true feelings.

Consumption Analysis

As with all regression analyses, there are various sources of bias and uncertainty associated with impact estimate results. We document these sources, and how we addressed them below.

- **Model specification errors:** The most difficult type of modeling error, in terms of bias and the ability to mitigate it, is specification error (which can cause omitted variable bias, improper functional form, or irrelevant variables). With this type of error, variables that predict model outcomes are included when they should not be, thus reducing the precision of the results, or left out when they should be included, possibly producing biased estimates. We addressed this type of error in two ways. First, by using a two-way fixed-effects model with customer-specific intercept that corrects for all time invariant customer characteristics and with a time-specific fixed effect that corrects for all outside influences that affect all customers similarly. Second, we tested a variety of model specifications to find the simplest model that effectively balances bias reduction and accuracy.
- **Measurement errors:** Measurement error can come from variables, such as weather data, which are commonly included in the analysis models. If a base temperature that does not reflect actual home characteristics is chosen for calculating degree-days or if an incorrect climate zone weather station is chosen, the model results could be subject to measurement error. We addressed this type of error by carefully choosing the closest weather station for each customer in the model. Specifying an incorrect time stamp (either pre-treatment or post-treatment) can also lead to measurement error. To the extent that the data received from the program implementer are correct, this should not be a problem, and we performed checks to try to find any issues such as scaling factors that affect some time periods differently than others.
- **Heteroskedasticity:** This type of modeling error can result in imprecise model results due to variance changing across customers with different levels of consumption. The team addressed this type of error by examining residual plots for evidence for heteroscedasticity, and found no evidence.

- **Serial correlation:** This type of modeling error is due to correlation of multiple sequential observations within each customer. While this does not impact the model results, it can result in an underestimation of standard error estimates. The team assessed this type of error by checking autocorrelation.

- **Simultaneity** – This type of error, otherwise known as endogeneity, occurs when the dependent variable influences an explanatory variable. This is unlikely to be a problem in modeling demand response load impacts as we do not anticipate participant or non-participant spillover. This is because we do not anticipate that targeted customers would have taken energy conservation actions during the Flex Alert without being exposed to the messaging, and because we excluded non-exposed customers from our analysis. In addition, for the Flex Alerts, we anticipate no selection bias because the model includes the full population of relevant customers within the target zip codes (see Appendix E for a detailed list of these zip codes).

4. Key Findings

Chapter 4 provides a synthesis of key findings and recommendations from all aspects of this research study. We present results separately for the Conserve Energy SoCal Campaign (Section 4.1) and Flex Alerts (Section 4.2). In the final section, 4.3, we summarize key findings and provide actionable recommendations to inform future ME&O marketing campaigns.

4.1 Conserve Energy SoCal Campaign

The first section of this chapter distills the key findings specific to the Conserve Energy SoCal Campaign across the study methods, using the hierarchy of effects as a framework (Section 2.2.2) to present the study results (Section 4.1.1). The second section of this chapter discusses the effectiveness of individual campaign channels (Section 4.1.2).

4.1.1 Campaign Effectiveness

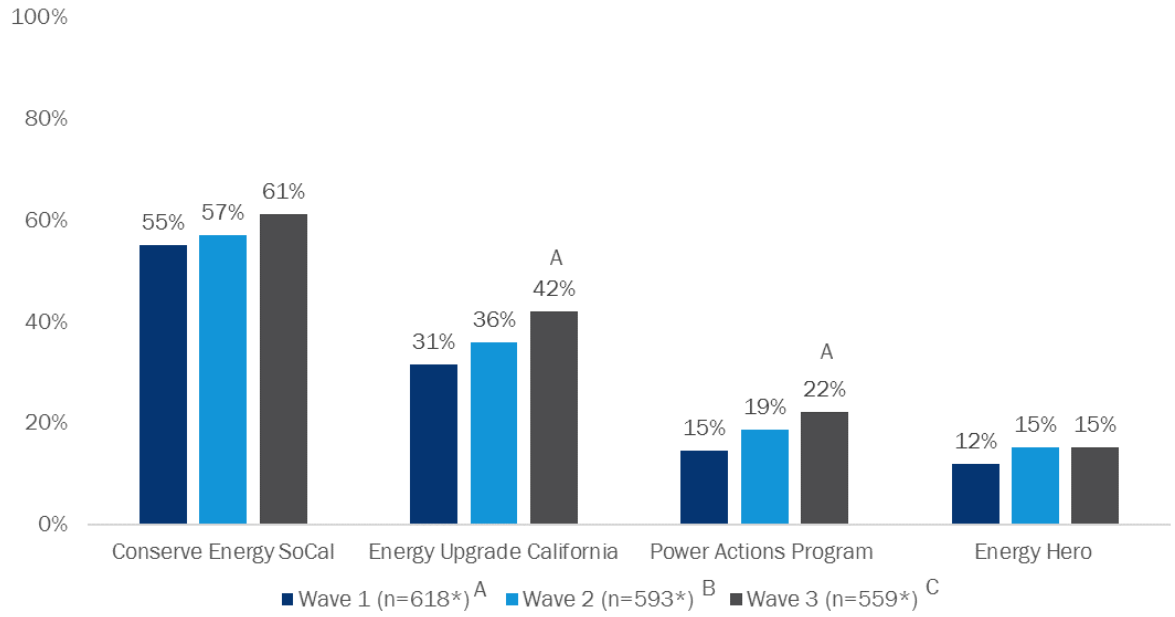
To assess campaign effectiveness through the hierarchy of effects framework, we first measured respondent awareness of campaign messaging, then we examined how respondents developed attitudes and beliefs about this messaging and we explored how respondents took action in response to this messaging.

Awareness and Knowledge of Campaigns and Energy Conservation

In each wave of the split-panel survey, we asked respondents consistent questions about their knowledge and awareness about specific energy conservation campaigns including Conserve Energy SoCal, as one of the main objectives of the campaign was to promote awareness of the Conserve Energy SoCal brand. We asked about awareness of several different energy conservation campaigns in California to provide a benchmark for Conserve Energy SoCal awareness. We performed significance testing on key survey variables of interest including campaign awareness. We assigned each wave a different letter and marked significant differences between waves with the corresponding letter of the wave that is significantly different[13]. Capital letters indicate significant differences at the 0.05 significance level and lowercase letters indicate significant differences at the 0.10 significance level. As shown in Figure 7, overall awareness of Conserve Energy SoCal was higher than any other Southern California energy conservation brand for all three waves of the survey. Awareness of Conserve Energy SoCal increased from Wave 1 (55%) to Wave 3 (61%), although the change was not significant (6 percentage point increase). It is important to note that Power Actions Program is not a real energy conservation program in California and was included as a "red herring" answer. Awareness of the Power Actions Program also increased by 7 percentage points over the duration of the campaign, which is a potential indicator of social desirability bias.

[13] Note: If two waves were significantly different, we only used letters to mark differences for one of the waves. For example, in Figure 7 below for Energy Upgrade California we note that Wave 3 is significantly different from Wave 1 with an "A." We imply that Wave 3 is also significantly from Wave 1 even though we do not mark the Wave 1 data point with a "C."

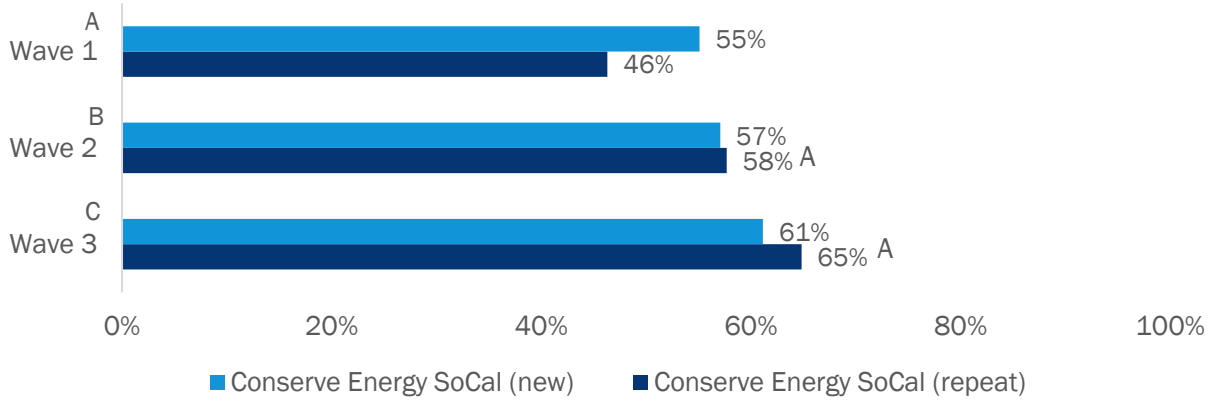
Figure 7. New Respondent Awareness of Energy Conservation Campaigns



*n's may be slightly higher or lower depending on missing values
Notes: a, b, and c indicate significant differences in proportions at the 0.10 significance level 3. A, B and C indicate significant differences in proportions at the 0.05 significance level

Awareness of Conserve Energy SoCal also increased throughout the campaign for both new and repeat respondents. Figure 8 illustrates that repeat respondents showed a larger statistically significant increase in awareness of the Conserve Energy SoCal Campaign (from 46% to 65%) than new respondents (from 55% to 61%). The difference in magnitude of the increases between new and repeat respondent awareness is likely a result of panel conditioning as the completion of the Wave 1 survey in and of itself raised awareness of the campaign. A full discussion of the influence of panel conditioning on Conserve Energy SoCal awareness is available in Appendix Appendix B.

Figure 8. New and Repeat Respondent Awareness of the Conserve Energy SoCal Campaign

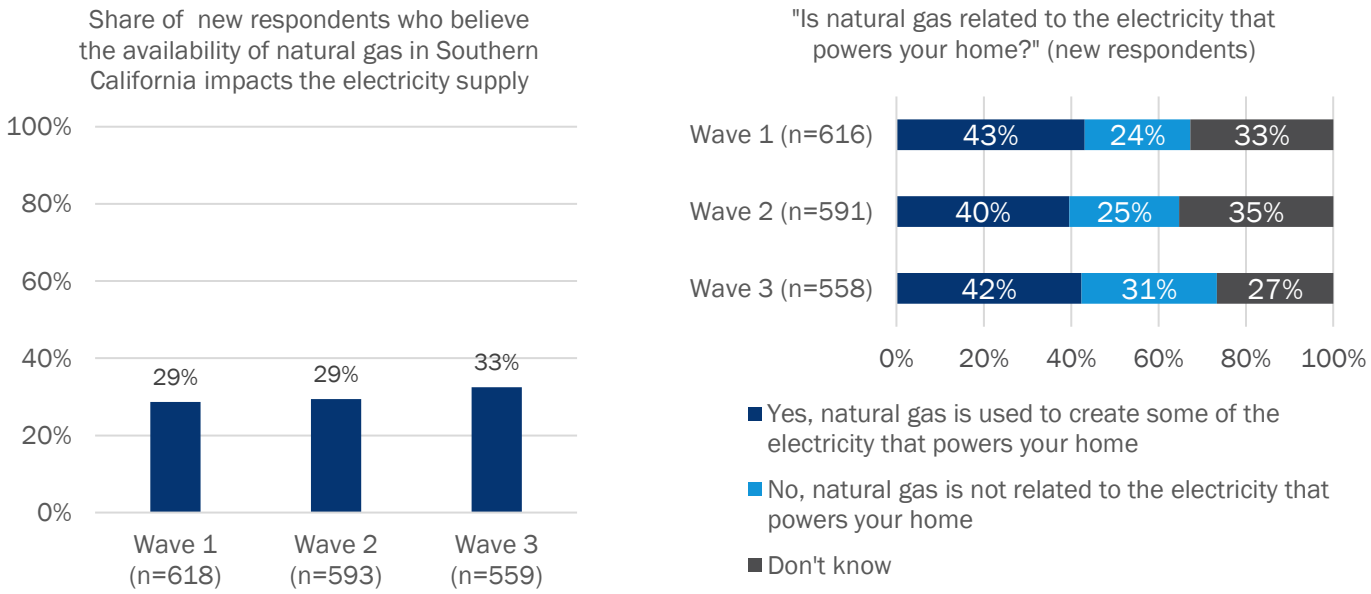


Notes: Wave 1 New n=591, Wave 2 New n=575, Wave 3 New n=549, Wave 1 Repeat n=434, Wave 2 Repeat n=437, Wave 3 Repeat n=443. 2. a, b, and c indicate significant differences in proportions at the 0.10 significance level 3. A and B and C indicate significant differences in proportions at the 0.05 significance level

Key Findings

The first stated goal of the campaign was to increase Southern California residents' knowledge of the interdependency between natural gas and electricity. We asked respondents about the connection between natural gas and electricity in two different ways in order to reduce measurement bias. Overall, respondents' awareness of the connection between electricity and natural gas stayed constant throughout the campaign as the share of respondents who believe that the availability of natural gas in Southern California impacts the electricity supply increased marginally (4 percentage points) from Wave 1 to Wave 3 (Figure 9). In addition, the percentage of respondents who believe that natural gas is related to the electricity that powers their homes stayed consistent throughout the campaign, ranging from 40-43% through the waves (Figure 9). These findings indicate that if educating residents about the connection between electricity and natural gas remains a conservation campaign goal, then then future campaigns should develop new tactics to educate residents about this topic.

Figure 9. New Respondent Awareness of the Connection between Electricity and Natural Gas

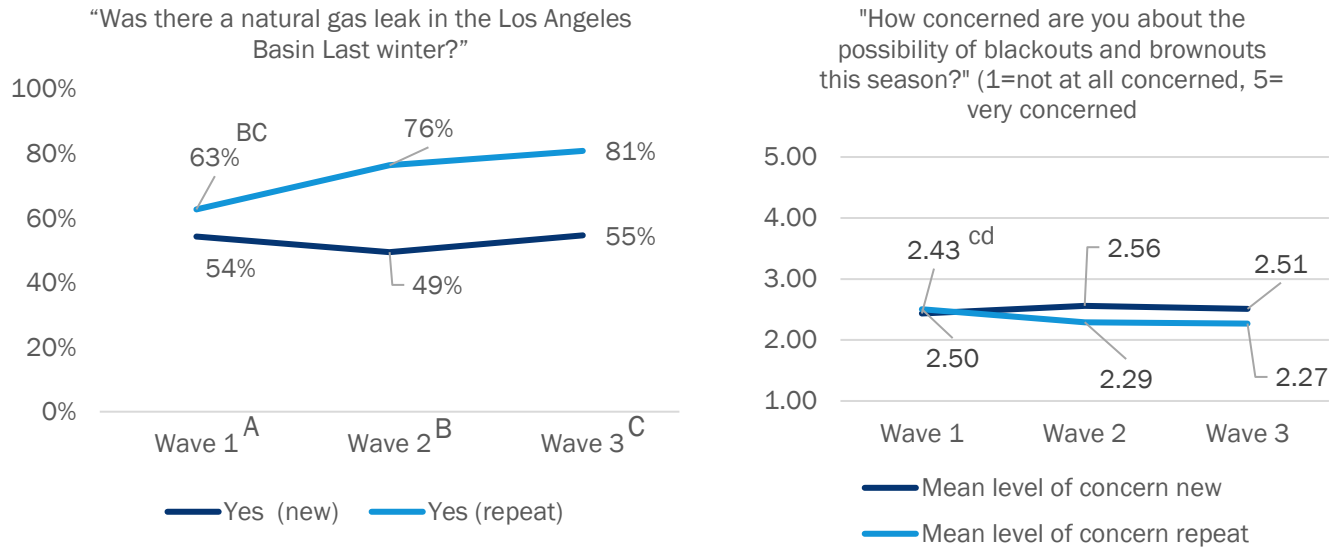


Personal Responsibility and Attitudes towards Energy Conservation

The second campaign goal was specifically to educate respondents about the necessity to save energy in the wake of a shortage in the supply of natural gas. We hypothesized that respondents' awareness of the natural gas leak in the Los Angeles Basin would likely have a direct effect on their level of concern about the impacts of energy shortages in the form of blackouts and brownouts. Overall, new respondents' awareness of the natural gas leak in the Los Angeles Basin stayed constant throughout the campaign (Figure 10). Repeat respondents' awareness of the gas leak significantly increased between Wave 1 and Wave 2 and the large magnitude of the increase in repeat respondents' awareness is likely a result of panel conditioning. The survey included a sentence that explained there was a gas leak at the Aliso Canyon facility, which likely helped inform repeat respondents about the leak for subsequent waves of the survey. Conserve Energy SoCal and Flex Alert ME&O highlighted the possibility of blackouts and brownouts resulting from the shortage of natural gas due to the gas leak at the Aliso Canyon Facility. Respondents were asked about their level of concern about the possibility of blackouts and brownouts on a scale from 1 to 5, where 1 is not at all concerned and 5 is very concerned. New respondents' mean level of concern about the possibility of blackouts and brownouts

stayed constant throughout the campaign, while repeat respondents' mean level of concern decreased significantly after Wave 1. One plausible explanation for the decrease in concern among repeat respondents is that repeat respondents gained exposure to campaign messaging featuring warnings about the possibility of blackouts and brownouts and energy shortages through taking the Wave 1 and Wave 2 surveys. These shortages did not end up being as severe as predicted, which may have caused repeat respondents to lose trust in campaign messaging over time, resulting in a decrease in repeat respondents' level of concern.

Figure 10. Awareness and Attitudes Towards the Aliso Canyon Natural Gas Leak

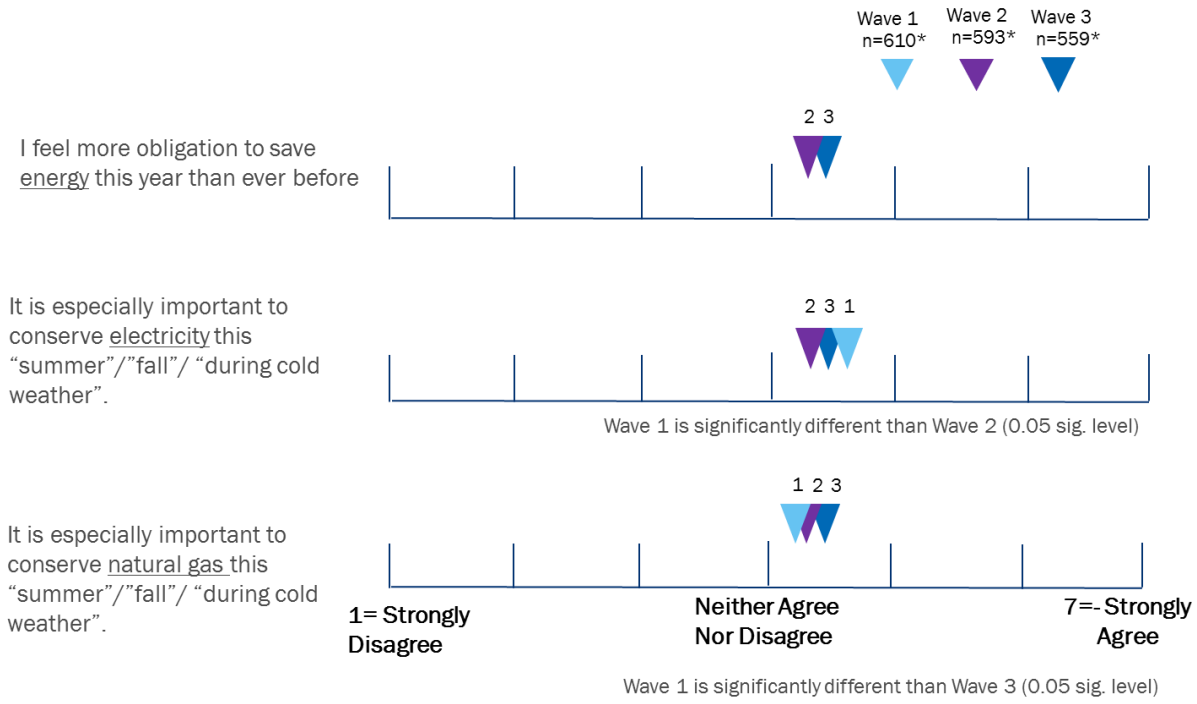


Notes: Wave 1 New n=610, Wave 2 New n=593, Wave 3 New n=559, for all repeat waves n=443, n's may be higher or lower depending on missing values 2. a,b, and c indicate significant differences in proportions at the 0.10 significance level 3. A and B and C indicate significant differences in proportions at the 0.05 significance level

In accordance with the hierarchy of effects model and the goals of the campaign, as customers become more aware of the Conserve Energy SoCal Campaign, they should begin to develop attitudes and beliefs about this material. Many of the calls to action in the campaign collateral intended to invoke a sense of urgency and concern among Southern California residents, and we asked respondents a series of questions intended to measure changes in attitudes towards energy conservation through the course of the campaign.

To measure respondents' attitudes and concern about natural gas supplies, we asked respondents to rate their feelings towards several different statements regarding their attitudes towards energy conservation on a scale from 1 to 7, where 1 is strongly disagree and 7 is strongly agree. The purpose of the first set of statements was to determine if new respondents felt a sense of urgency about energy conservation during the relevant campaign periods. New respondents' beliefs in the importance of conserving natural gas significantly increased from Wave 1 (mean=4.23) to Wave 3 (mean=4.46) (Figure 11). At the same time, new respondents' beliefs in the importance of conserving electricity decreased significantly from Wave 1 (mean=4.64) to Wave 2 (mean=4.35).

Figure 11. New Respondents' Sense of Urgency about Energy Conservation

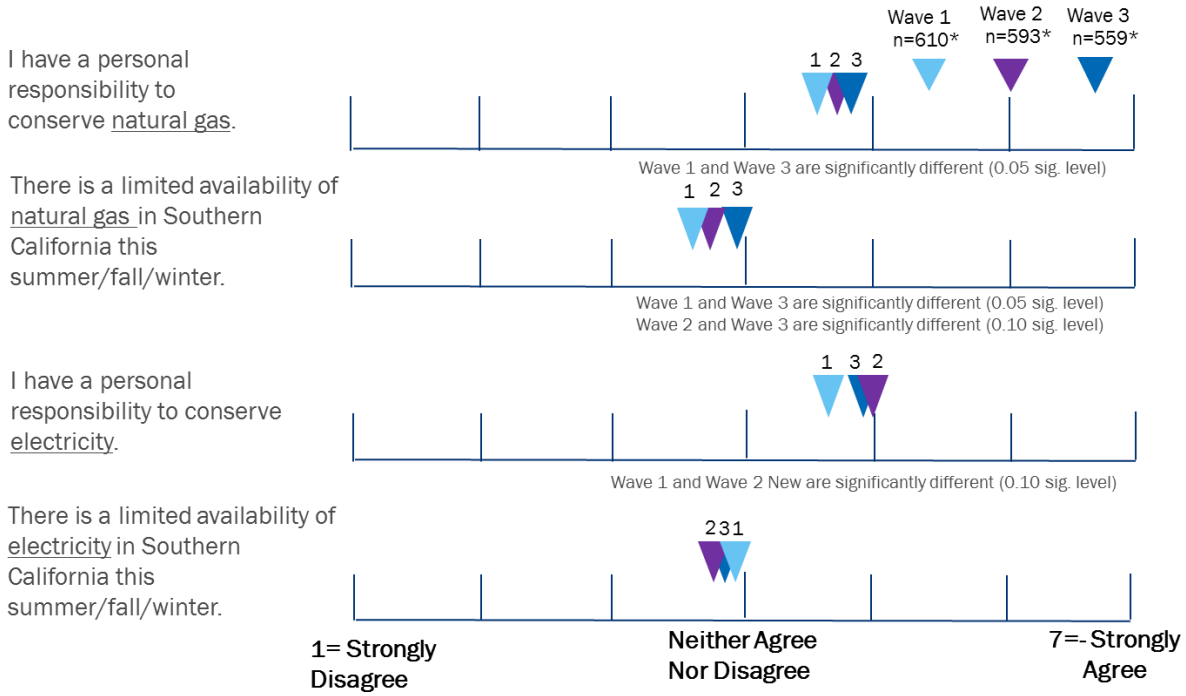


*n's may be slightly higher or lower depending on missing values
Note: The statement: "I feel more obligation to save energy this year than ever before" was not asked in Wave 1.

Figure 12 shows respondents also felt more strongly about conserving natural gas than electricity for other key attitudinal statements. Respondents' perception of having a personal responsibility to conserve natural gas and belief that there was a limited supply of natural gas in Southern California significantly increased from Wave 1 to Wave 3. In contrast, respondents' perception of having a personal responsibility to conserve electricity significantly increased from Wave 1 (mean=4.77) to Wave 2 (mean=4.97), but decreased in Wave 3 (mean=4.92). In addition, respondents' belief that there was a limited supply of electricity in Southern California decreased from Wave 1 (3.92) to Wave 3 (3.88).

These results are not surprising given that results in Figure 9 show that respondents are not making the connection between electricity and natural gas. Respondents may have processed the campaign messages about natural gas shortages and the urgent need to conserve natural gas but stopped short of thinking about how natural gas shortages impact the electricity supply. Furthermore, if respondents have limited time and mental energy to focus on energy efficiency, then devoting more thought to the importance of natural gas conservation could reduce respondents' capacity to focus on electricity conservation.

