REPORT

San Diego Gas and Electric Company Summer Saver 2016 Program Evaluation

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Prepared for

San Diego Gas and Electric Co.

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Table of Contents

1 Executive Summary....1
2 Introduction and Program Summary....3
2.1 Report Structure....5
3 Data and Methodology....6
3.1 Data....6
3.2 Methodology....7
3.2.1 Ex Post Methodology....7
3.2.2 Ex Post Validation Analysis....8
3.3 Ex Ante Impact Estimation Methodology....12
4 Ex Post Load Impact Estimates....20
4.1 Residential Ex Post Load Impact Estimates....20
4.2 Nonresidential Ex Post Load Impact Estimates....23
4.3 Free Riders....27
4.4 Control Device Communications Failure....28
5 Ex Ante Load Impact Estimates....30
5.1 Ex Ante Estimates....30
5.1.1 Comparison of Ex Ante Load Impacts by Month....35
5.2 Comparison of 2015 Ex Ante Load Impacts to 2016 Ex Ante Load Impacts....38
5.3 Relationship between Ex Post and Ex Ante Estimates....39

1 Executive Summary

San Diego Gas and Electric Company's (SDG&E) Summer Saver program is a demand response resource based on central air conditioner (CAC) load control that is implemented through an agreement between SDG&E and Comverge, Inc. The previously funded program cycle ended in 2016; in January 2017, SDG&E filed its request to the CPUC for funding to cover the program years 2018 to 2022.[1] The 2017 program year was funded through CPUC-authorized bridge funding. This report provides ex post load impact estimates for the 2016 Summer Saver program and ex ante load impact forecasts for 2017–2027.

The Summer Saver program is available to residential and nonresidential customers with average monthly peak demand up to a maximum of 100 kW over a 12 month period. There are two enrollment options each for both residential and nonresidential customers. Residential customers can choose between 50% or 100% cycling and nonresidential customers can choose between 30% and 50% cycling. The incentive paid for each option varies and is based on the number of CAC tons being controlled at each site. The Summer Saver season runs from May 1 through October 31. A Summer Saver event may be triggered by temperature or system load conditions and customers are not automatically notified when an event occurs; however, customers can sign up to receive event notification.

At the end of 2016, there were 25,469 customers enrolled in the program with a total cooling capacity of 130,338 tons. This represents about a 3.5% decrease relative to 2015 enrolled customers and tons. For the 2016 program year, residential customers represented approximately 82% of Summer Saver participants and accounted for about 68% of the program's total cooling tons. Among residential participants, 39% selected the highest cycling option (100% cycling); among nonresidential participants, 77% selected the 50% cycling option over the 30% option. During the previous funding cycle, Summer Saver enrollment has steadily declined. In the future, Summer Saver enrollment is projected to substantially decrease in the early years of the forecast horizon, due to program changes, and slowly decline for the remainder of the forecast.

Five Summer Saver events were called in 2016, all lasting for four hours and taking place between 3 and 7 PM. Ex post load impacts are estimated using two approaches—a randomized control trial (RCT) design for a sample of residential customers and a propensity score matching (PSM) and difference-in-difference model for nonresidential customers. Table 1-1 shows the overall 2016 Summer Saver ex post load impacts and the average event window temperature. Over the five 2016 Summer Saver events, the average aggregate demand reduction for residential customers totaled 8.1 MW, and the largest load reduction was 12.9 MW on the July 22 event. The aggregate load reduction for nonresidential customers on the average event day was roughly 1.3 MW, or 0.28 kW per premise. The largest load reduction for nonresidential customers totaled 1.7 MW and occurred on the June 22 event. In aggregate, the average reduction for the entire Summer Saver program across all five event days totaled 9.7 MW.

[1] https://www.sdge.com/sites/default/files/regulatory/Application_of_SDGE_2018-2022_Demand_Response_with_attachments_COS.pdf

Table 1-1: 2016 Summer Saver Load Average Ex Post Impacts

Date	Impact				Avg. Event Temperature
	Per Ton (kW)	Per CAC Unit (kW)	Per Premise (kW)	Aggregate (MW)	
6/20/2016	0.10	0.26	0.37	8.7	88
7/22/2016	0.17	0.44	0.62	14.6	93
8/15/2016	0.14	0.37	0.52	12.2	90
9/26/2016	0.10	0.25	0.35	8.3	96
9/27/2016	0.05	0.14	0.20	4.6	84
Average*	0.11	0.29	0.41	9.7	90

* Reflects the average 2016 Summer Saver event

Ex ante load impacts are intended to represent weather conditions under normal (1-in-2 year) and extreme (1-in-10 year) conditions, defined for two scenarios: one representing weather conditions expected when the SDG&E system peaks and another representing weather conditions when the CAISO system peaks. The event window for ex ante impacts is 1 to 6 PM, which differs from the typical 2016 ex post event window of 3 to 7 PM.

The methodology for the 2016 evaluation differs from that used in previous years' evaluations in a number of ways. The changes are driven by declining ex post impacts for both customer segments from 2010 to 2016, lower observed impacts for both customer segments later in the summer (September and October), and anticipated program changes that will significantly alter the composition of the residential Summer Saver population in future years. In 2017, the bottom 30% of residential users will be dropped from the Summer Saver population, and starting in 2018, residential solar customers will no longer be able to participate in the program, shedding an additional proportion of the residential population. The dynamic enrollments result in year-over-year differences in ex ante impacts, unlike in previous years that assumed a flat enrollment forecast.