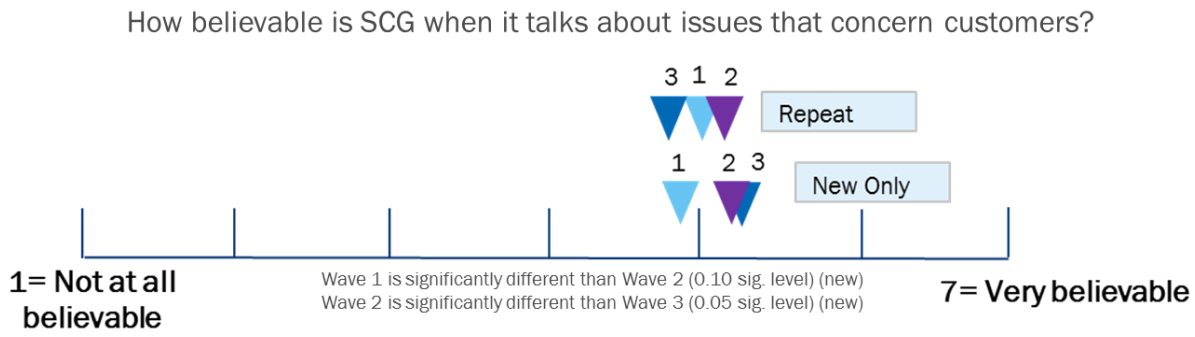
Figure 12. New Respondents' Attitudes towards Energy Conservation



*n's may be slightly higher or lower depending on missing values

Figure 13 shows the results of a question we asked respondents about their perceptions of SCG Gas' believability when it talks about issues that concern customers on a scale from 1 to 7, where 1 is not at all believable and 7 is very believable. Respondents' level of trust in the entity providing information to them can affect how they interpret and process information. New respondents found SCG to be more believable as the campaign advanced (Wave 1 mean=4.92, Wave 3 mean=5.20). Repeat respondents initially found SCG to be more believable from Wave 1 (mean=5.00) to Wave 2 (mean=5.08) and then less believable in Wave 3 (4.87) (Figure 13). Levels of trust may have moved in opposite directions for new and repeat respondents, because repeat respondents gained exposure to campaign messaging designed to raise awareness about energy shortages and the pressing need to save energy very early on in the campaign. These shortages did not end up being as severe as predicted, which may have caused repeat respondents to have some disillusionment with information provided by their electricity providers by the end of the campaign. The mixed messages about the status of the gas leak and energy shortages in Southern CA in the media could have added to this if repeat respondents were more likely to pay attention to related news after taking the survey.

Figure 13. Respondent's Level of Trust in SoCal Gas



Note: Wave 1 New n=610, Wave 2 New n=593, Wave 3 New n=559, for all repeat waves n=443, n's may be higher or lower depending on missing values

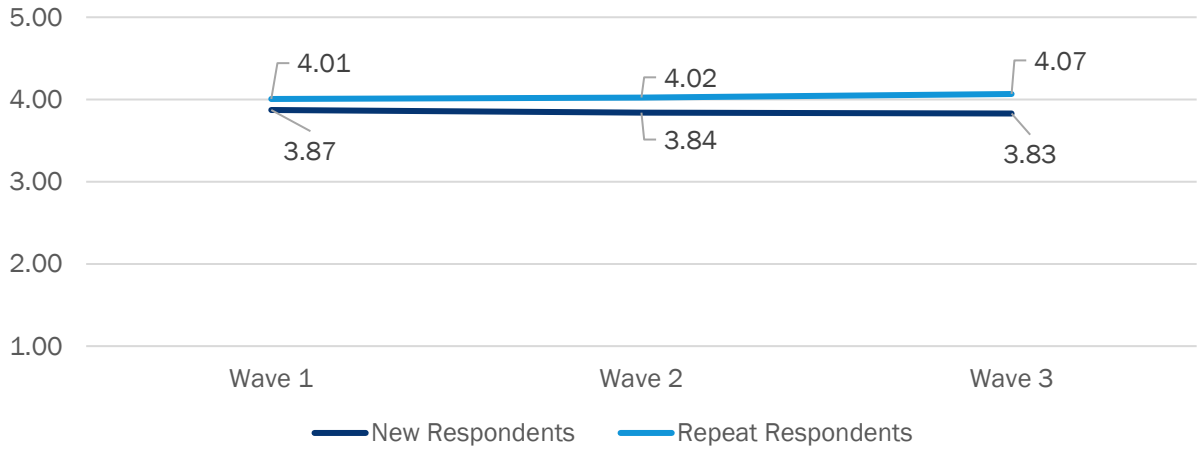
Behavior Change and Energy Conservation Actions Taken

In accordance with the hierarchy of effects model and the goals of the campaign, as customers become more aware of the Conserve Energy SoCal Campaign, they begin to develop attitudes and beliefs about campaign material, which should prompt them to take action.

We assessed the impacts of the campaign on behavior indirectly through measuring changes in respondents' knowledge about energy conservation strategies in the home and directly through measuring self-reported changes in numbers of energy savings actions taken. This corresponds with the two of the primary campaign goals of raising awareness of how to conserve energy in terms of strategies and tips and driving energy conservation activities.

Overall, respondents' self-reported level of knowledge about how to save energy in their homes stayed constant throughout the campaign for both new and repeat respondents. Both new and repeat respondents' reported a high mean level of knowledge about how to save energy in their homes on the Wave 1 survey, as new respondents gave an average knowledge level of 3.87 and repeat respondents gave an average knowledge level of 4.01 on a five-point scale from "not at all knowledgeable" to "very knowledgeable." This indicates that the campaign had little room for influence on respondents' knowledge about energy conservation behaviors in the home (Figure 14).

Figure 14. Respondents' Level of Knowledge about How to Save Energy in Their Homes

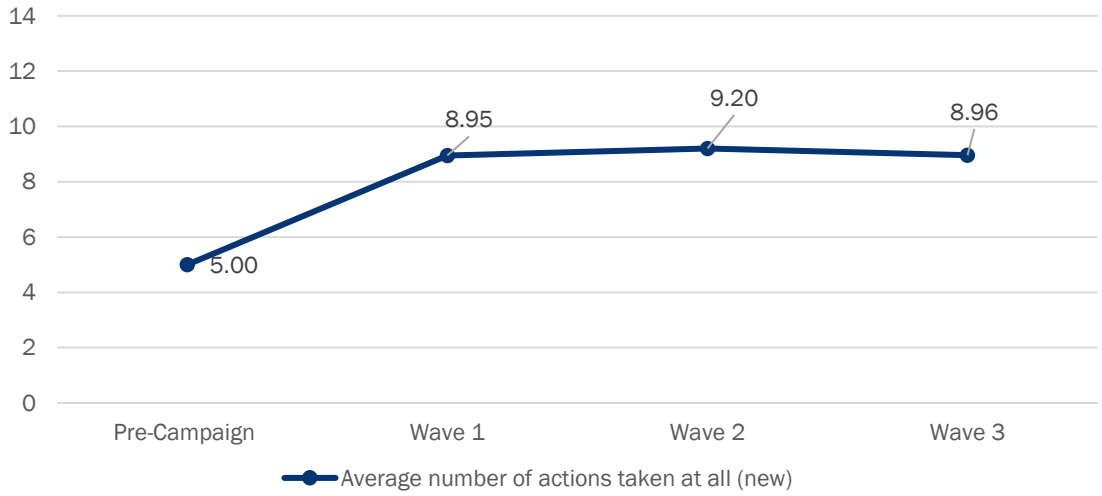


Notes: Wave 1 New n=598, Wave 2 New n=576, Wave 3 New n=537, for all repeat waves n=442

Respondents appeared to act on their high level of knowledge about how to take energy saving actions. Respondents also reported completing a high share of campaign-promoted energy saving actions regularly on the Wave 1 survey. We asked respondents about 14 key energy-saving actions promoted by the Flex Alert and Conserve Energy SoCal Campaigns. We estimated the number of actions taken before the campaign began by first asking respondents if they began taking each action during the campaign period. We asked respondents to think back 3 to 7 months to determine when they began taking these actions and consequently respondents' answers to these questions may be affected by recall bias. We then subtracted the mean number of actions respondents began taking during the campaign period from the mean number of actions taken at the time of the Wave 1 survey to calculate an estimate of the number actions taken before the campaign began[14]. Overall, respondents engaged in more than one third of campaign-targeted actions (mean of 5/14) before the campaign began. The mean number of energy-saving actions taken jumped from 5 actions before the campaign began to 9 actions on the Wave 1 survey. However, the mean number of actions taken stayed constant throughout the campaign. The relatively high number of reported actions taken at the time of the Wave 1 survey left less room for improvement in subsequent waves of the survey, but we can't solely attribute the lack of increase in energy-saving actions to the fact that respondents already engaged in some actions at the time of the Wave 1 survey.

[14] Analyzing data from each wave of the survey to project the number of actions taken before the campaign resulted in similar mean estimates (range 3.95 to 4.42)

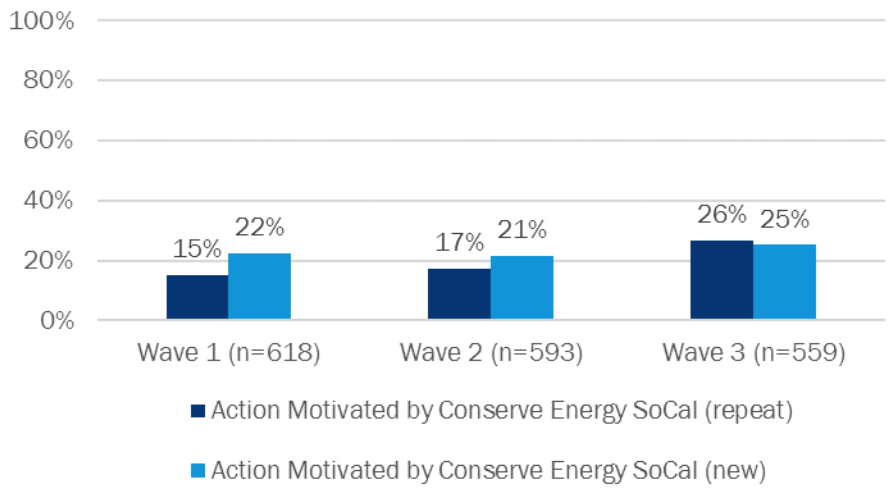
Figure 15. Count of Energy Saving Actions Taken During the Campaign Period (New Respondents)



Notes: 1. Wave 1 New n=587, Wave 2 New n=577, Wave 3 New n=559 2. a, b, and c indicate significant differences in proportions at the 0.10 significance level 3. A and B and C indicate significant differences in proportions at the 0.05 significance level

As shown in Figure 16, we asked new respondents if they were specifically motivated to take energy saving actions by the campaign. We used information from two screening question for this analysis: (1) whether or not the respondent was aware of the campaign, and (2) whether or not the respondent began taking the action after the campaign began. Respondents who were aware of the campaign and indicated they began taking actions after campaign started were asked if they were motivated by the Conserve Energy SoCal Campaign to take these actions. If respondents were unaware of the campaign or did not begin taking any actions after the campaign began, we considered them to have taken zero actions as a result of the campaign and included them in the analysis. The share of all respondents who took at least one energy-saving action directly because of the campaign increased slightly from Wave 2 to Wave 3 (4 percentage points).

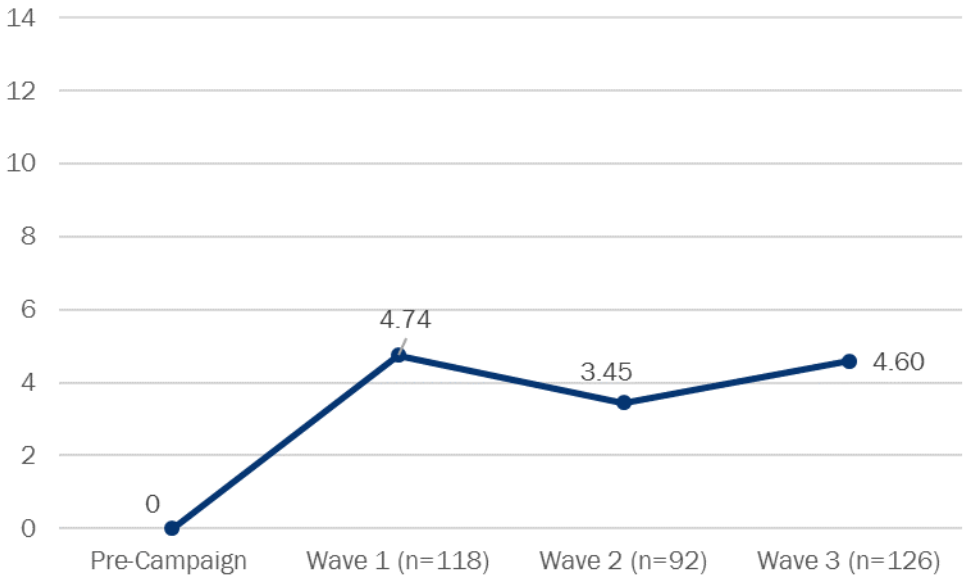
Figure 16. Share of Respondents Motivated by the Conserve Energy SoCal Campaign to Take at Least One Additional Energy-Saving Action



We then calculated the average number of actions taken for respondents who were motivated by the campaign to take at least one new action (Figure 17). New respondents were motivated to take several new actions right after the start of the campaign (mean=4.74) and the mean number of actions taken stayed relatively constant in subsequent waves of the survey.

Overall the campaign had a moderate effect on behavior change and in the future, recommending innovative energy-saving tips that are less likely to be part of customers' current daily habits may help to improve campaign influence on behavior change.

Figure 17. Average Number of Actions Taken Motivated by Conserve Energy SoCal



4.1.2 Individual Channel Success

We presented respondents with different pieces of marketing collateral during each wave of the split panel survey to get their initial impressions of the campaign and to inform future collateral development. We showed all respondents, irrespective of previous campaign awareness, images of the collateral. We selected the marketing material to present for each survey to match the types of media that were focus points of the campaign during the period right before YouGov fielded each survey. Overall, aided recall of every type of ME&O collateral used during the campaign increased for both new and repeat respondents throughout the duration of the campaign. We also presented web usability study participants with a piece of marketing collateral in order to gain a more in-depth qualitative perspective about a key piece of campaign collateral.

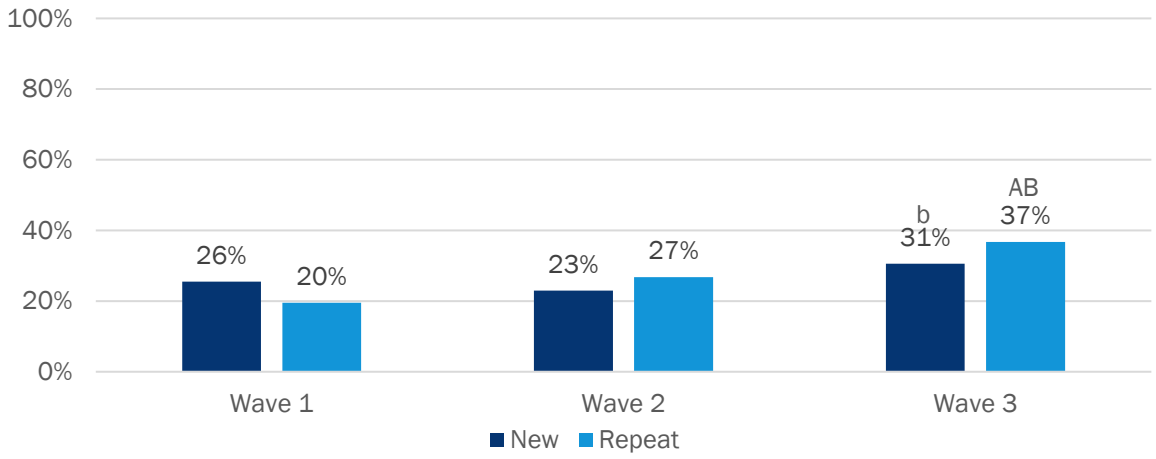
Conserve Energy SoCal Website

As discussed previously, one of the three main goals of the campaign was to drive energy conservation actions, and directing customers to the Conserve Energy SoCal website was one of the main target actions featured in Conserve Energy SoCal marketing materials. For each wave of the split-panel survey, we showed respondents a screenshot of the Conserve Energy SoCal Campaign homepage and asked them if they had previously visited the website shown in the screenshot (Figure 18).

Figure 18. Conserve Energy SoCal Website Screenshot

The share of respondents who visited the website significantly increased from Wave 1 to Wave 3 for both new and repeat respondents. The greatest increase in the share of respondents who visited the website occurred between Wave 2 and Wave 3 (Figure 19).

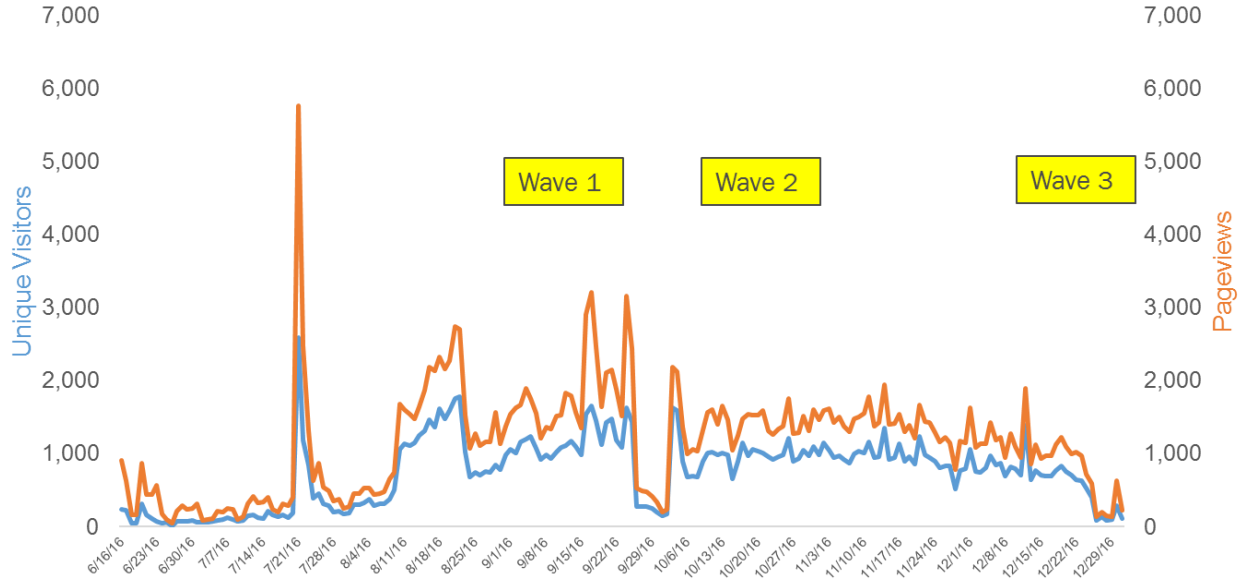
Figure 19. Share of Respondents Who Recalled Visiting the Conserve Energy SoCal Website



Notes: 1. Wave 1 New n=615, Wave 2 New n=591, Wave 3 New n=557, Wave 1 Repeat n=440, Wave 2 Repeat n=440, Wave 3 Repeat n=440. a,b, and c indicate significant differences in proportions at the 0.10 significance level 3. A and B and C indicate significant differences in proportions at the 0.05 significance level

Despite being a focal point of the campaign, the website represented a small share of the campaign budget at 3% ($130,000). Figure 20 shows the number of new visitors to the website stayed relatively constant throughout the campaign with the exceptions of a spike at the start of the campaign, when other channels began directing people to the website, and a dip in September when PulsePoint switched out creative content (Figure 20).

Figure 20. Conserve Energy SoCal Website Unique Visits and Page Views

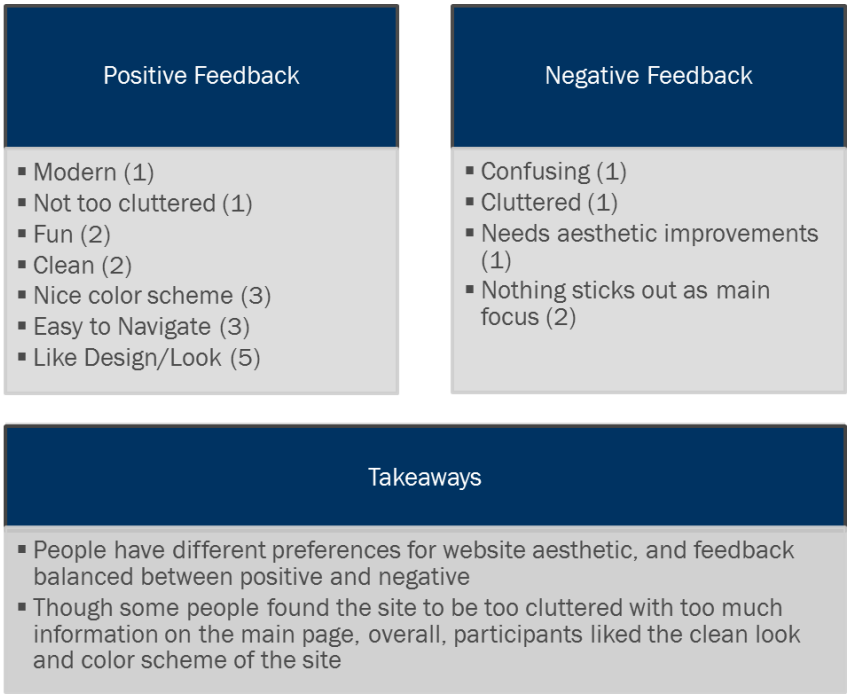


Source: PulsePoint Group

Web Usability Findings

In addition to quantitative metrics of website success, the web usability study offered information on how users interacted with the site and whether or not they were able to find useful information. To begin the web usability study, we showed participants a Facebook posting and asked them to use it to navigate to the website. Once they were on the site, participants gave their first impressions and initial thoughts. We present a summary of impressions and the number of people who made the observation in Figure 21.

Figure 21. First impression of the website with comment count in parentheses.



We asked participants to complete six tasks on the site. We present the findings for each task below.

Task 1: Use this website to learn why it is important to conserve energy this year.

Eighty percent of participants were able to use the website to learn about the Aliso Canyon gas leak and why it was important to conserve electricity in 2016. Those that were able to find the information thought that the task was easy. In some cases, however, participants did not successfully complete the task and were confused between the "How Conservation Works" and "Conservation Strategies" icons. At the end of the first task, 60% of participants reported that they felt compelled to keep exploring the website after they completed the first task.

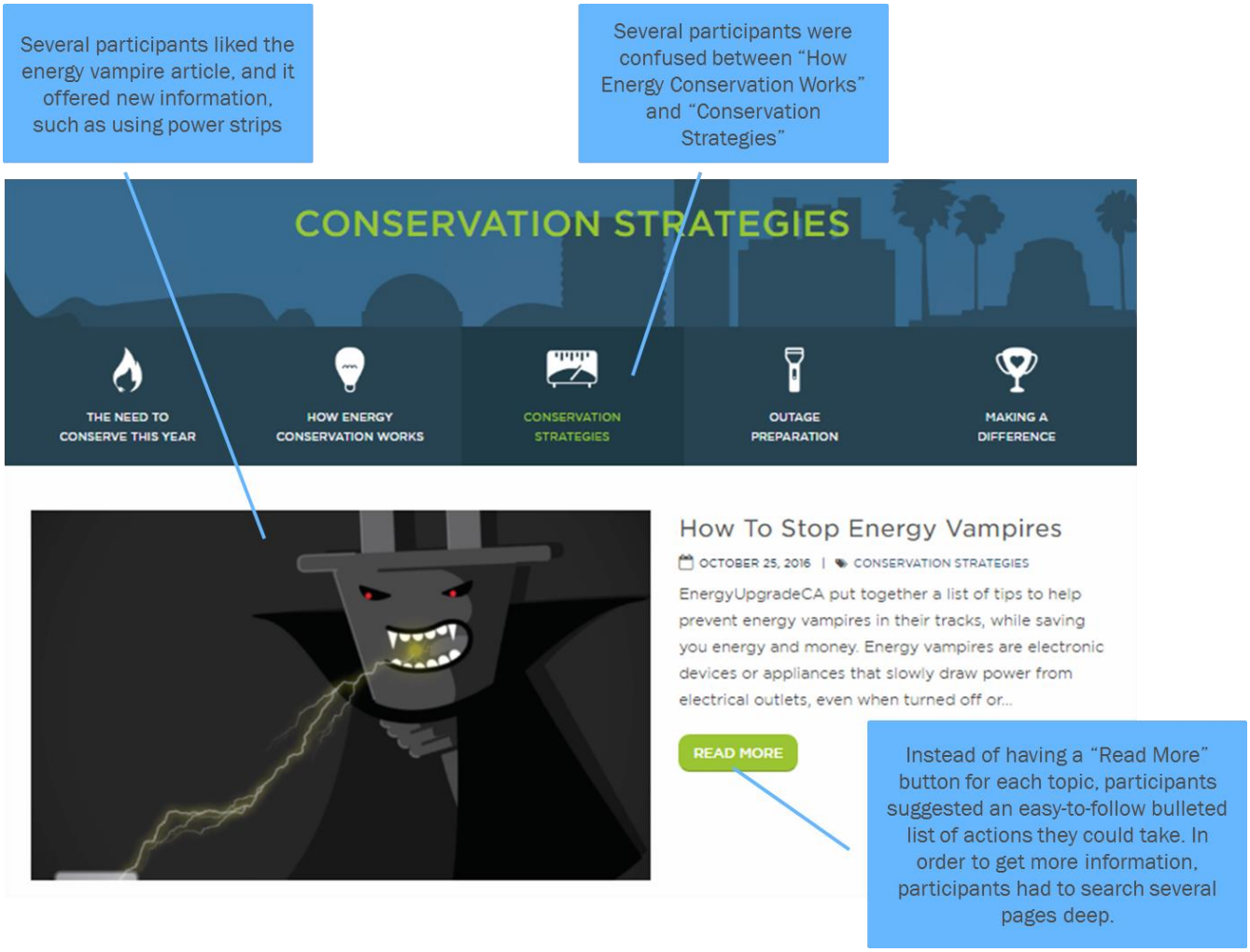
Task 2: Use this website to learn about how to save energy in your home.

Ninety percent of participants successfully used the website to learn about how to save energy in their homes. Although 87% of participants said they would be likely to try some of the recommended actions, 67% of participants reported that they already take at least some of the actions, such as turning off lights and running full dishwasher loads. This finding was consistent with the split panel survey, as most survey respondents reported that they took an average of 9 of the 14 campaign-

targeted energy conservation on the Wave 1 survey behaviors at the time of the survey. New actions that participants showed interest in adopting included turning down the water heater, washing clothes in cold water, using power strips, and unplugging electronics. Figure 22 presents comments and suggestions about the site.

At the end of the task, nine out of fifteen participants said they would share the website. Of those nine, two said they would share it only if someone asked, and two said they would share only with family.

Figure 22. Participants' suggestions and comments while learning about conservation strategies on the site



Task 3: Let's say you found this website to be interesting. How would you follow this site on social media?

Seventy-three percent of participants preferred following the campaign on social media, such as Facebook or Twitter, and they knew how to use the social media icons to get to the Conserve Energy SoCal pages. Thirteen percent of participants preferred to get email updates about the campaign. However, the website does not currently include an email sign-up section. In order to increase campaign engagement, an email sign-up bar could be added to the website so that interested individuals can easily sign up for campaign letters.

Task 4: Sign up for Flex Alerts.

All participants easily navigated to the Flex Alert website and attempted to sign up. Though we did not ask them to actually sign up, three participants did. None of the participants were already signed up for Flex Alerts prior to participating in the study. One participant had a hard time finding the Flex Alert icon at the very top of the website and suggested that it should be in line with the rest of the conservation "buckets."

Task 5: Energy providers in Southern California offer incentives for energy efficiency actions. How would you find out what types of incentives were available to you?

Thirty percent of participants found energy efficiency incentives, such as rebates, from their energy providers using the website. However, only one participant completed this task easily. Participants needed to navigate through several pages and search the website to find the incentives for energy efficiency upgrades. It is likely that individuals casually browsing the website would not find this topic if not directed to it. Since this is an energy efficiency action that directly links to the goals of the campaign, future ME&O campaigns with similar goals should explore how to more effectively drive customers to energy efficiency programs.

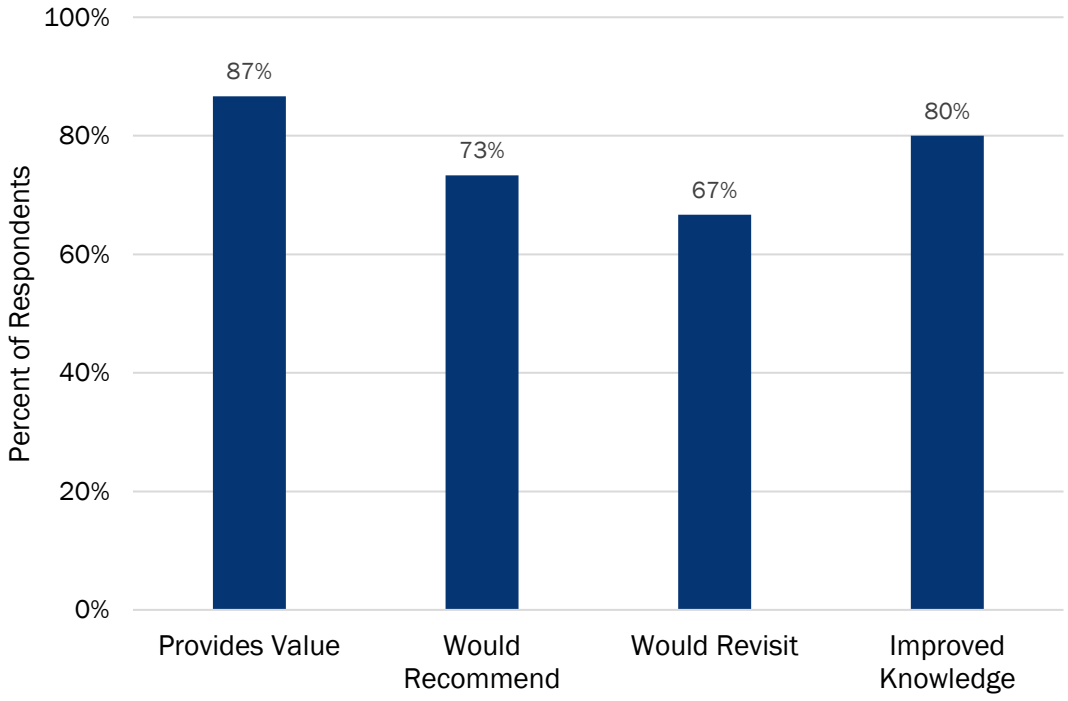
Task 6: While exploring the website today, did you become interested in Cool Days, Cool Deals?

Only four out of fifteen people saw the "Cool Days, Cool Deals" logo at the top of the page, but once directed to it, most participants were interested and excited by the deals. Some participants noted that their primary reason for revisiting the website would be to check out new deals. In order to increase website traffic, the "Cool Days, Cool Deals" logo on the website could be made more visible, as this type of program increases the stickiness of the website.

Overall Impressions and Findings

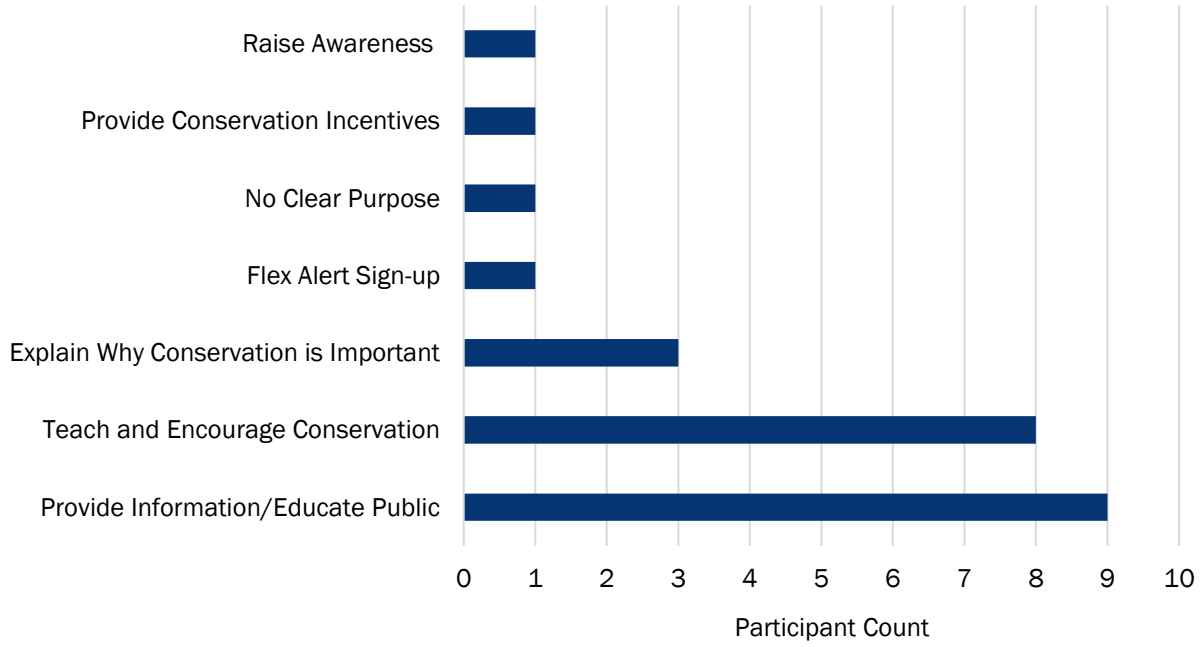
As shown in Figure 23, participants indicated whether the website provided value, if they would recommend it or revisit it, and if it improved their knowledge. The impressions of the website were positive, with 87% of participants indicating that the website provided value and 80% indicating that it improved knowledge. The lowest score was for revisiting the website, as only 67% of participants indicated that they would revisit. Overall, all impression metrics revealed participants' positive reception of the site.

Figure 23. Overall Impressions of the Website



We asked participants what they thought the website was trying to communicate. Nine participants thought the website provided information or educated the public. Eight participants noted that the site aimed to teach and encourage conservation. Overall, participants successfully identified the objectives of the campaign (Figure 24).

Figure 24. Participants' interpretations of the website's purpose

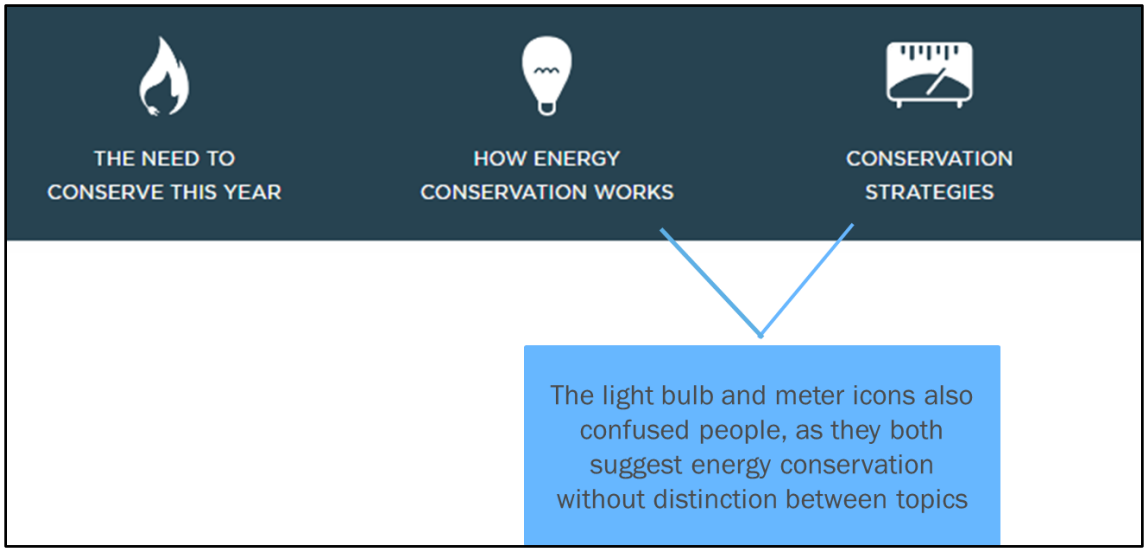


Key Findings

The web usability study produced several insightful findings regarding website navigation and participant familiarity with conservation. A key finding was that participants could not easily distinguish between the different conservation-related buckets, such as "how energy conservation works" and "conservation strategies." The icons for the topics did not help participants distinguish between the content (Figure 25).

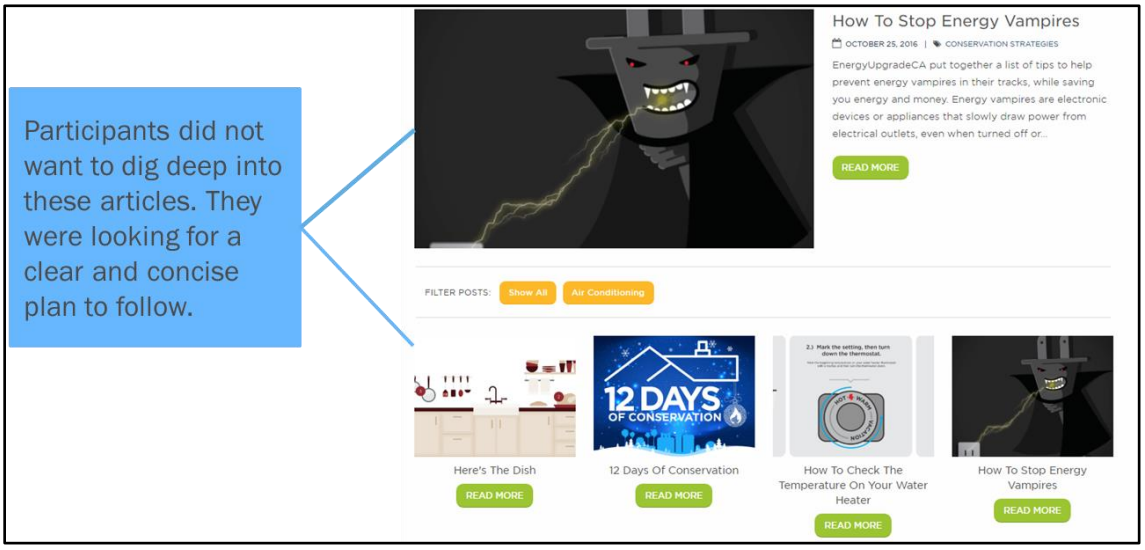
In the conservation strategies task, we asked participants to learn about ways to save energy. We found that participants were looking for a clear list of actionable items, as opposed to several articles that they would have to read individually.

Figure 25. Campaign Bucket Icon Redundancy



At the time of the study, the conservation strategies page featured an "energy vampire" article, which offered advice for preventing unused electronics from using energy (Figure 26). While participants found the topic to be interesting, the energy vampire topic was only one small segment of the tips and tricks that are available in other sections of the site, and most participants did not explore further into additional articles.

Figure 26. Energy Conservation Strategy Page



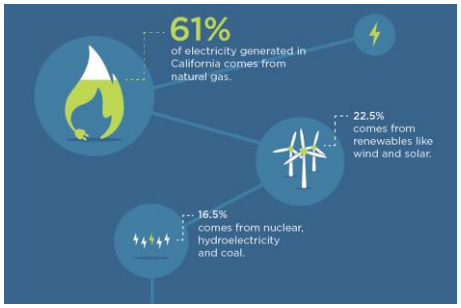
Social Media

In addition to the website, the campaign also primarily focused on using social media channels to spread energy conservation messaging. The campaign utilized several channels including Facebook, SnapChat and Twitter. We chose to assess the effectiveness of Facebook posts on the customer survey as this channel had the widest reach. For each wave of the survey, we selected the most popular

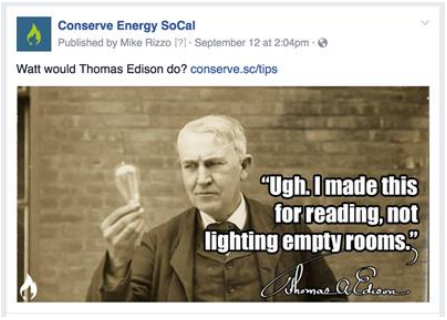
Key Findings

Facebook post within the previous month and asked respondents if they recalled seeing the content (Figure 27).

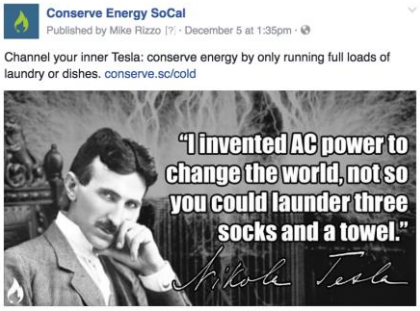
Figure 27. Facebook Posts used in the Split Panel Survey



Wave 1



Wave 2

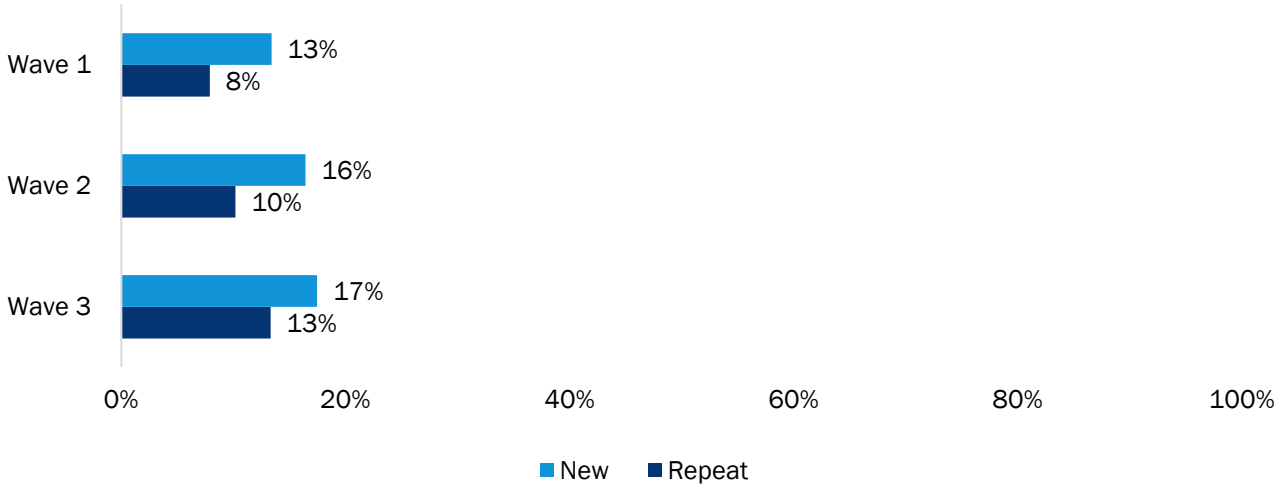


Wave 3

Source: PulsePoint Group

Recall of the Facebook posts increased equally from Wave 1 to Wave 3 for new respondents (4 percentage points) and repeat respondents (4 percentage points, Figure 28).

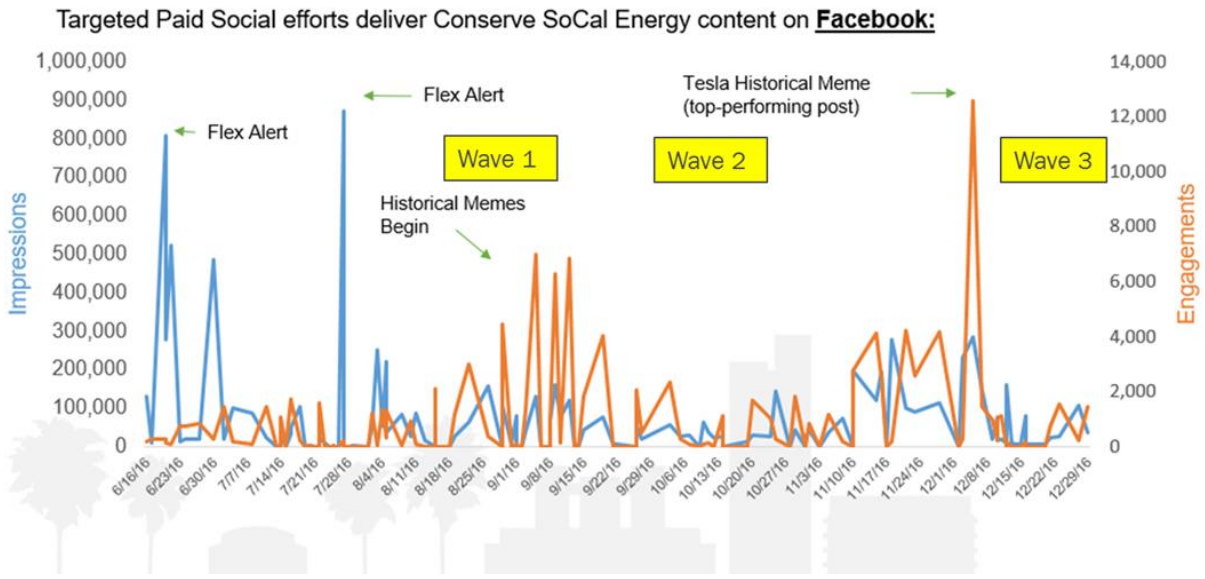
Figure 28. Share of Respondents Who Recalled Seeing Conserve Energy SoCal Facebook Posts



Notes: 1. Wave 1 New n=616, Wave 2 New n=592, Wave 3 New n=558, Wave 1 Repeat=440, Wave 2 Repeat=441, Wave 3 Repeat=44

Overall, Facebook content succeeded in generating 9.18 million impressions and 113,000 engagements while Twitter served to generate 6 million impressions and 3,200 engagements (Figure 30). At $1.25 million, social media spending represented the largest share of the Conserve Energy SoCal budget spent on any channel (25%).

Figure 29. Conserve Energy SoCal Facebook Impressions and Engagements



Source: PulsePoint Group

PulsePoint began using historical meme's to advertise the Conserve Energy SoCal Campaign on social media in September 2016, right before YouGov fielded the Wave 2 survey. Figure 30 presents an example of a historical meme, along with web usability participants' interpretations and impressions of the posting. PulsePoint metrics show an increase in Facebook impressions and engagements after the memes began, which coincides with when the largest increase in recall of the Facebook ME&O which occurred between Waves 1 and 2 (Figure 29). A large spike in Facebook and Twitter impressions and engagements also occurred right before the Wave 3 survey went into the field when PulsePoint released the Nicola Tesla Meme (see Wave 3 image in Figure 27). Although the Tesla meme was a very popular piece of shareable content, it only features two very basic energy saving tips. Since this channel proved the most successful in terms of generating awareness of the campaign, future campaigns should consider embedding more effective calls to action.

Figure 30. Historical Meme with Web Usability Participant Feedback

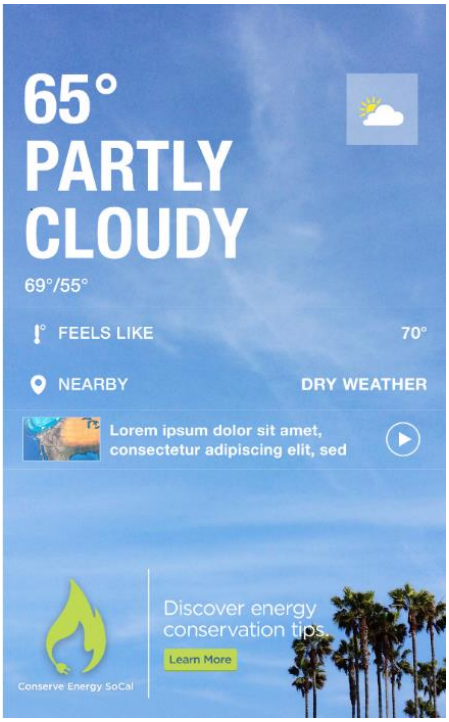
Digital Media

The campaign spent 19% of the total Conserve Energy SoCal budget ($968,625) on digital media including paid advertisements on search engines intended to drive customers to the Conserve Energy SoCal Website, digital videos, and online advertisements.

Online Advertisements

According to the PulsePoint Group, online advertisements (digital display media) generated 46.4 million impressions and a 0.44% Click-through Rate (CTR), which exceeded the channel CTR goal of a 0.08% to 0.10%. We asked Wave 3 survey respondents if they recalled one specific online advertisement, which was a screenshot of a paid advertisement featured on Weather.com (Figure 33).

Figure 31. Weather.com Paid Advertisement



Source: PulsePoint Group

Respondents' level of recall of the Weather.com ad was similar to their recall levels for other online sources at 21% (n=555).

Paid Search

PulsePoint reported that paid search advertising generated 4.2 million impressions, which is less than the 9.2 million impressions generated by Facebook and 6 million impressions generated by Twitter. In addition, paid searches generated a CTR of 1.09%, exceeding the channel goal of 1.00%. The campaign spent $4.93 per click for paid searches and overall the campaign under-delivered on the number of paid search clicks as there was a $17,000 budget surplus for digital media due to savings on paid searches.

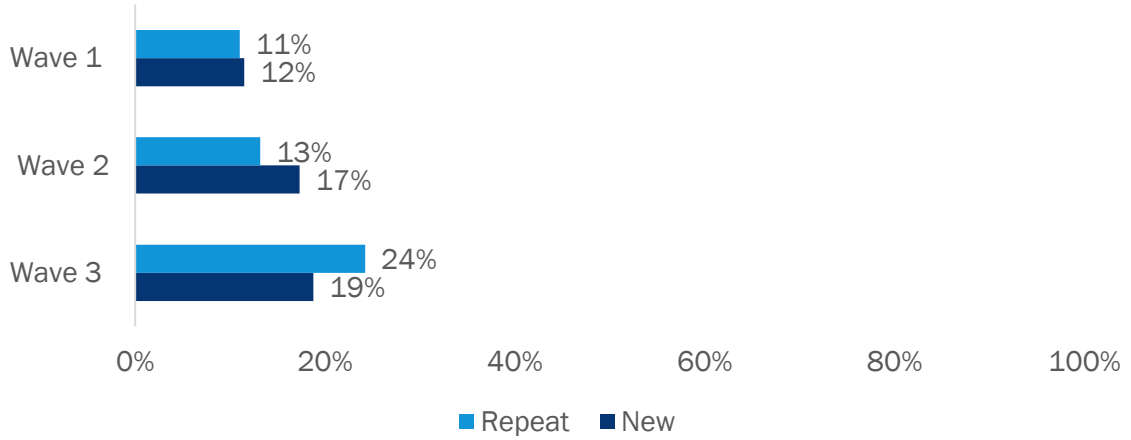
Streaming Videos

The campaign created several digital videos for use on the website, social media, and digital streaming. We reviewed the videos and found that 92% touched the campaign goals as well as all three of the Hierarchy of Effects model stages. Eighty-five percent of the videos also included the website link. However, only 31% of the videos offered direct energy-saving action tips (Table 3).

For the survey, we showed survey respondents a different video promoting energy conservation and the Conserve Energy SoCal Campaign for each wave of the survey. The videos highlighted topical seasonal content. The Wave 1 video showed general conservation tips, the Wave 2 video discussed the connection between electricity and natural gas and the Wave 3 video presented energy conservation tips for cold weather. Respondents' level of recall of digital videos was similar to that of other digital media channels in Wave 3. The share of respondents who recalled seeing the videos

increased from Wave 1 to Wave 3 for both new respondents (7 percentage point increase) and repeat respondents (12 percentage point increase).

Figure 32. Share of Respondents Who Recalled Seeing Conserve Energy SoCal Videos



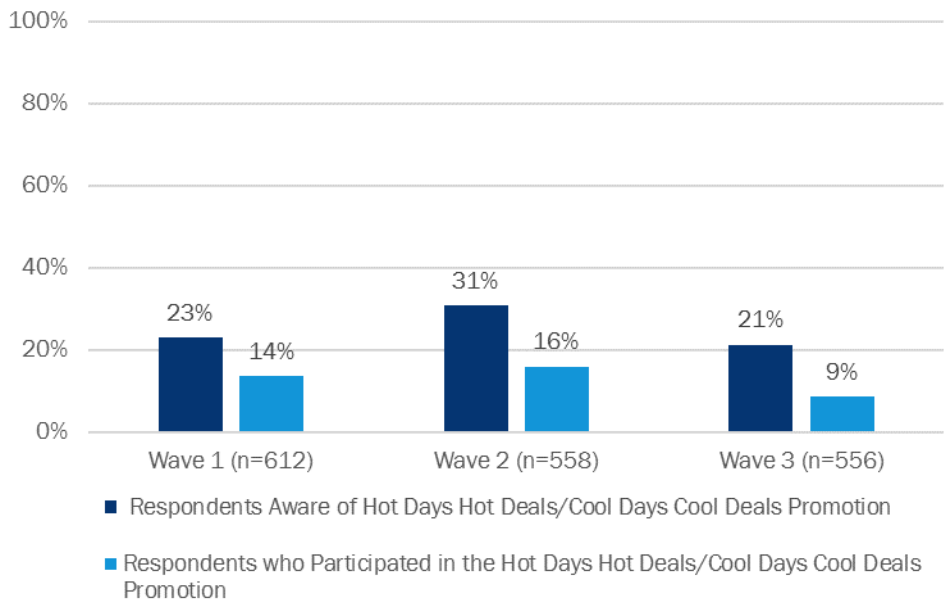
Notes: 1. Wave 1 New n=617, Wave 2 New n=593, Wave 3 New n=558, Wave 1 Repeat n=441, Wave 2 Repeat n=442, Wave 3 Repeat n=441.

Digital videos superseded the reach of all other social media channels used for the campaign with 11.2 million impressions. In addition, campaign video content achieved a 76% Video Completion Rate (VCR), falling within campaign goal range of 66% to 78%.

Outreach

The Conserve Energy SoCal Campaign featured a variety of outreach events promoting energy conservation throughout the campaign. Events were a smaller campaign focus and comprised a minor portion of campaign spending (4%, $188,000). A featured campaign promotion, Hot Deals Hot Days, ran over the summer and the purpose of this promotion was to encourage residents to leave their homes and head to air conditioned places in the community to reduce AC loads on days of peak energy use. The promotion extended into the winter months with Cool Days, Cool Deals and Figure 33 shows that the promotion was more effective in the summer and early fall, as awareness of the promotion dropped by 10 percentage points from Wave 2 to Wave 3 and participation in the program also dropped by 7 percentage points from Wave 2 to Wave 3. Importantly, the web usability study found that only four out of fifteen people noticed the Cool Days, Cool Deals logo at the top of the webpage, but once directed to it, the majority of people were interested and excited by the deals. Several web usability participants indicated that they would return to the website only to check on current deals, indicating that the coupons were an effective way to keep individuals engaged in the campaign.

Figure 33. Awareness and Engagement with the Cool Days Cool Deals/Hot Days Hot Deals Promotion



Another campaign event, Cinespia, was an outdoor movie screening which featured energy conservation messaging and was very effective at generating earned media, with press from sites such as the Elite Daily and LA Weekly. The Cinespia screening had a smaller reach than the Cool Days Cool Deals and Hot Days Hot Days promotion as only 10% of respondents recalled hearing about the event and 4,000 people attended the event.

Newspaper

The Conserve Energy SoCal Campaign included advertisements in community newspapers. Spending on community newspapers represented a small portion of the campaign budget at 3% ($141,350). The campaign had a cost effectiveness goal for newspapers of $127 per thousand impressions (CPM) and this goal was met as newspapers achieved a CPM of $79.

4.1.3 Channel Effectiveness Comparisons

Overall, unique campaign channels were effective at targeting different metrics. We compared channel effectiveness in terms of how well respondents recalled the channel, channel effectiveness at driving Conserve Energy SoCal awareness, and respondents' preferences for channels as sources of information.

Channel Recall

The Conserve Energy SoCal Website was the strongest performing channel in terms of the share of respondents who recalled seeing the channel in the survey. The Pacific Wheel Lighting Display on the Santa Monica Pier, which featured six different light shows with energy-themed displays was similarly

popular. Table 11 shows that the lighting display had a high level of visibility as 31% of respondents in Wave 3 recalled seeing the display

Table 11. Respondent Recall of Campaign Channels

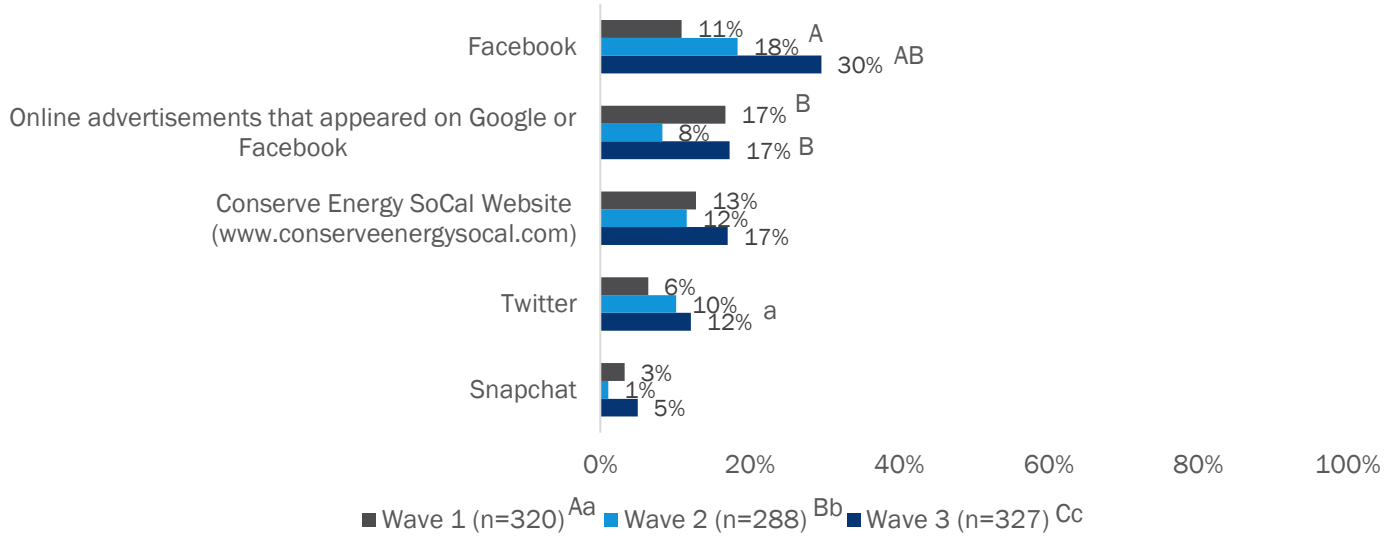
	Wave 1	Wave 2	Wave 3
Campaign Website (n=615*)	26%	23%	31%
Pacific Wheel Lighting Display (n=593)		31%	
Newspaper Ad (n=593)		24%	
Email (n=558)			24%
Paid Search (n=555)			21%
Digital Videos (n=617*)	12%	17%	19%
Facebook Posts (n=616*)	13%	16%	17%
Our Electricity Children's Book (n= 593)		15%	
Hot Deals Hot Days/Cool Deals Cool Days (n=612*)	14%	16%	9%
Cinespia Movie Screening (n=1,184**)	10%		

*Responses may be higher or lower depending on the wave
**Includes all Wave 1 respondents
Note: Some channels were only used during specific periods of the campaign and therefore were not asked about on all waves of the survey

Driving Conserve Energy SoCal Awareness

We assessed individual channel effectiveness at raising respondent awareness about the Conserve Energy Campaign through the split channel survey by asking respondents where they heard about the Conserve Energy SoCal Campaign. The share of respondents who heard about the Conserve Energy SoCal Campaign through Facebook increased significantly in Wave 3, and Facebook became the source where respondents most frequently heard about Conserve Energy SoCal by the end of the campaign, followed by paid online advertisements and Conserve Energy SoCal.com (Figure 34).

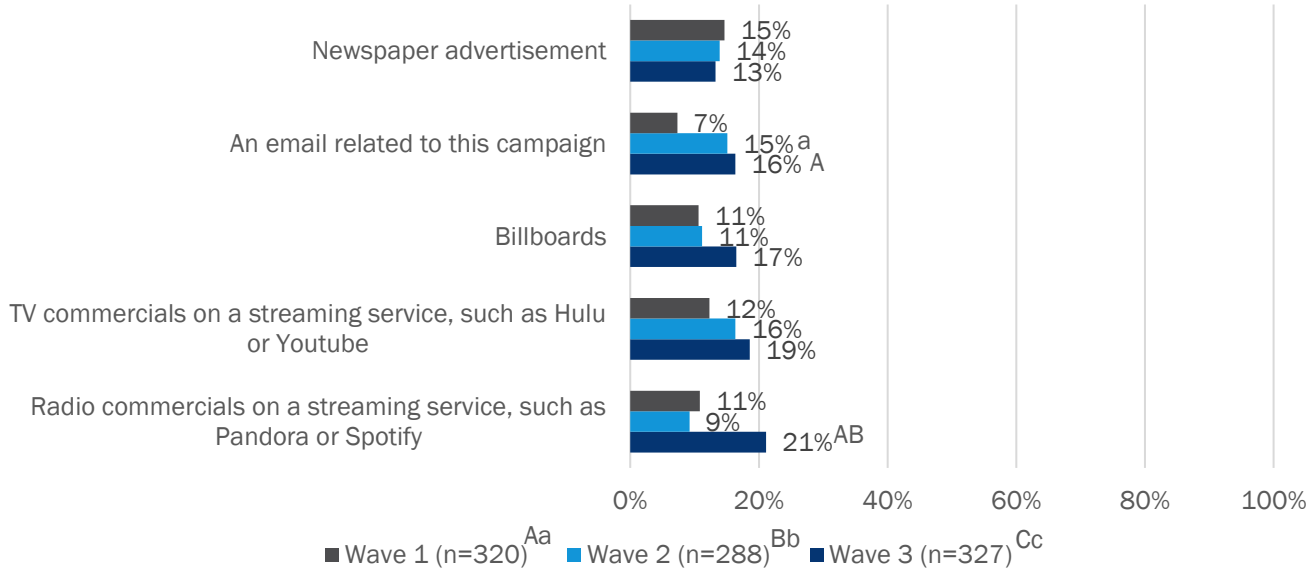
Figure 34. New respondents' Source of Awareness about the Conserve Energy SoCal Campaign (Social Media and Internet Sources)



Notes: a, b, and c indicate significant differences in proportions at the 0.10 significance level
3. A and B and C indicate significant differences in proportions at the 0.05 significance level

Radio streaming ads were the most effective channel at increasing respondents' awareness about the Conserve Energy SoCal Campaign out of any broadcast and non-digital media channels. In addition, the share of respondents who heard about the Conserve Energy SoCal Campaign through radio streaming commercials also increased significantly between Waves 2 and 3 (11 percentage points) (Figure 35). Higher levels of respondent awareness in Wave 3 corresponds with the campaign media schedule as radio streaming ads for the Conserve Energy SoCal Campaign began around the time the Wave 2 survey launched in early October and ran up until the Wave 3 survey was launched in mid-December.

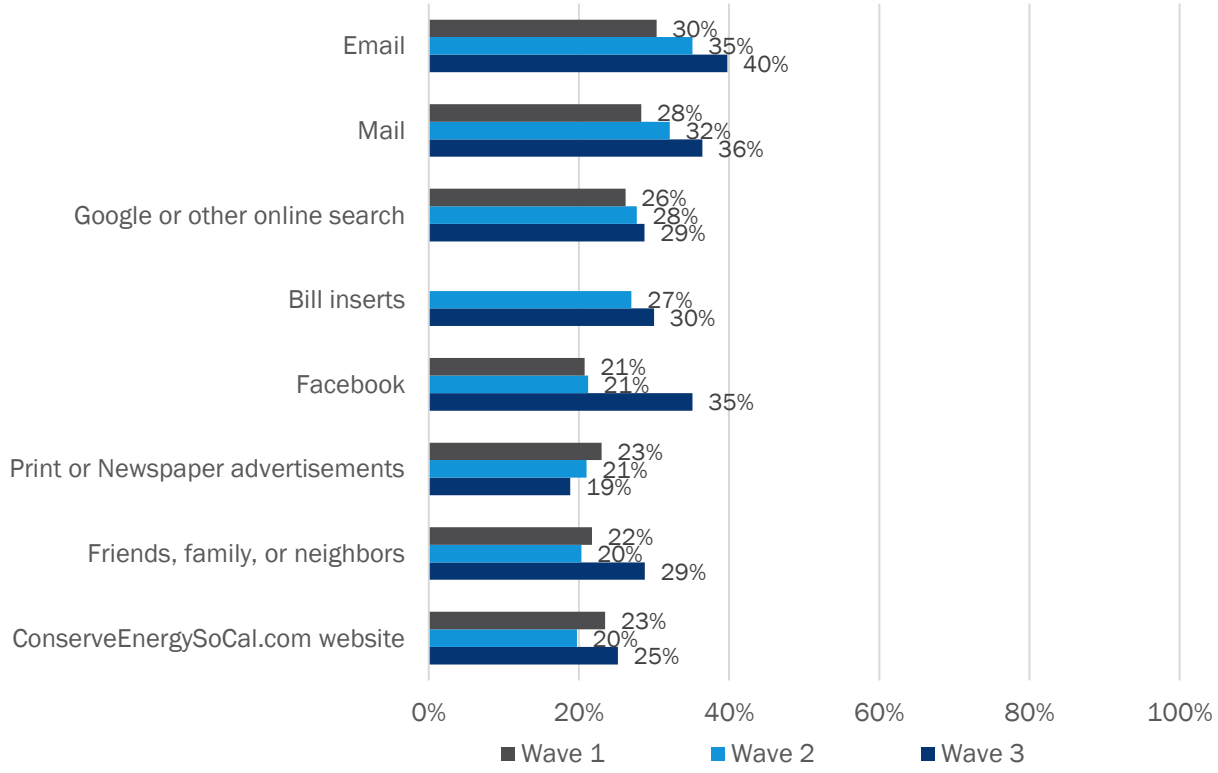
Figure 35. New respondents' Source of Awareness about the Conserve Energy SoCal Campaign (Other Sources)



Notes: a, b, and c indicate significant differences in proportions at the 0.10 significance level
3. A and B and C indicate significant differences in proportions at the 0.05 significance level

Respondents' highest preferred sources of information about energy conservation were direct mail (36%) and email (40%) followed by Facebook. Facebook also grew in popularity as one of respondents' preferred sources of information about energy programs that help customers use less energy. Respondents' preference for Facebook as source of information about energy conservation programs grew from 21% to 35% between Wave 2 and 3, which is the largest increase in preferences for any information source during the entirety of the campaign. Again this timing corresponds with the launch of some of the most popular Facebook content, such as the Tesla meme.

Figure 36. Respondents' Preferred Source of Information about Energy Conservation Programs



4.2 Flex Alert Outcomes

The Flex Alert program was created during the California Energy crisis in 2001 to support emergency energy conservation during times of energy supply shortages and high peak demand. When a Flex Alert is called, customers are encouraged to conserve energy through simple actions such as turning up the thermostat and postponing the use of appliances until after peak periods during times of limited supply. As there was a concern that supplies of natural gas and electricity would not be adequate to meet periods of high peak demand after the Aliso Canyon gas leak, the CPUC authorized budget for Flex Alerts events as a tool to reduce demand during peak periods to mitigate the threat of blackouts and brownouts. The California Independent System Operator (CAISO) operates the Flex Alert Program, and CAISO has the authority to determine when grid conditions necessitate calling a Flex Alert. CAISO generally informs the news media the day before they call a Flex Alert event.

The majority of the Aliso Canyon ME&O campaign Flex Alert budget was dedicated to promoting awareness of Flex Alerts and educating customers about how to take action on event days, through television ads, radio ads, online media, and digital billboards. A small portion of the campaign budget was dedicated to "trigger advertisements" which notified customers when Flex Alerts were in effect through radio ads, social media, and digital billboards.

Key Findings

In 2016[15], three Flex Alert events were called—one in June and two in July. The June event was limited to customers in Southern California and both July events were issued statewide. Table 12 provides a summary of the date, day of week, duration and weather profiles for each event. One event day during the 2016 peak season, June 20th, had significantly higher temperatures than the other two days (on July 27th and 28th).

Table 12. Flex Alert Events

Event Date	Day of Week	Start Time	End Time	Event Duration	Average Event Temp (F)	Max Event Temp (F)
6/20/2016	Monday	10AM	9PM	11 hours	96	102
7/27/2016	Wednesday	2PM	9PM	7 hours	87	91
7/28/2016	Thursday	2PM	9PM	7 hours	87	90

The first section of this chapter describes how we used the split panel survey to assess Flex Alert effectiveness by channel and by measuring awareness of Flex Alerts and Flex Alert sign-ups over time (section 4.2.1). The second section of this chapter discusses how we calculated the impact associated with the three Flex Alerts called in 2016 through a consumption analysis.

4.2.1 Split Panel Study

We asked split panel survey participants questions about Flex Alerts that were similar to questions asked about the Conserve Energy SoCal Campaign, including questions about respondents' awareness of Flex Alerts, sources of information about Flex Alerts, and actions taken (whether or not participants signed up for Flex Alerts). As shown above, Flex Alerts were called in June and July, so we chose to measure Flex Alert channel effectiveness using Wave 1 data as respondents completed the Wave 1 survey in August, soon after the Flex Alerts were called.

Channel Data

SoCal Gas used broadcast media including TV and radio commercials to raise awareness about Flex Alerts. We asked respondents where they heard about Flex Alerts in the Wave 1 survey and respondents' sources of information about Flex Alerts corresponded with Flex Alert channel spending. Wave 1 respondents who were aware of Flex Alerts (n=786) primarily heard about Flex Alerts through TV commercials (55%) and TV commercials also represented the largest share of Flex Alert budget spending (48%) (Table 13).

Table 13. Respondents' Source of Information about Flex Alerts (Wave 1)

Channel	Share of Respondents (n=786)	Share of Flex Alert Budget
TV commercials	55%	48%
Radio commercials	41%	27%
Ads in my community, such as billboards or buses	13%	17%
Social Media	9%	N/A
Online Advertisements Appearing on Google or Facebook	7%	9%

[15] The Flex Alert program was active in the years prior to 2016. The IOUs contributed funding for the Flex Alert program both in 2014 and 2015. Flex Alerts were called on February 6th, 2014, June 30th, 2015, and July 1st, 2015. The three Flex Alerts discussed in this report were the only the Flex Alerts called in 2016.

TV Commercials

The Flex Alert campaign ran TV commercials to inform customers about the possibility of Flex Alerts during the summer. We asked all Wave 1 respondents if they recalled seeing one of the Flex Alert TV commercials titled "Hands," which asked respondents to take key energy conservation actions during Flex Alerts. Respondents recalled these ads at a high rate as 35% of Wave 1 respondents recalled seeing the "Hands" TV commercial. Overall, Flex Alert TV commercials achieved a Cost per rating point (CPP) of $2,523 which met the cost-effectiveness goal of $3,527 CPP.

Radio Ads

The campaign featured "trigger" radio ads to alert residents during a Flex Alert and other "continuity" radio ads to inform customers about the possibility of a Flex alert. The survey featured an example of one of Flex Alert continuity radio ads and 34% of respondents recalled hearing this radio ad. Overall, radio ads also met cost effectiveness goals as radio ads in the LA area achieved a rate of $497 CPP, which met the CPP goal of $572. Radio ads in the Riverside-San Bernadino areas achieved a $129 CPP which also met the cost effectiveness goal of $171 CPP for this area.

PulsePoint re-used all Flex Alert content broadcast on TV and radio channels from previous years. As such, high levels of awareness of TV and radio content can't be directly attributed to the Aliso Canyon ME&O campaign in 2016, because respondents may have seen or heard this content prior to the Aliso Canyon ME&O campaign.

Digital Billboards (OOH)

The campaign used digital billboards along freeways in Southern California to raise awareness about Flex Alerts and inform customers when a Flex Alert was in effect. PulsePoint reported a CPM rate of $4.25, which met the CPM goal of $7.65 CPM.

Awareness and Actions Taken

CAISO called all three Flex Alerts before the first wave of the survey was sent out. As a result, we did not expect large changes in Flex Alert outcomes through each wave of the survey. Figure 37 shows respondents' levels of awareness about Flex Alerts stayed constant throughout the campaign. Opinion Dynamics conducted a ME&O campaign snapshot survey of 250 SCG residents in late June and early July, 2016. This survey included the same Flex Alert awareness questions used in the Aliso Canyon split-panel surveys and results showed that 69% of snapshot survey respondents were aware of Flex Alerts. These results indicate that respondents likely had a high level of awareness about Flex Alerts one month after the campaign began and that Aliso Canyon ME&O efforts did not result in increased levels of awareness about Flex Alerts. The Flex Alert program had been in existence for 15 years at the time the Aliso Canyon ME&O campaign began. As such, it is likely that customers learned about Flex Alerts in the years prior to the Aliso Canyon Campaign, which reduced the potential for the campaign to have an effect on Flex Alert awareness.

Figure 37. Respondent Awareness of Flex Alerts

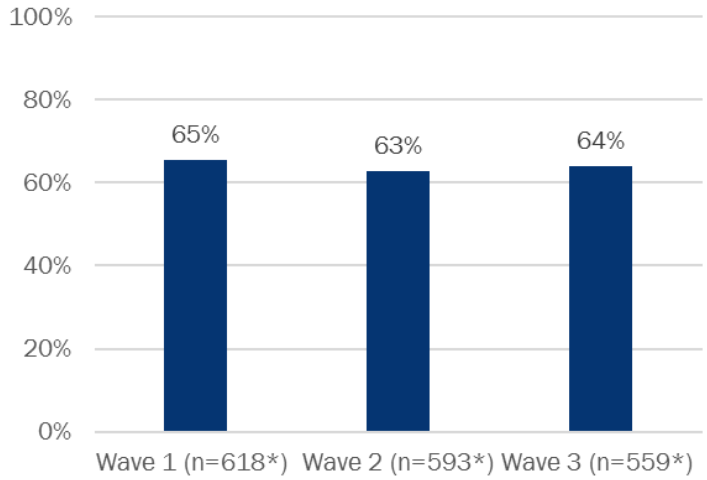
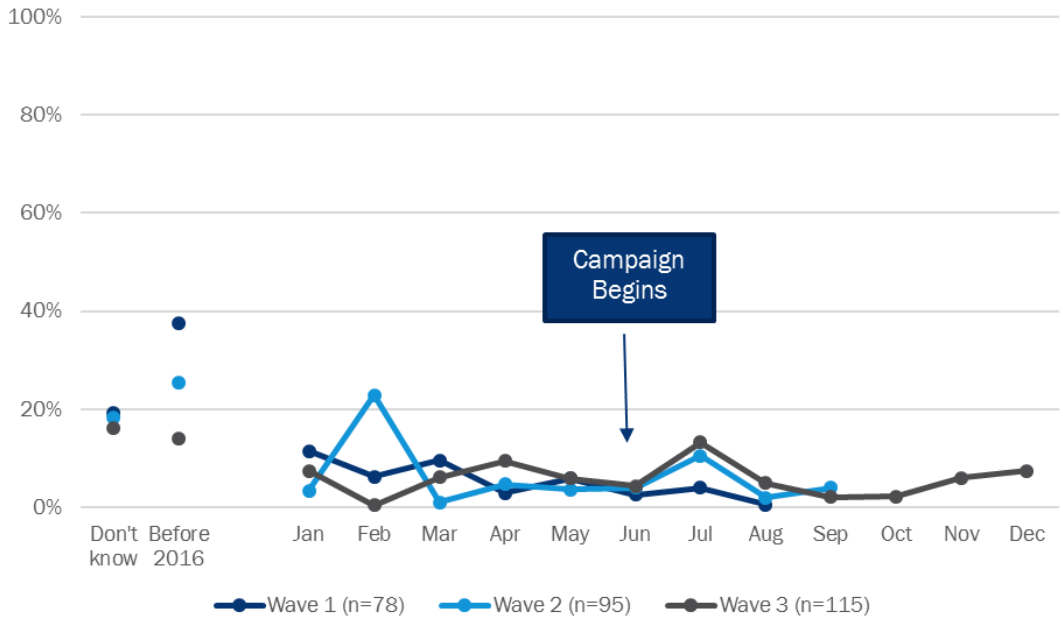


Figure 38 shows that for respondents who signed up for Flex Alerts, there was a slight increase in the share of respondents who signed up for Flex Alerts in July, one month after the campaign began. In addition, the three event days called in 2017 were June 20, July 27, and July 28, which may have also prompted the slight increase in respondents who signed up for Flex Alerts in July. However, the number of respondents who signed up for Flex Alerts in July ranged from 4 to 17 respondents per wave, representing a small share of total survey respondents.

Figure 38. Timing of Flex Alert Sign-ups for New Respondents



Notes: Results show the percentage of respondents who signed up for Flex Alerts during each time period out of the total number of respondents who signed up for Flex Alerts

Key Findings

The lack of evidence that the Aliso Canyon ME&O campaign increased awareness of Flex Alerts or drove Flex Alert sign-ups makes it difficult to attribute behavioral changes directly to the Aliso Canyon ME&O campaign in 2016.

4.2.2 Consumption Analysis

We completed a consumption analysis to quantify the demand impacts associated with the three Flex Alerts called during the campaign period. Below we identify the population of customers included in the analysis, describe Flex Alert events, and provide the associated demand reduction results.

Flex Alert Population

We estimated demand reduction impacts for 223,378 SCE residential customers residing in the targeted zip code areas.

As discussed above, our modeling efforts focused on SCE non-DR customers (i.e., customers that are not already participating in SCE's Other DR Programs) as well as customers who are not enrolled in SCE's NEM program in the targeted zip code areas. Because of this, there may be additional—yet very difficult, if not impossible, to model—demand reduction impacts that are not captured in the analysis. These include: 1) additional demand reduction impacts realized by Other DR Program participants that would not have been realized in absence of Flex Alerts. These additional impacts could result from Flex Alert related actions taken by SCE DR customers—exposed to Flex Alert communications—residing both within and outside of the targeted zip code areas; 2) demand reduction impacts realized by SCE non-DR customers—exposed to Flex Alert communications—residing outside the targeted zip code areas; and 3) demand reduction impacts realized by non-SCE customers who were exposed to Flex Alert communications.

Flex Alert Estimated Demand Reductions

We developed a statistical regression model to estimate a reference hourly demand load during event periods. The statistical model predicts what hourly demand would have been on the event day, particularly during the event, if no event had been called. We then compare this reference load to observed event day load to establish the demand reductions by hour for each event. The following figure provides the actual or "observed" event day hourly load (gray) and predicted load or "reference" (blue) for each event. The second and third events show clear evidence of load reduction, albeit small reductions, during event hours. However, Event 1, which was called throughout the day of June 20 for approximately 11 hours, and had peak temperatures of 102 degrees Fahrenheit shows evidence of a load increase during the early hours of the event and a load decrease during the latter hours of the event. However, it is important to point out that we did not have well matched comparison/reference days—given the extreme temperature—for this event, making the modeled results unreliable[16]. As a result, given the ability to find better reference load days based on temperature profiles for the two July events, we present average July event impacts (covering Events 2 and 3) as what one could expect on an average Flex Alert day in 2016.

[16] For Event 1, as outlined and illustrated in Appendix A, the model does a relatively poor job of estimating high demand period consumption during non-event days (compared to Event 2 and 3). And, for obvious reasons, the most important time to ensure model accuracy (i.e., the ability to estimate consumption) is during high demand periods as those are the very times when Flex Alerts are called.

Figure 39. Observed Load and Estimated Reference Load, Event 1

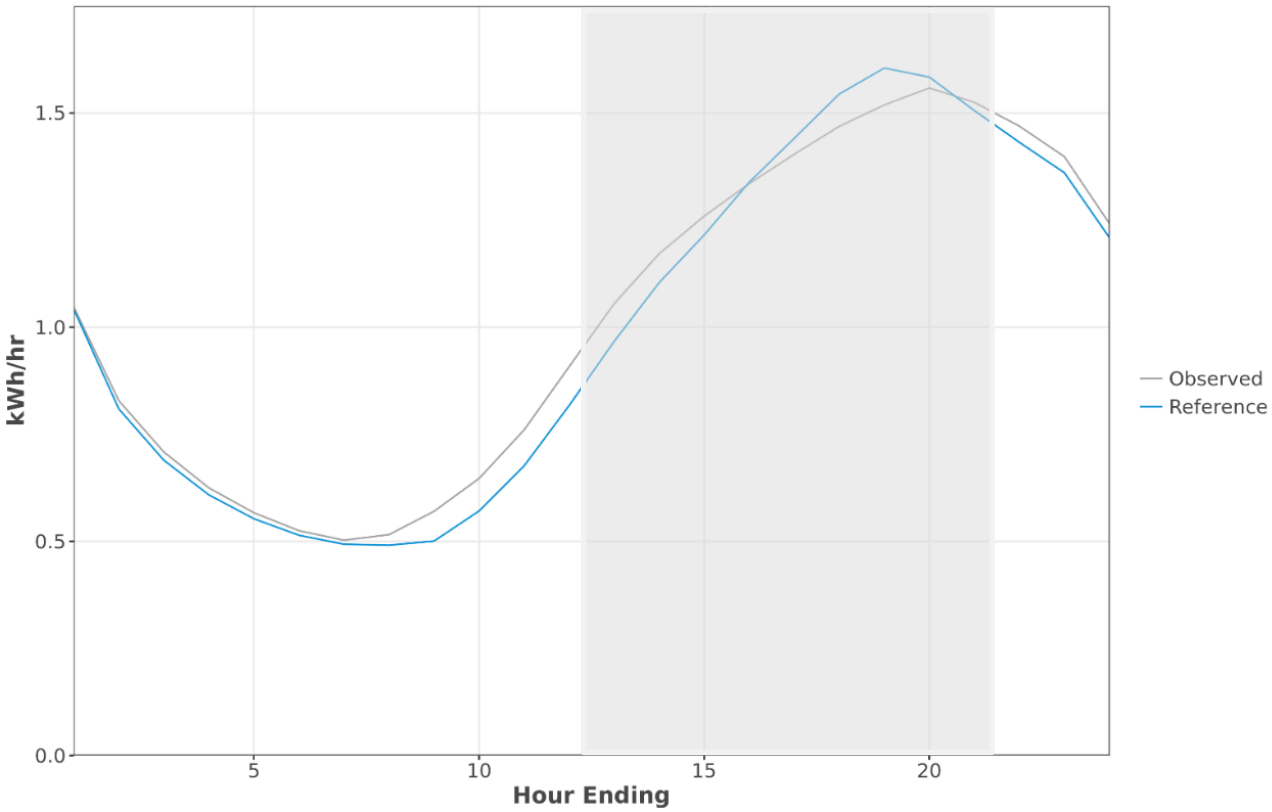


Figure 40. Observed Load and Estimated Reference Load, Event 2

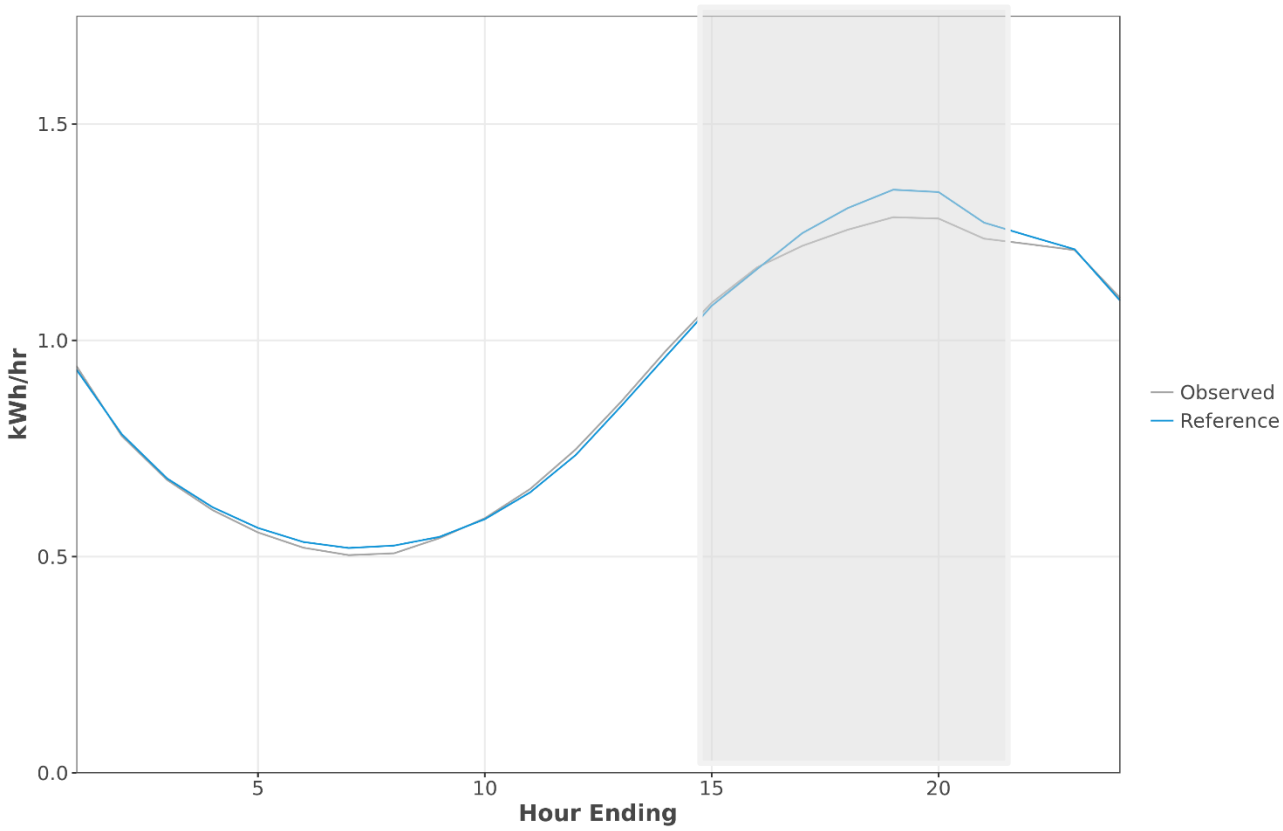
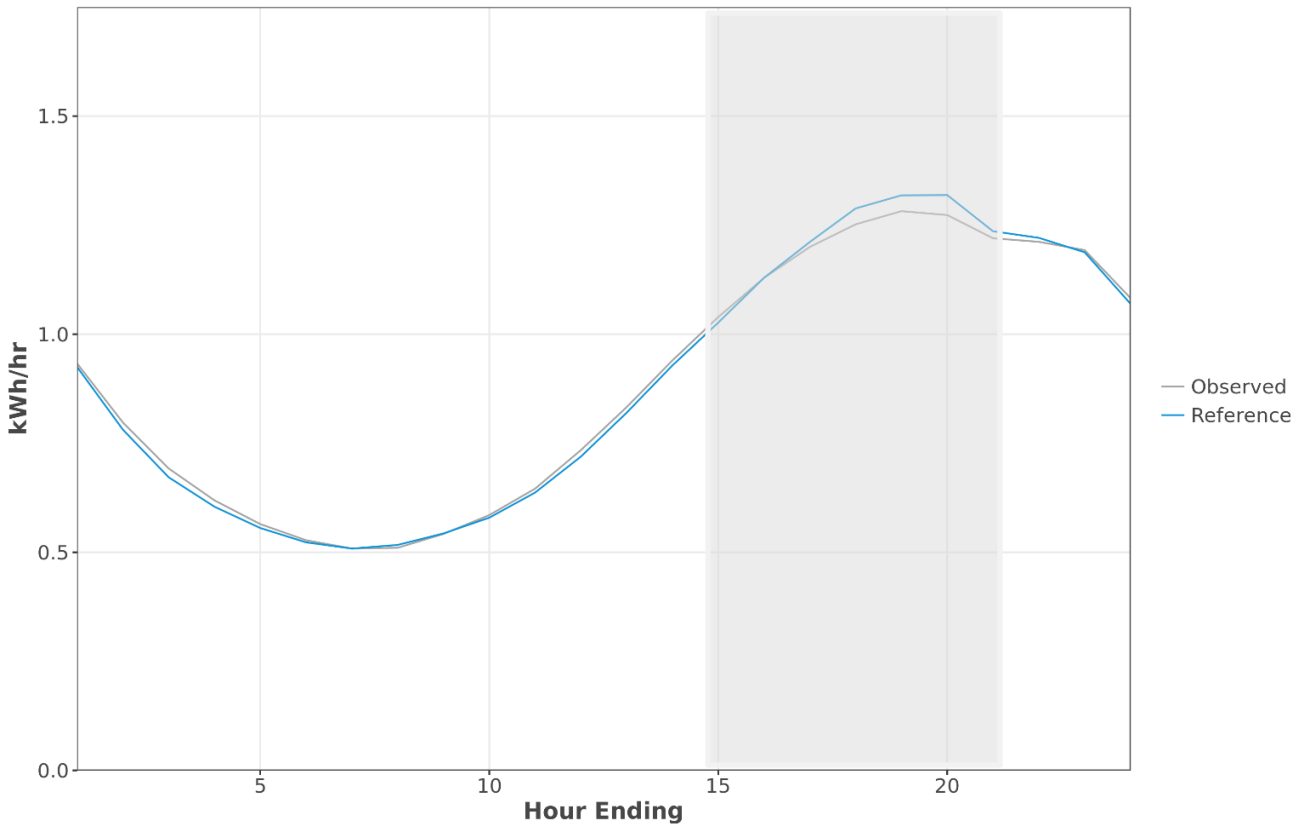


Figure 41. Observed Load and Estimated Reference Load, Event 3



Average ex post DR impacts for the two July events (i.e., Events 2 and 3) are 0.024 kWh/hr resulting in 5.5 MWh/hr reduction for the customers in the targeted zip codes. Impacts vary across the events. When looking at results by event, the June 20th event shows an increase in energy demand during the event (denoted by the negative sign for estimated load impacts, where the estimated reference load had lower demand than the observed load). However, as mentioned above, the results of this model are unreliable. Because of this, we use the July average (i.e., the average impacts of Event 2 and 3) as the best estimate of an average Flex Alert impact for customers in targeted zip codes in 2016.

Table 14. Average Event Impacts for Population of Modeled Customers in Target Zip Codes

Event	Estimated Reference Load (kWh/hr)	Observed Load (kWh/hr)	Estimated Load Impact (kWh/hr)	Average Event Temp (F)	Max Event Temp (F)	Uncertainty Adjusted Impact - Percentiles				
						10th	30th	50th	70th	90th
June 20	1.27	1.29	-0.017	96	102	-0.024	-0.020	-0.017	-0.014	-0.010
July 27	1.25	1.22	0.031	87	91	0.026	0.029	0.031	0.033	0.036
July 28	1.22	1.20	0.018	87	90	0.013	0.016	0.018	0.020	0.023
July Average	1.23	1.21	0.024	87	91	0.019	0.022	0.024	0.027	0.030
Total (MWh/hr)*	**276**	**270**	**5.5**	**90**	**102**	**4.319**	**4.998**	**5.469**	**5.939**	**6.618**

* Total MWh/hr = 233,378 customers X 0.024 kWh/hr.

Consumption Analysis Findings and Discussion of Key Methodological Challenges

We estimate that Flex Alert customers reduced electricity demand by 0.024 kWh/hr on average during Flex Alert events. This resulted in a total reduction of 5.5 MWh/hr across the total population of 223,378 residential customers in the targeted zip code areas (excluding residential customers participating in Other DR Programs and NEM program participants). Demand reduction estimates for the July events are statistically significant at a 95 percent confidence level. However, given the awareness of Flex Alerts stayed constant throughout the campaign, it is unclear how much of this demand reduction was due to the Flex Alert brand equity or due to the Conserve Energy SoCal Campaign.

Our results fall within the range of estimates found in evaluation reports for Flex Alert campaigns[17] conducted over the last ten years. The findings from these varied methodologies range from no statistically significant demand reductions to 282 MWh/hr demand reductions. This variation in results speaks to the inherent difficulty of measuring the impacts associated with Flex Alert campaigns. Importantly, variation in results likely reflect the various methodologies[18] evaluators employed to assess demand reduction impacts associated with Flex Alerts, as well as challenges related to program design and deployment for social marketing campaigns. We document these challenges below to provide context when assessing the effectiveness of the Flex Alert campaign.

- **Identifying exposed customers**. For marketing, education and outreach campaigns, we often do not know what energy conservation actions or behaviors were taken, or what induced those changes. Additionally, given the delivery channels for the campaign, we will not know which customers were exposed to the campaign. This is in direct contrast to traditional load control programs that typically send a signal to existing household HVAC equipment to reduce energy consumption during the event (so we know which households participated) and removes customer behavior out of the equation (as the equipment cycles on and off without any customer interaction). In contrast, Flex Alerts rely upon customers being exposed through various marketing channels during the event day and understanding what types of conservation actions they can take, and deciding to take those actions during the event. As a result, our study is unable to identify which customers were actually exposed to the Flex Alert messaging, and instead the Team models impacts for the population of customers in the targeted zip code areas.

- **Excluding DR participant customers**. As noted above, this evaluation excludes customers enrolled in Other DR programs. We can surmise that excluding these customers would potentially underestimate the demand reductions associated with the Flex Alert. These customers likely have a higher capability and interest in reducing loads on event days and may

[17] The Team reviewed three prior evaluations of Flex Alerts to inform our evaluation approach as well as to compare impact estimates derived from the analysis. These evaluation reports include Christensen Associates Energy Consulting, 2013 Impact Evaluation of California's Flex Alert Demand Response Program, CALMAC Study ID SCE0343.01, February 28, 2014. http://www.calmac.org/publications/2013_Flex_Alert_-_Impact_Eval_-_Final_20140228.pdf. Summit Blue Consulting, 2008 Flex Alert Campaign Evaluation Report, CALMAC Study ID: PGE0270.01, December 10, 2008. http://www.calmac.org/publications/2008_Flex_Alert_Final_Report_12-18-08.pdf. Summit Blue Consulting, 2006-2007 Flex Your Power NOW! Evaluation Report, CALMAC Study ID PGE0255.01, May 22, 2008. http://www.calmac.org/publications/Flex_Your_Power_Now_2006-2007_Evaluation_Report_-_Summit_Blue.pdf

[18] These include consumption analysis using a reference load day approach (consistent with this evaluation), 'indirect impact analysis' conducted via telephone surveys in designated media areas regarding air conditioning and or lighting behaviors before, during and after Flex Alert events, as well as examination of CAISO level forecast and observed load data to identify aggregate demand response.

have taken additional steps, beyond their participation in Other DR programs, as a result of Flex Alert communications.

- **Excluding Net Metered customers**. This evaluation also excludes residential customers with net energy metering because of the added difficulty of disaggregating distributed energy generation effects from demand impacts**.** Similar Other DR Program customers, NEM customers may have higher capability and interest in reducing loads on event days.

- **Selecting well-matched non-event days.** Weather is a major driver for household energy consumption particularly during hot periods. Due to this, it is essential to have as similar non-event day weather profiles to use as a reference for estimating demand reductions as possible (e.g., equivalency of proxy days in terms of temperature conditions). To ensure the best matches possible for each event day, we used Mahalanobis distance matching to select nine non-event days that best matched the hourly profile of the event day. Mahalanobis distance minimizes the difference between the event and non-event day temperatures at each hour, corrected for the measured variation in temperature at that hour and the correlation of temperature between hours. We describe this approach and document the temperatures for matched weather days in Appendix Appendix D.

- **Measuring small effect sizes**. The size of demand reductions for Flex Alert campaigns depend upon customer exposure and willingness and ability to take conservation actions. As a result, given that there is less certainty around exposure, and reductions depend upon conservation practices during an event, we surmise that demand reductions may be smaller than a traditional load control DR program. As a result, depending on the efficacy of the marketing campaign in encouraging customers to reduce their energy consumption, it can be more or less difficult to detect statistically significant demand reduction results. Because we had millions of consumption observations to draw upon, we were able to detect relatively small impacts by using a fixed effects model.

Finally, it is notable that our results are considerably lower than CAISO reported demand reductions during Flex Alert events[19]. We understand that CAISO bases their estimates on their day-ahead demand prediction model that estimates demand for all of CAISO territory, which covers many more customers and much more area than the Aliso Canyon target zip codes, making a direct "apples-to-apples" comparison of the two numbers very difficult, if not impossible.

4.3 Summary of Findings and Recommendations

In the following sections, we summarize key findings and provide actionable recommendations to inform future ME&O marketing campaigns based on our audit and verification of ME&O Activities (Section 4.1.13.1), evaluation of ME&O effectiveness (Section 3.2) and analysis of Flex Alert outcomes (4.2).

4.3.1 Description of Findings: Audit and Verification of ME&O Activities

[19] CAISO estimated impacts of 530 MWh/hr on 6/20/2016 (Event 1), 490 MWh/hr on 7/27/2016 (Event 2), and 540 MWh/hr on 7/28/2016 (Event 3). SOUCE: California Public Utilities Committee, Aliso Canyon Demand-Side Management Impact Summary http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/News_and_Updates/2017_AlisoDSMImpactSummary_01-31.pdf

Key Findings

The evaluation team uncovered several insights through the audit and verification study and developed recommendations to address each finding. The findings and recommendations are as follows:

- **Finding: The Conserve Energy SoCal ME&O Activities aligned with the CPUC's direction.** Analysis of the related policy documents, SCG's monthly ME&E Reports to the CPUC, participation in weekly Advisory Group Meetings, and review of campaign goals, messaging buckets, content and channels, all provide evidence that ME&O activities were planned, executed, and launched in alignment with CPUC's direction.

- **Finding: The Conserve Energy SoCal Campaign utilized 5 key messaging buckets, developed 90 unique pieces of campaign content, and disseminated content via seven channels, or media outlets.**

- **Finding: The Conserve Energy SoCal Campaign targeted individuals residing in 299 zip codes that are directly impacted by the closure of the Aliso Canyon Storage Facility near Porter Ranch, California. No additional targeting was undertaken.**

    - **Recommendation: While the timing of this campaign did not allow for additional targeting, if the campaign continues, the implementer should consider segmenting the target audience to develop more precise targeted marketing.** Market segmentation provides a powerful method to align strategy, positioning, and messaging with customer's interests and needs. This maximizes marketing spend and increases customer's motivation to act.

- **Finding: The Conserve Energy SoCal Facebook posts grew in popularity throughout the campaign.** Recall of Facebook posts increased throughout the Conserve Energy SoCal campaign. Respondents' preference for Facebook as a source of energy conservation information showed the largest increase throughout the campaign as compared to other channels. The historical Facebook memes proved especially popular with respondents. Despite the popularity of the Facebook postings, the review of campaign marketing materials showed that the majority of the social media stand-alone content did not offer calls to action, relied on the accompanying text of the post to provide critical information; or, if they included a call to action, it was to visit the Conserve Energy SoCal website.

    - **Recommendation: Future energy conservation campaigns should feature Facebook as a key campaign channel, and social media content should effectively leverage the platform to make calls to action.** Consider changing the content of Facebook and other social media posts so that the content directly provides substantial tips about how to save energy (i.e., calls to action).

- **Finding: Flex Alerts were not explicitly mentioned in the stated campaign goals.** From the existing documentation and through participation in weekly meetings there was limited evidence of integration between Flex Alerts and the Conserve Energy SoCal campaign. Flex Alerts often appeared to be an "add-on," despite Flex Alert spending accounting for nearly half of the total campaign budget. Interviews with the implementer indicated that the goal of Flex Alerts in was to raise awareness. A secondary goal of Flex Alert marketing was to trigger action during Flex Alert events, with the latter representing a small percentage of the Flex Alert marketing spend.

    - **Recommendation: Future energy conservation campaigns should feature a strategic marketing plan where all components of the campaign are addressed.** A strategic marketing plan maps overarching campaign objectives to campaign activities and

associated outcomes. Strategic marketing plans help to ensure that appropriate resources are devoted to achieving campaign objectives. Furthermore, strategic marketing plans provide a framework for the evaluation of campaign effectiveness.

- **Recommendation: Future energy conservation campaigns should consider different funding priorities for Flex Alerts.** Given that this study and past studies indicate that awareness of Flex Alerts is high and that this study found no increase in awareness throughout the campaign, spending less on ME&O activities to promote awareness may be prudent.

- **Finding: The Conserve Energy SoCal Campaign re-used Flex Alert content broadcast on TV and radio channels from previous years. As such, high levels of awareness of TV and radio content can't be directly attributed to the Aliso Canyon ME&O campaign in 2016, because respondents may have seen or heard this content prior to the Aliso Canyon ME&O campaign.**

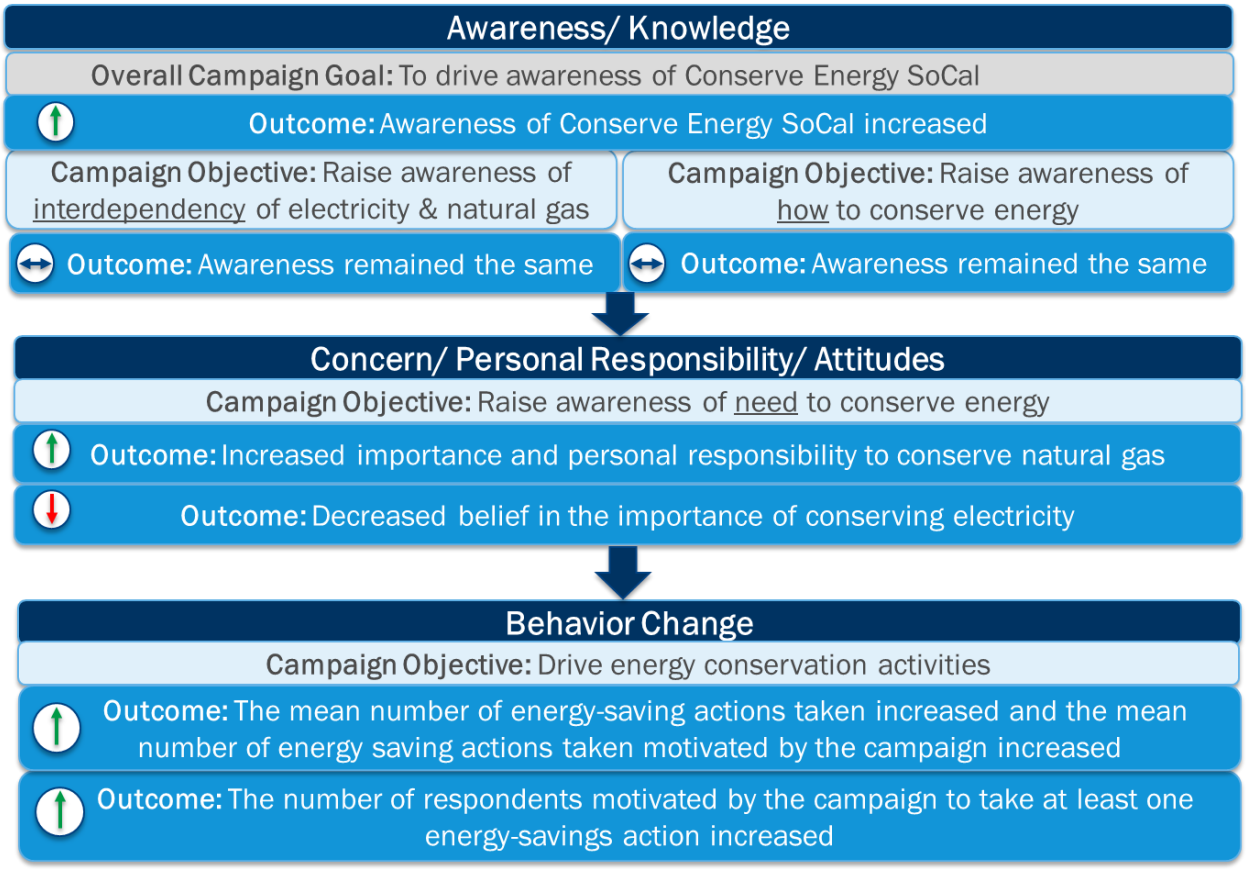
  - **Recommendation: Future campaigns utilizing Flex Alerts should consider developing fresh content to potentially increase awareness, concern, and behavior change related to Flex Alerts.** Consider changing the calls to action utilized in this content.

4.3.2 Description of Findings: Evaluation of ME&O Effectiveness

To evaluate the effectiveness of the Conserve Energy SoCal campaign, we utilized a type of popular marketing conceptual model, referred to as a hierarchy of effects model. The hierarchy of effects model posits that audiences go through a variety of changes in responding to advertising and other persuasive marketing messages (Lavidge and Steiner, 1961; Vakratsas and Ambler, 1999; Hoang Sinh, 2013). The basic assumptions are that customers first become aware of an offering, they then develop attitudes and beliefs about the offering, and as a result are prompted to take action.

We present overview of campaign performance, key findings, and recommendations in light of the specified Conserve Energy SoCal campaign objectives below (Figure 42).

Figure 42. Conserve Energy SoCal Campaign Effectiveness Overview



- **Finding: Respondent awareness of the Conserve Energy SoCal brand increased throughout the campaign.** Overall, the campaign succeeded in raising awareness of the Conserve Energy SoCal brand. Respondent awareness of the brand increased from 55% shortly after the campaign began to 61% at the close of the campaign.

    - **Recommendation: Because the Conserve Energy SoCal brand has gained traction in Southern California, ongoing and future campaign should leverage this success, which in turn maximizes ratepayer investment.** As the Conserve Energy SoCal campaign generated a high level of awareness in a short time period, the energy providers in Southern California should continue to leverage this brand during energy shortages. As the risk of energy shortages decline, emphasis should be placed on using the Conserve Energy SoCal brand equity to increase the reach of the state-wide energy conservation brand, Energy Upgrade California.

- **Finding: Survey and web usability respondents did not make the connection between natural gas and electricity, even after exploring campaign content.** Results from both the surveys and the web usability study showed that few people made the connection between natural gas and electricity.

- **Finding: The campaign influenced respondents' attitudes towards energy conservation.** Survey respondents increasingly believed there was a limited supply of natural gas in Southern California and that they had a personal responsibility to conserve natural gas. Though respondents' beliefs in the importance of natural gas conservation increased throughout the

campaign, their beliefs in the importance of electricity conservation decreased. In addition, the evaluation team asked web usability participants to explore content explaining why it was important to conserve energy. Some participants did not uncover the message in the website videos or text. Others did not demonstrate understanding of why energy conservation is important even after having read the materials. This further indicates that not all respondents understood the connection between natural gas and electricity.

- **Recommendation: Future campaigns should continue to address the interdependency of electricity and natural gas as well as develop new tactics to educate residents on this topic, especially if this topic remains a conservation campaign goal.**

- **Finding: Web usability participants were not able to find utility energy efficiency programs via the Conserve Energy SoCal website.** Participants needed to navigate through several pages and search the website to find incentives and programs for energy efficiency upgrades. It is likely that individuals casually browsing the website would not find this topic if not directed to it.

  - **Recommendation: Future energy conservation campaigns should explore how to drive customers to energy efficiency programs**. Given the frequent importance of websites in campaigns and that energy efficiency programs are a key way to drive energy conservation, it is essential for campaigns to help customers make this important connection.

- **Finding: Overall, the campaign influenced more people to take energy saving actions**. When we surveyed respondents two months after the campaign began, 22% of respondents reported taking at least one new energy-saving action directly as a result of the campaign. The share of respondents who took at least one energy-saving action directly because of the campaign increased slightly throughout the campaign (a 4 percentage point increase from second survey to the third survey).

- **Finding: Using the Aliso Canyon emergency appeared to be an effective campaign strategy and self-reported conservation behaviors increased two and a half months into the campaign as compared to pre-campaign levels. However, incremental effects on behavior were not observed four months and six months into the campaign.** The mean number of energy saving actions taken by survey respondents jumped from 5 actions before the campaign began to 9 actions at the time the first survey was sent out, two and a half months after the campaign began. Furthermore, respondents were influenced by the campaign to take several new actions between the start of the campaign and the time the first survey was sent out (mean=4.74). However, the mean number of actions taken overall and the mean number of actions taken motivated by the Conserve Energy SoCal campaign stayed constant throughout the rest of the campaign period.

  - **Recommendation: Future energy conservation campaign calls to action should feature new and novel behaviors as the campaign progresses.** This will give customers the opportunity to increase their conservation behaviors.

- **Finding: Overall, respondents' level of knowledge about how to save energy in their homes was high and stayed constant throughout the campaign.** We asked respondents about their level of knowledge regarding energy saving actions in the home. Respondents reported a high level of knowledge when we conducted our first survey two and a half months after the start of the campaign (4.01 on a five-point scale where one is "not at all knowledgeable" and five is "very knowledgeable"). This indicated that the campaign had little room for influence on respondents' knowledge about energy conservation behaviors in the home. Since the energy

tip calls to action remained similar throughout the campaign, it is not surprising that the mean knowledge level stayed constant in subsequent surveys.

- **Recommendation: Consider recommending innovative energy-saving tips that are less likely to be a part of customers' current daily habits.** For example, the website might educate people about deeper home energy efficiency retrofits that they can complete with the help of utility-run programs.

- **Finding: We estimate that Flex Alert customers reduced electricity demand by 0.024 kWh/hr on average during Flex Alert events.** This resulted in a total reduction of 5.5 MWh/hr across the total population of 223,378 residential customers in the targeted zip code areas (this figure excludes residential customers participating in other demand response and net energy metering programs). Demand reduction estimates for the July events are statistically significant at a 95% confidence level. However, given the awareness of Flex Alerts stayed constant throughout the campaign, it is unclear how much of this reduction is due to the Flex Alert brand equity and how much is due to the Conserve Energy SoCal Campaign.

Appendix A. Data Collection Instruments


Wave 1.docx


Wave 2 NEW.do


Wave 2 REPEAT.d


Wave 3 NEW.do


Wave 3 REPEAT.d

Appendix B. Quantifying the Effects of Panel Conditioning on Split Panel Survey Results

Panel conditioning arises if repeated questioning of panel members affects responses such that responses to questions differ for experienced panelists as compared to new panelists. Repeated questioning may affect respondents' views about the topic under study, especially with regard to topics for which their views would not have been well developed prior to the survey. In addition, respondents may be able to give more correct answers when they take the same survey multiple times. According Warren & Halpern-Manners (2012)[20] if a study is designed so that survey responses from new respondents from a fresh sample are compared to repeat respondents at each wave, the new respondent groups can serve as a counterfactual scenario. If new and repeat respondents to not differ due to other confounding factors, then the differences in answers between new and repeat respondents can be attributed to panel conditioning.

We took steps to reduce bias associated with panel attrition to ensure that our new and repeat groups had similar demographic characteristics by applying post-stratification weights.

Overall, weighted results were very similar across waves and new and repeat respondents for the key demographic variables of age, race, gender, and education. Figure 43 shows that respondents who took all three waves of the survey were more likely to have more years of education than new respondents.

Figure 43. Demographics of Survey Respondents

Race	Wave 1 only (n=610)	Wave 2 only (n=593)	Wave 3 only (n=559)	All waves (n=443)
Race				
Hispanic	38%	41%	37%	36%
White	38%	34%	40%	39%
Black	9%	10%	10%	9%
Asian	7%	8%	7%	9%
Mixed	4%	3%	5%	3%
Native American	1%	2%	1%	1%
Other	2%	1%	1%	1%
Education				
No HS	7%	3%	6%	3%
High school graduate	43%	35%	37%	30%
Some college	27%	25%	22%	25%
2-year	7%	12%	12%	7%
4-year	11%	18%	16%	26%
Post Grad	5%	8%	7%	9%
Gender				
Male	48%	45%	51%	47%

[20] Warren, John Robert, and Andrew Halpern-Manners. "Panel conditioning in longitudinal social science surveys." Sociological Methods & Research 41, no. 4 (2012): 491-534.

Race	Wave 1 only (n=610)	Wave 2 only (n=593)	Wave 3 only (n=559)	All waves (n=443)
Female	52%	55%	49%	53%
Age				
All waves	45 (18-90)	42 (18-90)	45 (18-90)	46 (20-87)

The similarities in demographics between new and repeat respondents across groups give us the ability to use the new respondent groups as counterfactuals and attribute differences between new and repeat respondents to panel conditioning.

We took specific steps to quantify the magnitude of panel conditioning that is present in this study. We examined the effect of panel conditioning on the key outcome variable of awareness of the Conserve Energy SoCal Campaign.

We used a traditional logit model to predict the likelihood of awareness of the Conserve Energy SoCal Campaign. The outcome variable was the "yes/no" answer to the question "Have you ever seen or heard anything about Conserve Energy SoCal." Model results show that the effect of taking the survey in Wave 1 and Wave 2 vs. taking the survey in Wave 2 only was not a significant predictor of Conserve Energy SoCal awareness in Wave 2 (Table 15). We controlled for the demographic variables of age, gender, and education in this model as well as a variable that accounted for respondents' knowledge about how to save energy in their homes.

Table 15. Predicting the Likelihood of Awareness of the Conserve Energy SoCal Campaign in Wave 2

	Coefficient	Marginal Effect (dy/dx)	Standard Error	z	P-value	[95% Confidence Interval]	
Indicator for respondents who took Wave 1 & Wave 2 Surveys	**0.30**	**0.07**	**0.22**	**1.33**	**0.18**	**-0.14**	**0.74**
Age	-0.01	0.00	0.01	-1.17	0.24	-0.02	0.00
Education	-0.07	-0.02	0.08	-0.86	0.39	-0.21	0.08
Gender	0.70	0.17	0.20	3.44	0.00	0.30	1.10
Knowledge	0.00	0.00	0.00	0.07	0.94	0.00	0.00
Constant	-0.32	-	0.56	-0.57	0.57	-1.42	0.77

Similarly, we looked at the effect of taking the survey in all three waves on Wave 3 awareness and the effect was not significant (Table 16). These model results do necessarily indicate that panel conditioning did not occur in this study, rather, the results indicate that for a key indicator of campaign awareness, the differences in answers given between new and repeat respondents was not large enough to be significant.

Table 16. Predicting the Likelihood of Awareness of the Conserve Energy SoCal Campaign in Wave 3

	Coefficient	Marginal Effect (dy/dx)	Standard Error	z	P-value	[95% Confidence Interval]	
Age	0.00	-0.01	0.00	-3.05	0.00	-0.02	0.00
Education	0.00	0.02	0.04	0.46	0.65	-0.06	0.10
Gender	0.04	0.17	0.12	1.50	0.13	-0.05	0.40

	Coefficient	Marginal Effect (dy/dx)	Standard Error	z	P-value	[95% Confidence Interval]	
Knowledge	0.00	0.00	0.00	-1.53	0.13	0.00	0.00
Indicator for respondents who took Wave 1, 2, and 3	-0.01	-0.02	0.12	-0.18	0.86	-0.27	0.22
Constant	-	0.62	0.31	2.00	0.05	0.01	1.23

Appendix C. The Benefits of Split Panel Surveys

Split panel studies have several benefits over static surveys and traditional surveys that are discussed below:

1. Causal Inferences

First, there are three necessary conditions to make causal inferences. The first requirement is time order. Causation is present if the cause precedes the effect. In the case of ME&O programs, conservation behavior resulting from marketing calls-to-action must occur prior to the realization of energy savings in order to attribute a portion or all of the cause of the energy savings to ME&O activities. The second requirement is that causation can occur only if there is an association between the two variables under study. A ME&O activity must address a particular energy savings measure or behavior in order for an association to exist between the ME&O activity and the energy savings measure or behavior. The relationship between ME&O activity and energy savings must be nonspurious; that is, the relationship between ME&O activity and energy savings must not be due to a third variable, such as the availability of a new federal incentive. Panel studies often satisfy the first two necessary conditions (time order and association), given that panel studies represent measurement of variables over time, and are able to associate independent and dependent variables. If designed appropriately, panel studies may also be used to rule out alternative explanations, such as looking at the interactive effects of other energy efficiency actions in the market. However, meeting this third criteria may be challenging. "The panel study is a relatively powerful non-experimental method for examining causality."

2. Measuring change over time

The second benefit of our study is that it allows us to measure change over time. Panel studies are more powerful and often produce more accurate results than cross-sectional studies, as many confounding variables are controlled for when measuring change. Because this split-panel study measures change at the individual level (new respondents), in addition to measuring different sets of potentially matched people at different times (repeat respondents). We were able to isolate individual differences between participants. This eliminates a key set of potential confounding variables.

3. Collect data to inform formative and summative evaluation objectives concurrently

Panel studies also enable evaluators to conduct both formative and summative evaluations concurrently. Formative evaluation focuses on "ways of improving and enhancing programs rather than rendering definitive judgment about effectiveness" (Patton 2008). Formative evaluation contrasts with summative evaluation. "Summative evaluations judge the overall effectiveness of a program and are particularly important in making decisions about continuing or terminating an experimental program or demonstration product." Given that panel studies include data collection at multiple time points, both continuous improvement and effectiveness data can be collected and analyzed.

4. Track behavior changes and market trends.

Finally, panel studies can reveal shifting attitudes and patterns of behavior that might go unnoticed with other research approaches. This is particularly useful for tracking behavior changes and market trends. For example, a panel study can track customers' attitudes toward a utility throughout the campaign lifecycle. Consider the campaign theory of change model outlined in Table 1: The objective of marketing is for customers to first become aware of an offering, then develop attitudes and beliefs about the offering, and finally for customers to take action. A survey conducted at a particular point in

time might capture how many people are at various points in the campaign lifecycle, but not illuminate the success of the campaign due to the snapshot nature of the survey.

(A) Making comparisons between respondents who took all waves of the survey allow us to isolating several confounding variables. Because panel studies measure change at the individual level, as compared to measuring different sets of potentially matched people at different times, individual differences between participants can be isolated. This eliminates a key set of potential confounding variables. Comparisons between respondents who took all waves of the survey also allows us to be able to look at whether a particular customer's attitude changes as they potentially experience more campaign elements. For example, in the Energy Conservation Campaign Focus Group Findings, the data suggested that customers naturally associated conservation with water conservation, due to the drought in California. The split panel study can be used to track if the messaging around energy conservation is differentiating from the water conservation messages people are accustomed to hearing. Knowing customer attitudes and behaviors prior to program implementation, during implementation, and after implementation can help determine ME&O influence on energy savings behavior.

The combination of comparing both all waves (A) and one wave only (B) helps to rule out alternative explanations. While it is often impossible to rule out all causes, the more causes that can be ruled out, the stronger the case for causality. The relationship between ME&O activity and energy savings must be nonspurious; that is, the relationship between ME&O activity and energy savings must not be due to a third variable, such as the availability of a new federal incentive. Panel studies often satisfy the first two necessary conditions (time order and association), given that panel studies represent measurement of variables over time, and are able to associate independent and dependent variables. If designed appropriately, panel studies may also be used to rule out alternative explanations, such as looking at the interactive effects of other energy efficiency actions in the market. However, meeting this third criteria may be challenging. "The panel study is a relatively powerful non-experimental method for examining causality."

Appendix D. Consumption Analysis Approach and Validation

We estimated *ex post* results for each of the Flex Alert events called during the 2016 event period.

D.1 Data Cleaning

D.1.1 AMI Consumption Data

The AMI consumption data was generally of good quality. We received residential AMI consumption data for 233,625 customers in targeted zip codes (over 160 million records) for reference days and event days. After excluding NEM customers and participants in Other SCE residential DR programs, we conducted our statistical analysis on 96% of the remaining customers. Notably, the primary reason for the reduced record count was that some customers had 15-minute interval data and others had 1-hour interval data, so we rolled all intervals up to 1-hour, which meant that we aggregated about 30% of the records to the hourly level. This appears in Table 17 as a reduced record count, but there was no data loss. We summarize data cleaning steps in the table below.

Table 17. Data Cleaning for Impact Analysis

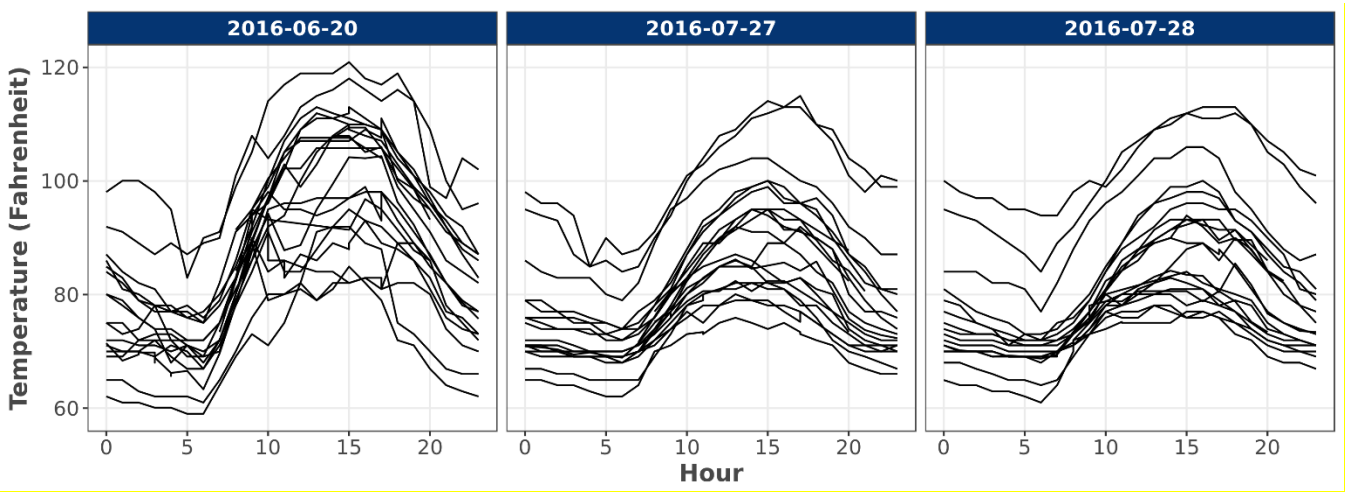
Records (N)	Records (% Remaining)	Customers (N)	Customers (% Remaining)	Drop Reason
160,199,473	100%	233,625	100%	Raw data from Matched Days and Event Days
153,722,484	96%	230,619	99%	Remove Net Energy Metering Customers
115,325,504	72%	230,619	99%	Convert 15-min Intervals to Hourly
111,560,283	70%	223,378	96%	Remove residential SCE DR Program Participants

D.1.2 Weather Data

We gathered weather data from the National Oceanic and Atmospheric Administration's National Centers for Environmental Information, which houses the Integrated Surface Database of hourly weather measurements for thousands of locations across the country. We used 21 weather stations in the targeted zip codes and matched each customer to the nearest weather station to best reflect the temperatures that they experienced. We downloaded hourly weather data from those stations and merged it with consumption data.

Figure 44 shows that the weather stations recorded a range of temperatures on event days. As can be seen, Event 1 was an extremely high temperature day.

Figure 44. Temperatures for All Weather Stations on Event Days



D.2 Estimating Approach

D.2.1 Model Specification

We used a linear fixed-effects regression (LFER) modeling approach for the DR impact analysis. This model accounts for the time-invariant, household-level factors affecting energy use without measuring those factors and entering them explicitly into the model. These factors are contained in a household-specific intercept, or the constant term in the regression equation.

We selected the regression model specification to predict referential load during event days to address specific event day characteristics. Weather is generally the most important predictor of energy consumption. Cooling degree hours (CDH) with base 75 is included in the model as the primary weather variable. The model also includes the hour of the day, as time of day is highly predictive of load.

As is standard practice for DR impact analysis, we tested many models. We selected the final model based on fit with observed load, especially during the hours leading up to the event, and performance of the model for matching load on non-event days. We check multiple models because there are unique situations applicable to the program area that may influence energy consumption. We judged the ultimately selected model fit primarily on replication of observed load during non-event hours, especially the hours before the event, so there is a high level of confidence in the hourly reference estimates during event hours.

We fit separate regressions for each of the three events, using the same model specification. The model specification is as follows:

Equation 1: *Ex Post* Regression Model

$$kw_{it} = \alpha_0 + \alpha_i + \beta_{event} \cdot Event + \beta_{event\ CDH} \cdot Event \cdot CDH_t + \sum_{h=1}^{23} \beta_{hour\ h} \cdot Hour_h + \sum_{h=1}^{23} \beta_{event\ hour\ h} \cdot Event \cdot Hour_h + \beta_{CDH} \cdot CDH_t + \sum_{h=1}^{23} \beta_{cdh\ hour\ h} \cdot CDH_t \cdot Hour_h + \beta_{mornload} \cdot Morning\ Load_i + \sum_{h=1}^{23} \beta_{mornload\ hour\ h} \cdot Morning\ Load_i \cdot Hour_h + \varepsilon_{it}$$

Where:

$\alpha_0 =$ Overall intercept

$\alpha_i =$ Participant specific intercept

ε_{it} = Error term

Event = Indicator variable for event day

Hour = Set of 23 indicator variables for hours of the day

CDH = Base 75 cooling degree hours

CDH by Hour = The interaction of CDH and hour

Morning load = The mean load for the participant for the hours of midnight through 10am for the day

Morning load by Hour = The interaction of morning load and hour

D.2.2 Day Matching

Not all days are included in the data used in the regression model. For example, including cool days when air conditioning is not used does not add useful information for modeling what happens on the hottest days, when events are called. For each event day, we used Mahalanobis distance matching to select nine non-event days that best matched the hourly profile of the event day. Mahalanobis distance matching minimizes the difference between the event and non-event day temperatures at each hour, corrected for the measured variation in temperature at that hour and the correlation of temperature between hours. In order to estimate reference load correctly, the matched days need to cover the range of temperatures experienced on event days (blue) and non-event days (gray). One event day, June 20, 2016, had significantly higher temperatures than all of the other days in the 2016 peak season. For this day, we still used the top nine matched days for modeling (similar to what we did for the other two event days), but checked models that included additional terms such as functions of CDH and interactions between CDH and the other variables, to help adjust for the higher temperatures. Figure 45 provides event day and non-event day temperatures prior to matching, while Figure 46 provides event and matched non-event day temperatures.

Figure 45. Event Day and Non-Event Day Temperatures before Matching

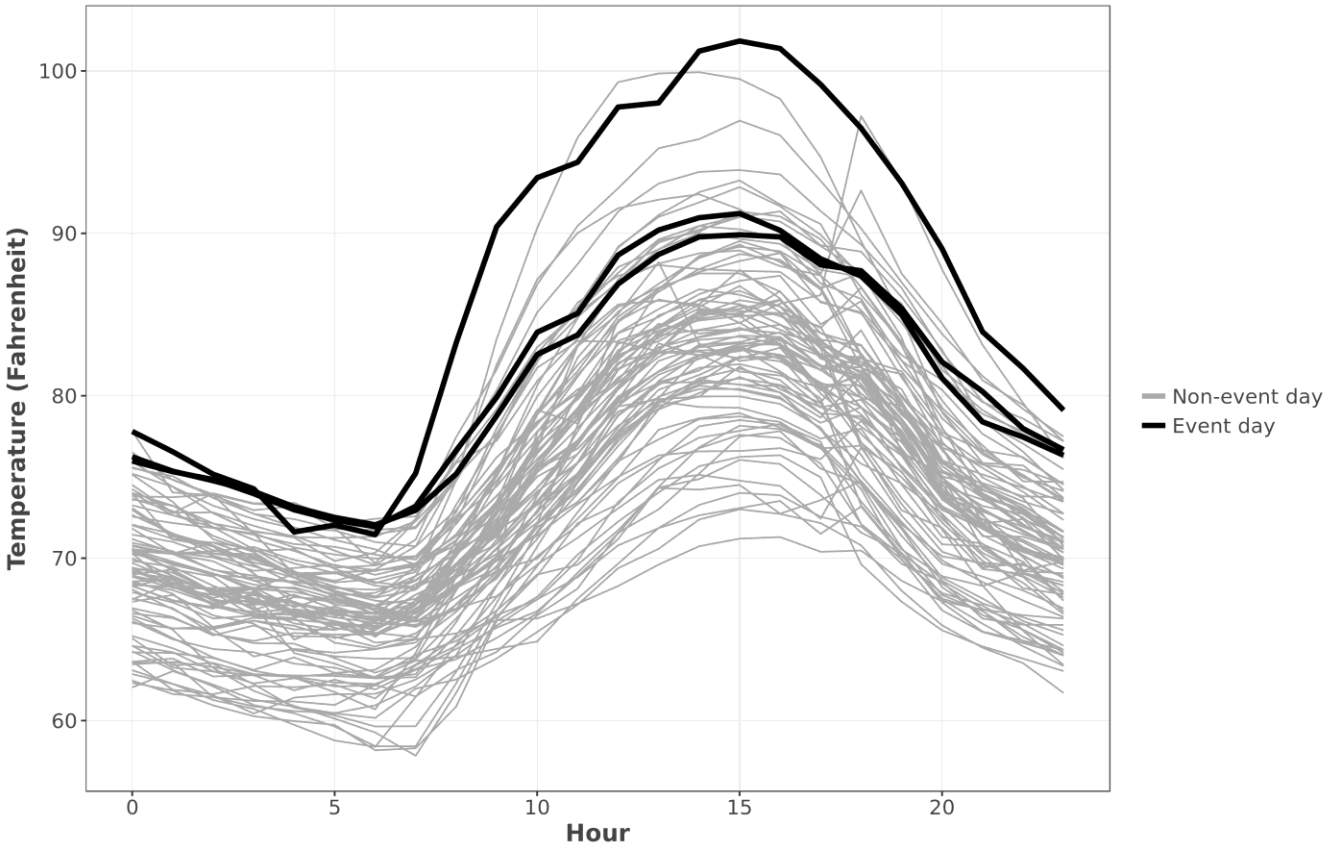
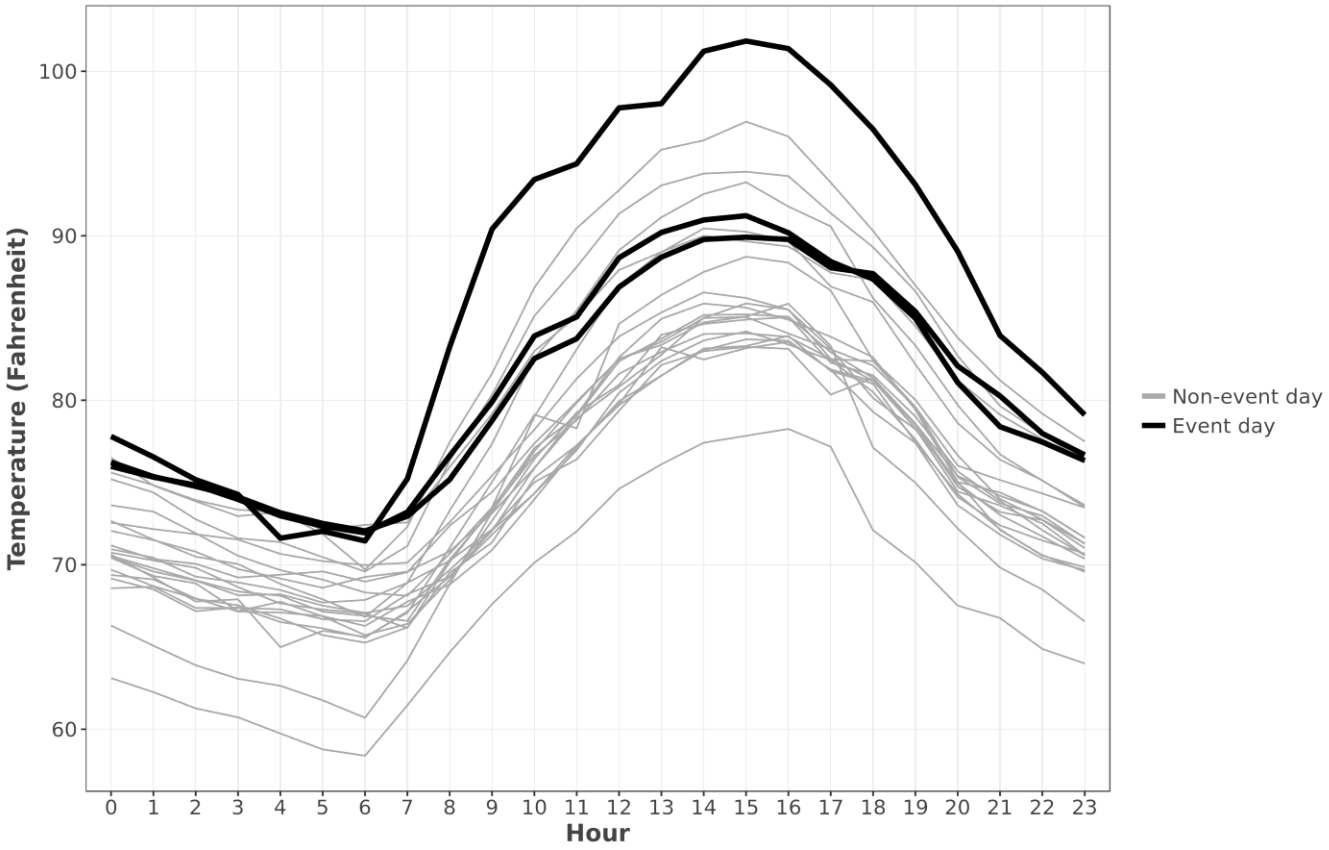


Figure 46. Event Day and Non-Event Day Temperatures after Matching



D.2.3 Model Validation

We tested a range of models before choosing a final specification. The primary method for evaluating the validity of a linear fixed effects model is to compare observed energy consumption to the consumption predicted by the model. When observed and modeled load (e.g., reference load) are similar, especially on event day mornings and on non-event days with weather similar to event days, it shows that the model is effectively estimating the reference load.

Figures 7, 9, and 10 below compare observed energy consumption and the energy consumption predicted by the model on a non-event day (e.g., reference load) for the models used for each of the three events. In all cases, the observed runtime falls within the 90% confidence interval of the modeled runtime, which helps confirm that the models' event-day reference loads are accurate.

In addition to predictive power, we also considered adjusted R-squared and Akaike's Information Criterion (AIC)[21] in model selection. We chose models that maximized adjusted R-squared and minimized AIC (see Table 21 through Table 23 for these values). We used bootstrapped variance estimation to adjust confidence intervals for heteroscedasticity and autocorrelation.

Figure 47 presents observed versus reference load on nine non-event days for event one. Overall, given that this event was one of the hottest of the year, we have concerns regarding the quality of the

[21] AIC balances predictive power and model parsimony, and thus helps guard against overfitting. For more, see: Palin and Haugh. "Eliminating the Guesswork: The Information Theoretic Approach to Model Selection." 2007 International Energy Program Evaluation Conference, Chicago, IL.

reference days to modeled days. Specifically, the model appears to do a poor job of estimating demand impacts during high demand periods.

Figure 47. Observed vs Reference Load on a Non-Event Day, Event 1 Model

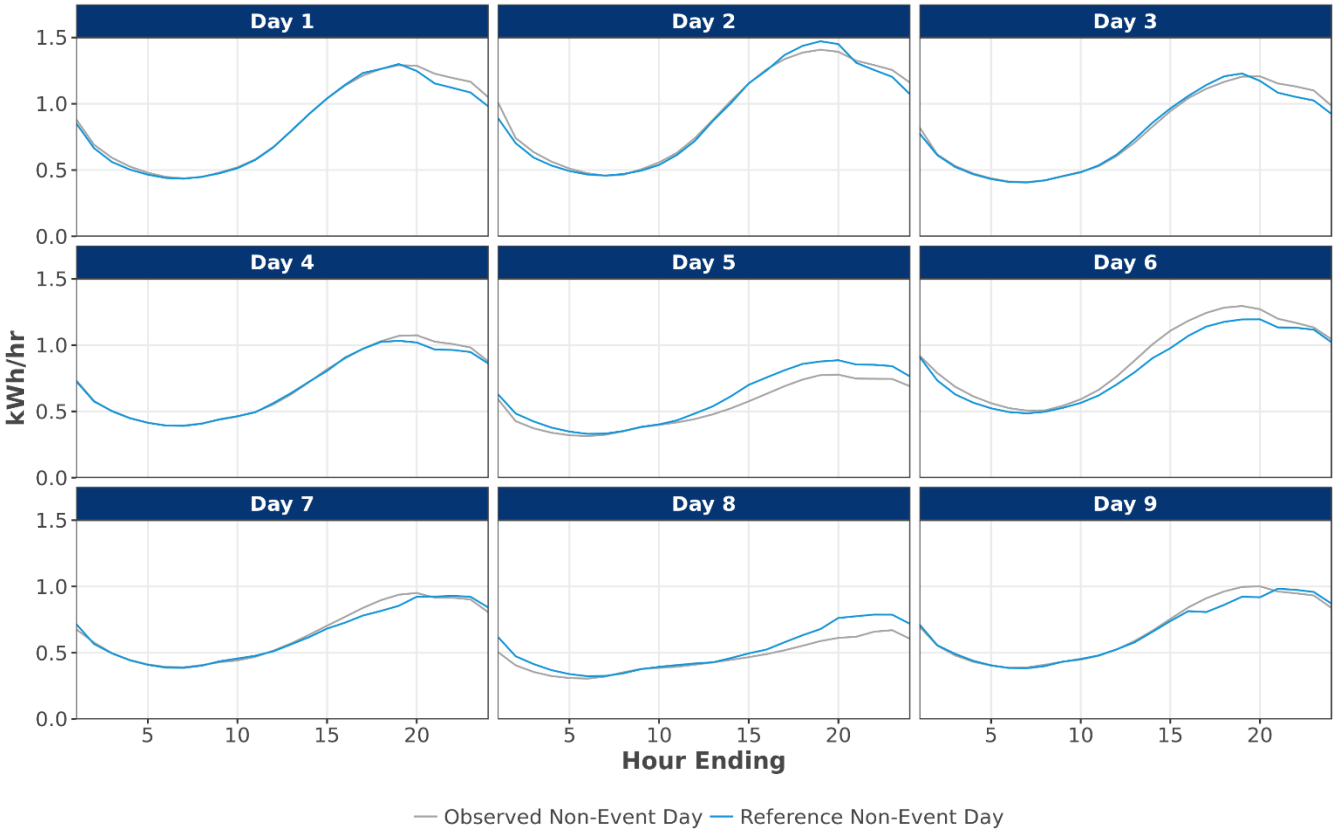


Figure 48 provides the observed hourly consumption for Event 1 and observed hourly consumption for non-event reference days. This demonstrates that the observed consumption was substantially higher on that day (Event 1) than all other matched days, likely due to the extremely high temperatures. This, along with the information presented in Figure 7, underscores that the unusually hot weather event (Event 1) was very different (in terms of observed usage) to the non-event days available to construct the underlying model. Given the fact that the model already was challenged (as demonstrated in Figure 7) to adequately estimate high demand periods, the extreme temperature (and observed demand) during Event 1 likely further compromised the model's ability to estimate reference consumption.

Figure 48. Mean Observed kWh/hr Consumption on Event 1 and Non-Event Reference Days

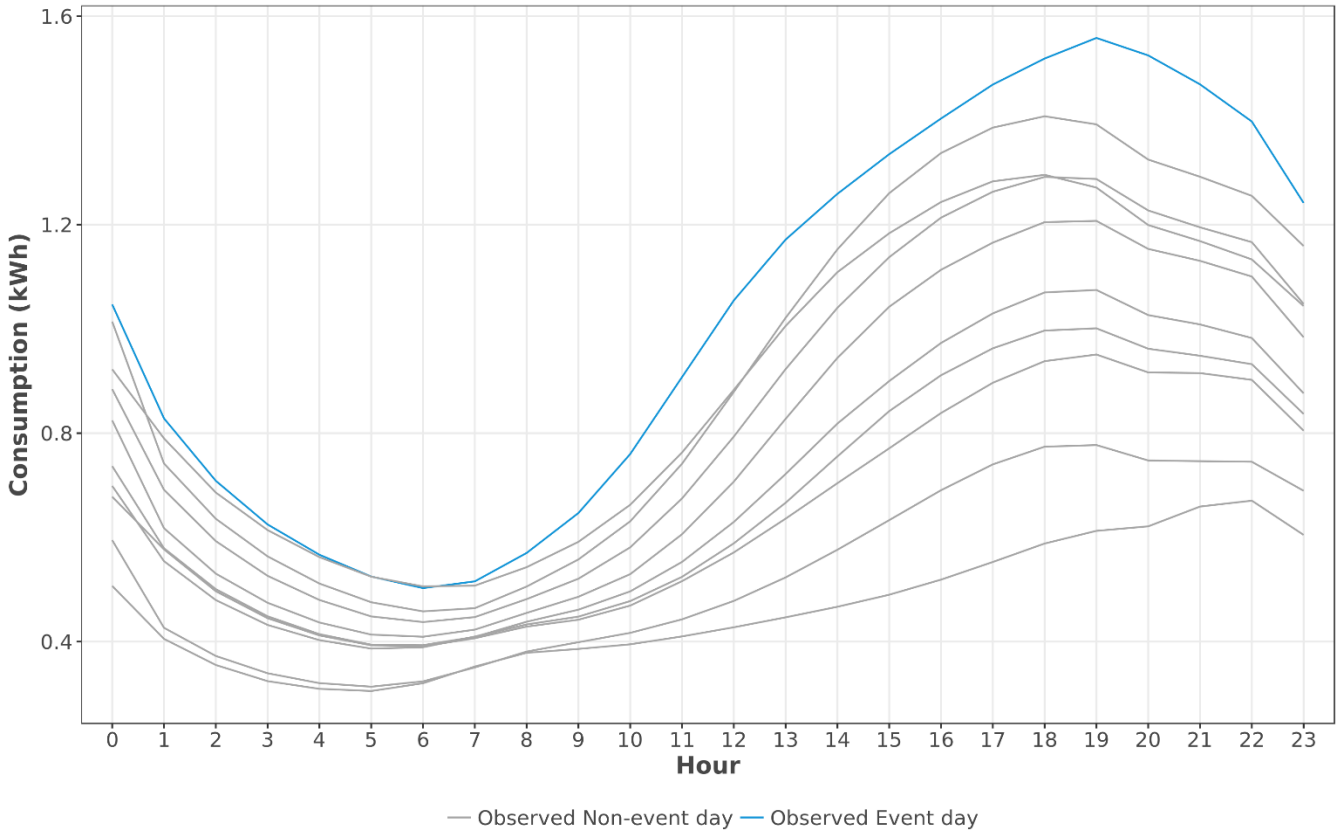


Figure 49 presents observed versus reference load on a non-event day for Event 2. Overall, the vast majority of observed non-event days are well matched to the reference non-event day.

Figure 49. Observed vs Reference Load on a Non-Event Day, Event 2 Model

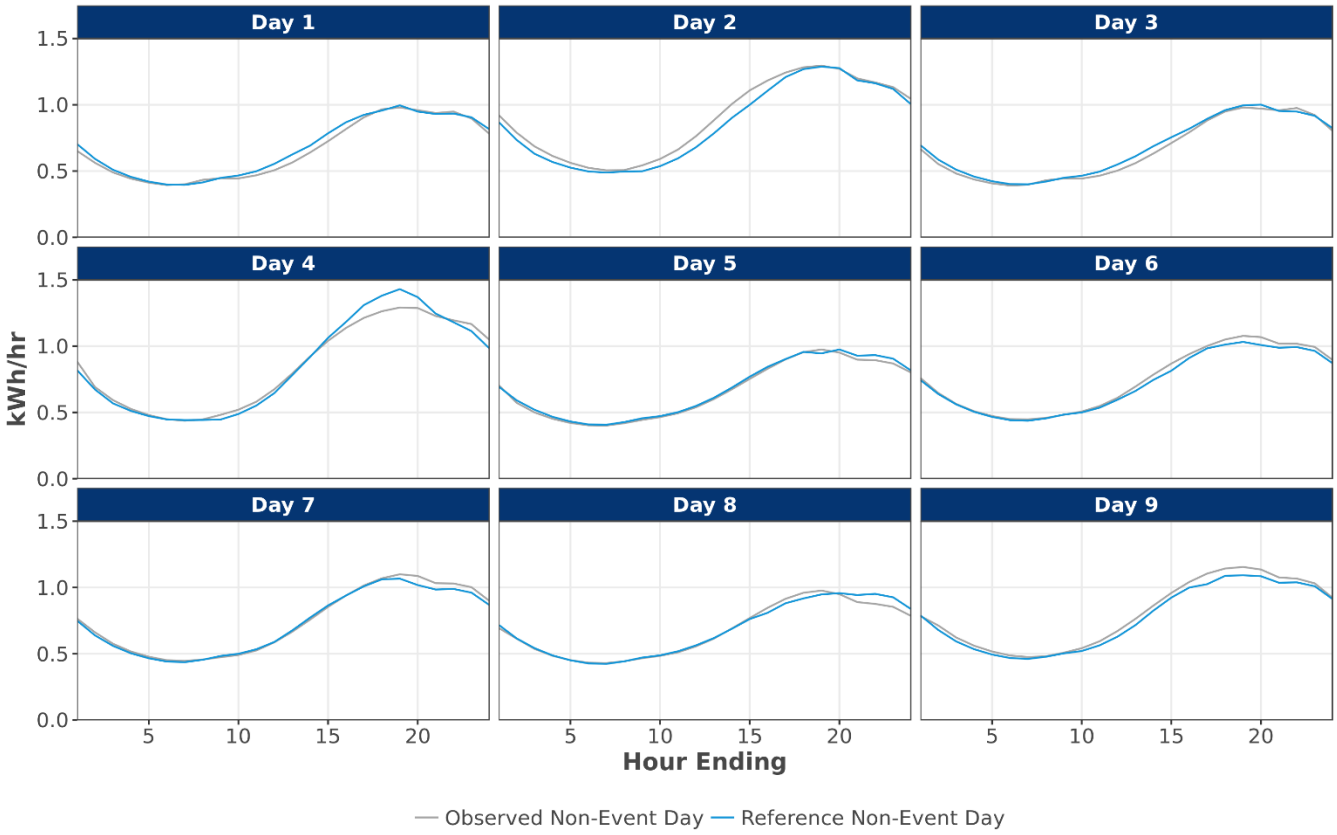
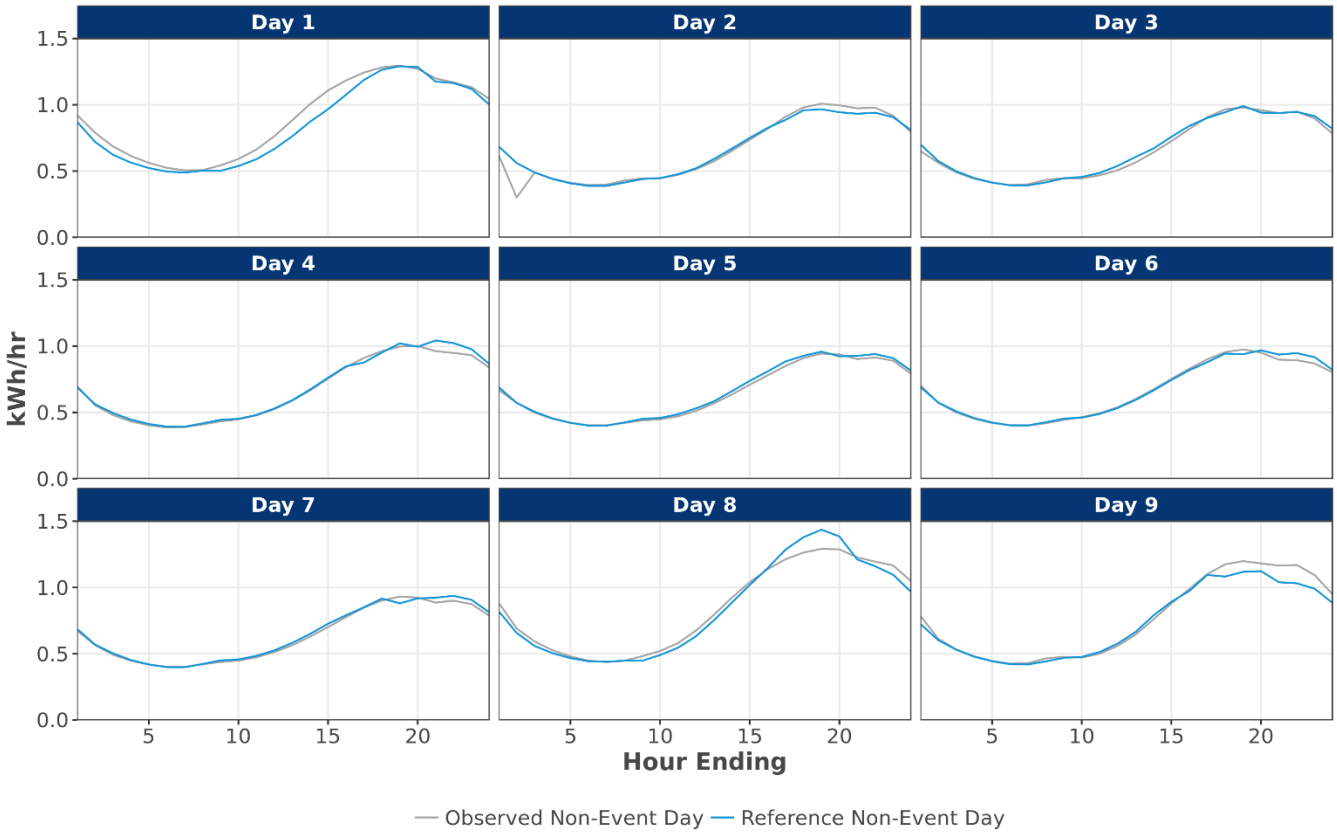


Figure 50 presents observed versus reference load on a non-event day for Event 3. Overall, the vast majority of observed non-event days are well matched to the reference non-event day. Notably, the second non-event day (2) was not included in our estimate given missing data in the early morning hours.

Figure 50. Observed vs Reference Load on a Non-Event Day, Event 3 Model



D.3 Detailed Results

Table 18 through Table 20 below provide detailed estimated impacts for each of the Aliso Canyon Flex Alert events, including both kW and kWh impacts.

Table 18. Event 1 Estimated Impacts

Hour Ending	Estimated Reference Load (kWh/hr)	Observed Load (kWh/hr)	Estimated Load Impact (kWh/hr)	Temp (F)	Uncertainty Adjusted Impact - Percentiles				
					10th	30th	50th	70th	90th
1	1.04	1.05	-0.005	77.8	-0.009	-0.007	-0.005	-0.004	-0.002
2	0.81	0.83	-0.019	76.6	-0.024	-0.021	-0.019	-0.017	-0.014
3	0.69	0.71	-0.019	75.2	-0.024	-0.021	-0.019	-0.017	-0.015
4	0.61	0.62	-0.016	74.3	-0.021	-0.018	-0.016	-0.015	-0.012
5	0.55	0.57	-0.014	71.6	-0.019	-0.016	-0.014	-0.012	-0.009
6	0.51	0.52	-0.011	72.0	-0.015	-0.013	-0.011	-0.009	-0.006
7	0.49	0.50	-0.009	71.5	-0.014	-0.011	-0.009	-0.008	-0.005
8	0.49	0.52	-0.025	75.2	-0.030	-0.027	-0.025	-0.022	-0.019

Hour Ending	Estimated Reference Load (kWh/hr)	Observed Load (kWh/hr)	Estimated Load Impact (kWh/hr)	Temp (F)	Uncertainty Adjusted Impact - Percentiles				
					10th	30th	50th	70th	90th
9	0.50	0.57	-0.070	83.3	-0.077	-0.073	-0.070	-0.066	-0.062
10	0.57	0.65	-0.076	90.4	-0.083	-0.079	-0.076	-0.073	-0.069
11	0.68	0.76	-0.084	93.4	-0.091	-0.087	-0.084	-0.081	-0.077
12	0.82	0.91	-0.091	94.4	-0.098	-0.094	-0.091	-0.088	-0.083
13	0.97	1.05	-0.088	97.8	-0.095	-0.091	-0.088	-0.085	-0.081
14	1.10	1.17	-0.068	98.0	-0.075	-0.071	-0.068	-0.064	-0.060
15	1.22	1.26	-0.044	101.2	-0.051	-0.047	-0.044	-0.041	-0.036
16	1.34	1.34	0.003	101.8	-0.005	0.000	0.003	0.006	0.011
17	1.44	1.40	0.037	101.4	0.030	0.034	0.037	0.040	0.045
18	1.54	1.47	0.075	99.2	0.068	0.073	0.075	0.078	0.083
19	1.60	1.52	0.086	96.5	0.080	0.083	0.086	0.089	0.093
20	1.58	1.56	0.026	93.1	0.020	0.023	0.026	0.028	0.031
21	1.51	1.52	-0.019	89.1	-0.024	-0.021	-0.019	-0.017	-0.014
22	1.43	1.47	-0.038	83.9	-0.043	-0.040	-0.038	-0.036	-0.033
23	1.36	1.40	-0.038	81.7	-0.042	-0.040	-0.038	-0.036	-0.033
24	1.21	1.24	-0.033	79.1	-0.038	-0.035	-0.033	-0.031	-0.028
Day	Reference Energy Use (kWh)	Observed Energy Use (kWh)	Change in Energy Use (kWh)	Cooling Degree Hours (Base 75)	Uncertainty Adjusted Impact - Percentiles				
					10th	30th	50th	70th	90th
June 20	24.1	24.6	-0.54	315	-0.57	-0.55	-0.54	-0.53	-0.51

Table 19. Event 2 Estimated Impacts

Hour Ending	Estimated Reference Load (kWh/hr)	Observed Load (kWh/hr)	Estimated Load Impact (kWh/hr)	Temp (F)	Uncertainty Adjusted Impact - Percentiles				
					10th	30th	50th	70th	90th
1	0.93	0.94	-0.008	76.0	-0.011	-0.009	-0.008	-0.007	-0.006
2	0.78	0.78	0.004	75.3	0.001	0.003	0.004	0.006	0.008
3	0.68	0.68	0.003	74.8	0.000	0.002	0.003	0.005	0.007
4	0.61	0.61	0.007	74.0	0.003	0.005	0.007	0.008	0.010
5	0.57	0.56	0.010	73.0	0.007	0.009	0.010	0.012	0.014
6	0.53	0.52	0.013	72.3	0.010	0.012	0.013	0.015	0.016
7	0.52	0.50	0.017	71.9	0.013	0.015	0.017	0.018	0.020
8	0.53	0.51	0.018	73.2	0.015	0.017	0.018	0.019	0.021
9	0.55	0.54	0.003	76.6	-0.001	0.001	0.003	0.004	0.007
10	0.59	0.59	-0.002	79.9	-0.006	-0.004	-0.002	0.000	0.002
11	0.65	0.66	-0.008	83.9	-0.013	-0.010	-0.008	-0.006	-0.003
12	0.73	0.75	-0.013	85.1	-0.018	-0.015	-0.013	-0.011	-0.008
13	0.85	0.86	-0.010	88.7	-0.017	-0.013	-0.010	-0.008	-0.004
14	0.96	0.98	-0.013	90.2	-0.019	-0.016	-0.013	-0.011	-0.007
15	1.08	1.09	-0.007	91.0	-0.013	-0.010	-0.007	-0.005	-0.001
16	1.16	1.17	-0.004	91.2	-0.010	-0.006	-0.004	-0.002	0.002
17	1.25	1.22	0.029	90.2	0.024	0.027	0.029	0.032	0.035
18	1.31	1.26	0.050	88.4	0.045	0.048	0.050	0.052	0.055
19	1.35	1.28	0.064	87.4	0.059	0.062	0.064	0.065	0.068
20	1.34	1.28	0.061	85.0	0.057	0.060	0.061	0.063	0.065
21	1.27	1.24	0.037	81.1	0.033	0.035	0.037	0.039	0.041
22	1.24	1.22	0.019	78.4	0.015	0.017	0.019	0.020	0.022
23	1.21	1.21	0.002	77.5	-0.002	0.000	0.002	0.003	0.005
24	1.09	1.10	-0.006	76.3	-0.010	-0.008	-0.006	-0.005	-0.003
Day	**Reference Energy Use (kWh)**	**Observed Energy Use (kWh)**	**Change in Energy Use (kWh)**	**Cooling Degree Hours (Base 75)**	**Uncertainty Adjusted Impact - Percentiles**				
					10th	30th	50th	70th	90th
July 27	21.8	21.5	0.26	181	0.24	0.26	0.26	0.27	0.29

Table 20. Event 3 Estimated Impacts

Hour Ending	Estimated Reference Load (kWh/hr)	Observed Load (kWh/hr)	Estimated Load Impact (kWh/hr)	Temp (F)	Uncertainty Adjusted Impact - Percentiles				
					10th	30th	50th	70th	90th
1	0.92	0.93	-0.008	76.2	-0.010	-0.009	-0.008	-0.007	-0.005
2	0.78	0.80	-0.016	75.4	-0.020	-0.018	-0.016	-0.015	-0.013
3	0.67	0.69	-0.020	74.8	-0.023	-0.022	-0.020	-0.019	-0.017
4	0.60	0.62	-0.015	74.1	-0.018	-0.016	-0.015	-0.013	-0.011
5	0.56	0.56	-0.009	73.2	-0.012	-0.010	-0.009	-0.008	-0.006
6	0.52	0.53	-0.005	72.5	-0.008	-0.006	-0.005	-0.004	-0.002
7	0.51	0.51	0.000	72.1	-0.003	-0.001	0.000	0.001	0.003
8	0.52	0.51	0.007	73.0	0.003	0.005	0.007	0.008	0.010
9	0.54	0.54	0.001	75.2	-0.002	0.000	0.001	0.003	0.005
10	0.58	0.59	-0.006	78.8	-0.010	-0.008	-0.006	-0.004	-0.002
11	0.64	0.65	-0.009	82.5	-0.013	-0.011	-0.009	-0.007	-0.005
12	0.72	0.73	-0.015	83.7	-0.020	-0.017	-0.015	-0.013	-0.010
13	0.82	0.83	-0.013	86.9	-0.018	-0.015	-0.013	-0.011	-0.007
14	0.93	0.94	-0.012	88.7	-0.017	-0.014	-0.012	-0.009	-0.006
15	1.03	1.04	-0.013	89.8	-0.018	-0.015	-0.013	-0.010	-0.007
16	1.13	1.13	0.000	89.9	-0.005	-0.002	0.000	0.002	0.006
17	1.21	1.20	0.011	89.8	0.006	0.009	0.011	0.013	0.017
18	1.29	1.25	0.036	88.1	0.032	0.034	0.036	0.038	0.041
19	1.32	1.28	0.036	87.7	0.032	0.035	0.036	0.038	0.041
20	1.32	1.27	0.046	85.4	0.042	0.044	0.046	0.047	0.050
21	1.24	1.22	0.016	82.1	0.012	0.015	0.016	0.018	0.020
22	1.22	1.21	0.009	80.3	0.005	0.008	0.009	0.011	0.013
23	1.19	1.19	-0.005	78.0	-0.009	-0.006	-0.005	-0.004	-0.001
24	1.07	1.08	-0.013	76.7	-0.017	-0.014	-0.013	-0.012	-0.009
Day	**Reference Energy Use (kWh)**	**Observed Energy Use (kWh)**	**Change in Energy Use (kWh)**	**Cooling Degree Hours (Base 75)**	**Uncertainty Adjusted Impact - Percentiles**				
					10th	30th	50th	70th	90th
July 28	21.3	21.3	0.01	175	-0.02	0.00	0.01	0.01	0.03

Table 21 through Table 23 provide the modeled coefficient, standard errors and adjusted R-squared for each event.

Table 21. Event 1 Model Coefficients and Standard Errors

Term	Estimate	Std error	T-statistic
hour1	-0.151	9.9E-04	-152
hour2	-0.187	9.9E-04	-189
hour3	-0.209	9.9E-04	-212
hour4	-0.220	9.9E-04	-223
hour5	-0.219	9.9E-04	-222
hour6	-0.199	9.9E-04	-202
hour7	-0.168	9.9E-04	-170
hour8	-0.143	1.0E-03	-142
hour9	-0.137	1.1E-03	-128
hour10	-0.144	1.1E-03	-130
hour11	-0.149	1.2E-03	-129
hour12	-0.167	1.2E-03	-141
hour13	-0.172	1.2E-03	-144
hour14	-0.167	1.2E-03	-141
hour15	-0.156	1.2E-03	-133
hour16	-0.126	1.1E-03	-109
hour17	-0.073	1.1E-03	-65
hour18	0.019	1.1E-03	17
hour19	0.116	1.0E-03	113
hour20	0.129	1.0E-03	127
hour21	0.128	1.0E-03	126
hour22	0.124	1.0E-03	122
hour23	0.070	1.0E-03	69
event	0.014	2.2E-03	6
cdh	0.025	1.4E-04	181
mornload	0.926	8.9E-04	1043
hour1:event	0.035	3.0E-03	12
hour2:event	0.035	3.1E-03	11
hour3:event	0.027	3.0E-03	9

Term	Estimate	Std error	T-statistic
hour4:event	0.021	3.0E-03	7
hour5:event	0.012	3.0E-03	4
hour6:event	0.009	3.0E-03	3
hour7:event	0.050	3.4E-03	15
hour8:event	0.170	4.2E-03	41
hour9:event	0.187	3.5E-03	53
hour10:event	0.208	3.3E-03	64
hour11:event	0.226	3.1E-03	72
hour12:event	0.219	3.1E-03	71
hour13:event	0.165	3.1E-03	53
hour14:event	0.102	3.1E-03	33
hour15:event	-0.023	3.1E-03	-7
hour16:event	-0.114	3.1E-03	-36
hour17:event	-0.216	3.1E-03	-69
hour18:event	-0.244	3.1E-03	-79
hour19:event	-0.082	3.0E-03	-27
hour20:event	0.037	3.0E-03	12
hour21:event	0.087	2.9E-03	29
hour22:event	0.086	2.9E-03	29
hour23:event	0.073	2.9E-03	25
hour1:cdh	-0.011	1.9E-04	-60
hour2:cdh	-0.016	2.3E-04	-71
hour3:cdh	-0.018	2.2E-04	-86
hour4:cdh	-0.020	2.2E-04	-91
hour5:cdh	-0.020	2.1E-04	-94
hour6:cdh	-0.021	2.2E-04	-100
hour7:cdh	-0.024	2.3E-04	-103
hour8:cdh	-0.027	2.4E-04	-113
hour9:cdh	-0.024	1.8E-04	-131
hour10:cdh	-0.020	1.6E-04	-125
hour11:cdh	-0.015	1.6E-04	-97
hour12:cdh	-0.009	1.5E-04	-59

Term	Estimate	Std error	T-statistic
hour13:cdh	-0.003	1.5E-04	-20
hour14:cdh	0.002	1.5E-04	14
hour15:cdh	0.009	1.5E-04	57
hour16:cdh	0.015	1.5E-04	96
hour17:cdh	0.021	1.5E-04	135
hour18:cdh	0.027	1.6E-04	172
hour19:cdh	0.031	1.7E-04	181
hour20:cdh	0.021	1.7E-04	125
hour21:cdh	0.013	1.7E-04	78
hour22:cdh	0.007	1.7E-04	40
hour23:cdh	0.001	1.7E-04	4
hour1:mornload	0.008	1.1E-03	7
hour2:mornload	-0.056	1.1E-03	-49
hour3:mornload	-0.123	1.1E-03	-108
hour4:mornload	-0.176	1.1E-03	-155
hour5:mornload	-0.225	1.1E-03	-197
hour6:mornload	-0.274	1.1E-03	-240
hour7:mornload	-0.307	1.1E-03	-269
hour8:mornload	-0.289	1.1E-03	-252
hour9:mornload	-0.257	1.1E-03	-224
hour10:mornload	-0.199	1.1E-03	-173
hour11:mornload	-0.150	1.1E-03	-131
hour12:mornload	-0.103	1.1E-03	-89
hour13:mornload	-0.062	1.1E-03	-54
hour14:mornload	-0.019	1.1E-03	-17
hour15:mornload	0.015	1.1E-03	13
hour16:mornload	0.045	1.1E-03	39
hour17:mornload	0.066	1.1E-03	57
hour18:mornload	0.066	1.1E-03	57
hour19:mornload	0.070	1.1E-03	61
hour20:mornload	0.071	1.1E-03	62
hour21:mornload	0.110	1.1E-03	96

Term	Estimate	Std error	T-statistic
hour22:mornload	0.120	1.1E-03	105
hour23:mornload	0.075	1.1E-03	65
event:cdh	-0.008	5.4E-05	-145
R squared	Adjusted R squared		
0.60	0.60		

Table 22. Event 2 Model Coefficients and Standard Errors

Term	Estimate	Std error	T-statistic
hour1	-0.122	9.3E-04	-131
hour2	-0.166	9.2E-04	-181
hour3	-0.192	9.2E-04	-209
hour4	-0.204	9.2E-04	-222
hour5	-0.205	9.2E-04	-223
hour6	-0.188	9.2E-04	-205
hour7	-0.149	9.2E-04	-162
hour8	-0.121	9.3E-04	-130
hour9	-0.113	9.6E-04	-118
hour10	-0.105	1.0E-03	-103
hour11	-0.090	1.1E-03	-82
hour12	-0.087	1.1E-03	-77
hour13	-0.079	1.1E-03	-70
hour14	-0.073	1.1E-03	-65
hour15	-0.056	1.1E-03	-51
hour16	-0.002	1.1E-03	-2
hour17	0.044	1.0E-03	43
hour18	0.133	9.8E-04	135
hour19	0.221	9.4E-04	235
hour20	0.208	9.3E-04	223
hour21	0.196	9.3E-04	211
hour22	0.164	9.3E-04	176

Term	Estimate	Std error	T-statistic
hour23	0.094	9.3E-04	101
event	0.073	1.7E-03	42
cdh	0.023	2.1E-04	111
mornload	0.804	8.1E-04	987
hour1:event	-0.032	2.5E-03	-13
hour2:event	-0.030	2.4E-03	-12
hour3:event	-0.038	2.4E-03	-16
hour4:event	-0.048	2.4E-03	-20
hour5:event	-0.054	2.4E-03	-22
hour6:event	-0.063	2.4E-03	-26
hour7:event	-0.066	2.4E-03	-27
hour8:event	-0.029	2.5E-03	-12
hour9:event	-0.016	2.5E-03	-6
hour10:event	-0.002	2.5E-03	-1
hour11:event	0.011	2.5E-03	4
hour12:event	0.005	2.6E-03	2
hour13:event	0.011	2.6E-03	4
hour14:event	-0.003	2.6E-03	-1
hour15:event	-0.011	2.6E-03	-4
hour16:event	-0.093	2.5E-03	-37
hour17:event	-0.144	2.5E-03	-57
hour18:event	-0.177	2.5E-03	-71
hour19:event	-0.171	2.5E-03	-69
hour20:event	-0.112	2.5E-03	-45
hour21:event	-0.066	2.5E-03	-27
hour22:event	-0.025	2.5E-03	-10
hour23:event	-0.005	2.5E-03	-2
hour1:cdh	-0.013	3.0E-04	-42
hour2:cdh	-0.040	9.0E-04	-45
hour3:cdh	-0.044	9.0E-04	-49
hour4:cdh	-0.048	9.1E-04	-52
hour5:cdh	-0.049	9.2E-04	-53

Term	Estimate	Std error	T-statistic
hour6:cdh	-0.051	9.0E-04	-57
hour7:cdh	-0.060	7.0E-04	-85
hour8:cdh	-0.038	3.6E-04	-104
hour9:cdh	-0.026	2.6E-04	-99
hour10:cdh	-0.022	2.4E-04	-93
hour11:cdh	-0.018	2.4E-04	-77
hour12:cdh	-0.012	2.3E-04	-50
hour13:cdh	-0.005	2.2E-04	-24
hour14:cdh	0.001	2.2E-04	5
hour15:cdh	0.008	2.2E-04	37
hour16:cdh	0.015	2.2E-04	68
hour17:cdh	0.026	2.3E-04	112
hour18:cdh	0.035	2.4E-04	149
hour19:cdh	0.044	2.6E-04	166
hour20:cdh	0.036	2.8E-04	131
hour21:cdh	0.024	2.8E-04	84
hour22:cdh	0.017	2.8E-04	58
hour23:cdh	0.008	2.8E-04	27
hour1:mornload	0.042	1.0E-03	42
hour2:mornload	-0.017	1.0E-03	-17
hour3:mornload	-0.078	1.0E-03	-77
hour4:mornload	-0.128	1.0E-03	-126
hour5:mornload	-0.174	1.0E-03	-172
hour6:mornload	-0.217	1.0E-03	-214
hour7:mornload	-0.258	1.0E-03	-255
hour8:mornload	-0.256	1.0E-03	-252
hour9:mornload	-0.238	1.0E-03	-235
hour10:mornload	-0.194	1.0E-03	-191
hour11:mornload	-0.155	1.0E-03	-153
hour12:mornload	-0.115	1.0E-03	-113
hour13:mornload	-0.076	1.0E-03	-75
hour14:mornload	-0.029	1.0E-03	-28

Term	Estimate	Std error	T-statistic
hour15:mornload	0.005	1.0E-03	5
hour16:mornload	0.032	1.0E-03	32
hour17:mornload	0.044	1.0E-03	43
hour18:mornload	0.037	1.0E-03	36
hour19:mornload	0.034	1.0E-03	34
hour20:mornload	0.036	1.0E-03	35
hour21:mornload	0.079	1.0E-03	78
hour22:mornload	0.093	1.0E-03	92
hour23:mornload	0.053	1.0E-03	52
event:cdh	-0.002	8.2E-05	-25
R squared	Adjusted R squared		
0.61	0.61		

Table 23. Event 3 Model Coefficients and Standard Errors

Term	Estimate	Std error	T-statistic
hour1	-0.128	9.3E-04	-137
hour2	-0.177	9.0E-04	-197
hour3	-0.201	9.0E-04	-224
hour4	-0.213	9.0E-04	-237
hour5	-0.213	9.0E-04	-237
hour6	-0.195	9.0E-04	-218
hour7	-0.153	9.0E-04	-171
hour8	-0.125	9.1E-04	-137
hour9	-0.122	9.3E-04	-131
hour10	-0.113	9.8E-04	-115
hour11	-0.099	1.0E-03	-94
hour12	-0.091	1.1E-03	-84
hour13	-0.085	1.1E-03	-77
hour14	-0.076	1.1E-03	-70
hour15	-0.065	1.1E-03	-61

Term	Estimate	Std error	T-statistic
hour16	-0.019	1.0E-03	-18
hour17	0.030	1.0E-03	30
hour18	0.127	9.6E-04	132
hour19	0.213	9.2E-04	231
hour20	0.211	9.1E-04	231
hour21	0.203	9.1E-04	223
hour22	0.168	9.1E-04	185
hour23	0.092	9.1E-04	101
event	0.030	1.8E-03	17
cdh	0.024	2.1E-04	117
mornload	0.830	8.2E-04	1016
hour1:event	0.020	2.5E-03	8
hour2:event	0.029	2.4E-03	12
hour3:event	0.015	2.4E-03	6
hour4:event	0.001	2.4E-03	1
hour5:event	-0.009	2.4E-03	-4
hour6:event	-0.021	2.4E-03	-9
hour7:event	-0.037	2.4E-03	-15
hour8:event	-0.024	2.4E-03	-10
hour9:event	-0.006	2.5E-03	-2
hour10:event	0.002	2.5E-03	1
hour11:event	0.016	2.5E-03	7
hour12:event	0.011	2.5E-03	5
hour13:event	0.009	2.5E-03	3
hour14:event	0.012	2.5E-03	5
hour15:event	-0.021	2.5E-03	-8
hour16:event	-0.048	2.5E-03	-19
hour17:event	-0.111	2.5E-03	-45
hour18:event	-0.111	2.5E-03	-45
hour19:event	-0.134	2.5E-03	-54
hour20:event	-0.060	2.4E-03	-25
hour21:event	-0.043	2.4E-03	-17

Term	Estimate	Std error	T-statistic
hour22:event	-0.007	2.4E-03	-3
hour23:event	0.013	2.4E-03	5
hour1:cdh	-0.013	3.0E-04	-44
hour2:cdh	-0.038	9.1E-04	-42
hour3:cdh	-0.042	9.0E-04	-47
hour4:cdh	-0.046	9.1E-04	-50
hour5:cdh	-0.046	9.3E-04	-50
hour6:cdh	-0.048	9.0E-04	-53
hour7:cdh	-0.055	7.4E-04	-74
hour8:cdh	-0.038	3.8E-04	-101
hour9:cdh	-0.025	2.6E-04	-97
hour10:cdh	-0.023	2.4E-04	-95
hour11:cdh	-0.019	2.3E-04	-81
hour12:cdh	-0.013	2.2E-04	-61
hour13:cdh	-0.007	2.2E-04	-33
hour14:cdh	-0.001	2.2E-04	-7
hour15:cdh	0.006	2.2E-04	29
hour16:cdh	0.014	2.2E-04	66
hour17:cdh	0.026	2.2E-04	118
hour18:cdh	0.036	2.3E-04	156
hour19:cdh	0.047	2.6E-04	182
hour20:cdh	0.025	2.6E-04	99
hour21:cdh	0.014	2.6E-04	53
hour22:cdh	0.008	2.6E-04	30
hour23:cdh	0.001	2.6E-04	2
hour1:mornload	0.023	1.0E-03	22
hour2:mornload	-0.015	1.0E-03	-14
hour3:mornload	-0.073	1.0E-03	-71
hour4:mornload	-0.121	1.0E-03	-118
hour5:mornload	-0.165	1.0E-03	-161
hour6:mornload	-0.206	1.0E-03	-201
hour7:mornload	-0.244	1.0E-03	-238

Term	Estimate	Std error	T-statistic
hour8:mornload	-0.248	1.0E-03	-241
hour9:mornload	-0.239	1.0E-03	-232
hour10:mornload	-0.200	1.0E-03	-195
hour11:mornload	-0.165	1.0E-03	-160
hour12:mornload	-0.124	1.0E-03	-121
hour13:mornload	-0.090	1.0E-03	-87
hour14:mornload	-0.043	1.0E-03	-42
hour15:mornload	-0.008	1.0E-03	-8
hour16:mornload	0.024	1.0E-03	23
hour17:mornload	0.040	1.0E-03	39
hour18:mornload	0.035	1.0E-03	34
hour19:mornload	0.037	1.0E-03	36
hour20:mornload	0.056	1.0E-03	55
hour21:mornload	0.104	1.0E-03	101
hour22:mornload	0.115	1.0E-03	112
hour23:mornload	0.074	1.0E-03	72
event:cdh	0.003	8.6E-05	33
R squared	Adjusted R squared		
0.61	0.61		

Appendix E. List of Locations Targeted by the Conserve Energy SoCal Campaign and Flex Alerts

Table 24. Locations Targeted by the Conserve Energy SoCal Campaign and Flex Alerts

City	Zip Code	City	Zip Code	City	Zip Code
AGOURA HILLS	91301	CULVER CITY	90230	LA PUENTE	91744
ALHAMBRA	91801		90232		91746
	91802	CYPRESS	90630		91747
	91803	DIAMOND BAR	91765	LA VERNE	91750
ALTADENA	91001	DOWNEY	90240	LAKEWOOD	90712
ARCADIA	91006		90241		90713
	91007		90242		90714
ARTESIA	90701	DUARTE	91010		90715
AZUSA	91702	EL MONTE	91731	LAWNDALE	90260
BALDWIN PARK	91706		91732	LOMITA	90717
BELL GARDENS	90201		91733	LOS ALAMITOS	90720
BELLFLOWER	90706		91734	LOS ANGELES	90001
BEVERLY HILLS	90210	EL SEGUNDO	90245		90002
	90211	ENCINO	91316		90003
	90212		91436		90004
BRADBURY	91008	GARDENA	90247		90005
BUENA PARK	90620		90248		90006
	90621		90249		90007
	90622	GLENDALE	91201		90008
BURBANK	91501		91202		90009
	91502		91203		90010
	91504		91204		90011
	91505		91205		90012
	91506		91206		90013
	91521		91207		90014
	91522		91208		90015
	91523		91210		90016
CALABASAS	91302	GLENDORA	91740		90017
	91372		91741		90018
CANOGA PARK	91303	GRANADA HILLS	91344		90019
	91304	HACIENDA HGTS	91745		90020
CARSON	90745	HARBOR CITY	90710		90021

City	Zip Code	City	Zip Code	City	Zip Code
	90746	HAWAIIAN GDNS	90716		90022
	90747	HAWTHORNE	90250		90023
	90895		90261		90024
CERRITOS	90703	HERMOSA BEACH	90254		90025
CHATSWORTH	91311	HOLLYWOOD	90028		90026
CITY INDUSTRY	91716	HUNTINGTON PK	90255		90027
CLAREMONT	91711	INGLEWOOD	90301		90029
COMPTON	90220		90302		90031
	90221		90303		90032
	90222		90304		90033
CORONA	91719		90305		90034
	91720	LA CANADA FLT	91011		90035
COVINA	91722	LA CRESCENTA	91214		90036
	91723	LA MIRADA	90638		90037
	91724		90639		90038
CTY OF CMMRCE	90040	LA PALMA	90623		90039
Los Angeles	90041		91603	SAN PEDRO	90731
	90042		91605		90732
	90043		91606	SANTA CLARITA	91387
	90044		91607	SANTA FE SPGS	90670
	90045		91608	SANTA MONICA	90401
	90046	NORTH HILLS	91343		90402
	90047	NORTHRIDGE	91324		90403
	90048		91325		90404
	90049		91326		90405
	90052		91329	SAUGUS	91390
	90056		91330	SHERMAN OAKS	91403
	90057	NORWALK	90650		91423
	90058	PACIFIC PLSDS	90272	SIERRA MADRE	91024
	90059	PACOIMA	91331	SIGNAL HILL	90755
	90061		91334	SOUTH GATE	90280
	90062	PANORAMA CITY	91402	STANTON	90680
	90063	PARAMOUNT	90723	STEVENSON RNH	91381
	90064	PASADENA	91101	STUDIO CITY	91604
	90065		91103	SUN VALLEY	91352
	90066		91104	SUNLAND	91040
	90067		91105		91041

City	Zip Code	City	Zip Code	City	Zip Code
	90068		91106	TARZANA	91356
	90071		91107	TEMPLE CITY	91780
	90072		91121	THOUSAND OAKS	91360
	90073		91124		91632
	90077		91125	TOPANGA	90290
	90079	PICO RIVERA	90660	TORRANCE	90501
	90089	PLAYA DEL REY	90293		90502
	90090	PLS VRDS EST	90274		90503
	90094	POMONA	91766		90504
	90095		91767		90505
	92259		91768		90506
LYNWOOD	90262		91769	TUJUNGA	91042
MALIBU	90263	REDONDO BEACH	90277	VAN NUYS	91401
	90265		90278		91405
MANHATTAN BCH	90266	RESEDA	91335		91406
MARINA DL REY	90292	RNCHO PLS VRD	90275		91411
MAYWOOD	90270	ROSEMEAD	91770	VENICE	90291
MIRA LOMA	91752	ROWLAND HGHTS	91748	VERDUGO CITY	91046
MISSION HILLS	91345	S PASADENA	91030	W HOLLYWOOD	90069
MONROVIA	91016	S SAN GABRIEL	91170	WALNUT	91788
MONTCLAIR	91763	SAN DIMAS	91773		91789
MONTEBELLO	90640	SAN FERNANDO	91340	WEST COVINA	91790
MONTEREY PARK	91754		91342		91791
	91755	SAN GABRIEL	91775		91792
MONTROSE	91020		91776		91793
N HOLLYWOOD	91601		91778	WEST HILLS	91307
	91602	SAN MARINO	91108	WESTLAKE VLG	91361
WHITTIER	90601				
	90602				
	90603				
	90604				
	90605				
	90606				
WILMINGTON	90744				
WINNETKA	91306				
WOODLAND HLS	91364				
	91367				

City	Zip Code	City	Zip Code	City	Zip Code
	91371				
Count of zip codes	299				

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