In 2017, on a typical event day under 1-in-2 year SDG&E-specific peaking conditions, aggregate load impacts are projected to equal 9.0 MW for residential customers and 2.2 MW for nonresidential customers, for a total program load reduction equal to 11.2 MW. Summer Saver load impacts typically increase with temperature; however, the opposite trend is observed for events taking place in September and October. Given the changes to modeling ex ante temperature relationships, the largest impacts are observed on the August monthly system peak days, despite hotter temperatures in September. The load impacts for the 1-in-2 year SDG&E-specific August monthly system peak day are estimated to be 10.9 MW for residential customers and 2.2 MW for nonresidential customers, for a total load reduction potential of 13.0 MW. In 2017, under 1-in-10 year SDG&E-specific peaking conditions, estimated impacts on the typical event day are forecasted to equal 11.8 MW and 2.2 MW for residential and nonresidential customers, respectively, or 14.0 MW in total. This is about 25% greater than on a typical event day under 1-in-2 year weather conditions. On the August SDG&E monthly system peak day for a 1-in-10 weather year, estimated impacts equal 11.4 MW and 2.2 MW respectively, for a total load reduction of 13.6 MW for the entire program.

2 Introduction and Program Summary

San Diego Gas and Electric Company's (SDG&E) Summer Saver program is a demand response resource based on central air conditioner (CAC) load control that is implemented through an agreement between SDG&E and Comverge, Inc. The previously funded program cycle ended in 2016; in January 2017, SDG&E filed its request to the CPUC for funding to cover the program years 2018 to 2022.[2] The 2017 program year was funded through CPUC-authorized bridge funding. This report provides 2016 ex post load impact estimates and ex ante load impact estimates for an 11 year forecast horizon (2017–2027) as required by the California Public Utilities Commission (CPUC) Load Impact Protocols,[3] even though the program may not continue in its current form beyond 2016.

The Summer Saver program is classified as a day-of demand response program and is available to both residential and nonresidential customers, where eligible nonresidential customers are subject to a demand limit; only those nonresidential customers with average monthly peak demand up to a maximum of 100 kW over a 12 month period may participate. Summer Saver events may only be called during the months of May through October. Under the current program, load control events must run for at least two hours but may also not run for more than four hours. Participants' air conditioners cannot be cycled for more than four hours in any event day and events cannot be triggered for more than 60 hours per year. Load control events can occur on weekends but not on holidays and cannot be called more than three days in any calendar week. These program rules apply to both residential and nonresidential customers alike.

Beginning in 2017, there will be several changes to the program design. First, the annual maximum of event hours will increase from 60 hours to 80 hours in 2017. A second change will be how Summer Saver events are triggered. Currently, an event is triggered by system conditions (4,000 MW). Under the new program design, event triggers will vary by month. In July, August, or September, a Summer Saver event may be triggered by a heat rate exceeding 19,000 Btu[4]/kWh. In May, June, or October, an event may be triggered by imminent statewide or local emergencies, extreme conditions, and/or local distribution needs. Beginning in 2017, there will also be changes to event durations and hours that events may be called. Currently, a Summer Saver event may be called between noon and 8 PM, where each event may last 2 to 4 hours. In 2017, an event may be called between noon and 9 PM, and each event may last 1 to 4.5 hours.

There are two enrollment options for both residential and nonresidential participants. Residential customers can choose to have their CAC units cycled 50% or 100% of the time during an event. The incentive paid for each option varies; the 50% cycling option pays $11.50 per ton per year

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2 https://www.sdge.com/sites/default/files/regulatory/Application_of_SDGE_2018-2022_Demand_Response_with_attachments_COS.pdf

3 See CPUC Rulemaking 07-01-041 Decision (D.) 08-04-050, "Adopting Protocols for Estimating Demand Response Load Impacts" and Attachment A, "Protocols."

4 British thermal unit, defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

of CAC capacity and the 100% cycling option pays $30 per ton per year. A residential customer with a four-ton CAC unit would be paid the following in the form of an annual credit on their SDG&E bill:

- $46 for 50% cycling; or
- $120 for 100% cycling.

Nonresidential customers have the option of choosing 30% or 50% cycling. The incentive payment for 30% cycling is $9 per ton per year and $15 per ton per year for the 50% cycling option. A nonresidential customer with five tons of air conditioning would be paid the following in the form of an annual credit on their SDG&E bill:

- $45 for 30% cycling; or
- $75 for 50% cycling.

Enrollment in the Summer Saver program as of September 2016 is summarized in Table 2-1. Total enrollment—as measured by number of customers, number of devices, and air conditioning capacity (measured in tons)—has decreased since fall 2015, continuing a decline in enrollment that was seen in 2014 over 2013 enrollments. As of October 2016, there were 25,469 customers enrolled in the program, which in aggregate represents 130,338 tons of CAC capacity. This represents about a 3.5% decrease in enrolled customers and in enrolled tons relative to 2015. For the 2016 program year, residential customers represented approximately 82% of Summer Saver participants and accounted for about 68% of the program’s total cooling tons. About 61% of residential customers selected the 50% cycling option and approximately 23% of nonresidential customers chose the 30% cycling option, which represent the lower of the two cycling strategies offered to those customer segments. After holding steady around 50% for many years, the percentage of residential customers taking the 100% cycling option has steadily declined—from 46% in 2014 to 43% in 2015 to 39% in 2016. The reverse trend has been observed among nonresidential customers selecting the 50% option, from 60% in 2010 to 77% in 2016. During the previous funding cycle, the Summer Saver enrollment has steadily declined. In the future, the Summer Saver enrollment is projected to substantially decrease in the early years of the next program cycle, due to changes to program enrollment rules.

Table 2-1: Summer Saver Enrollment – October 2016

Customer Type	Cycling Option	Enrolled Customers	Enrolled Control Devices	Enrolled Tons
Commercial	30%	1,047	3,052	11,823
	50%	3,522	7,711	29,637
	Total	4,569	10,763	41,460
Residential	50%	12,733	14,862	52,112
	100%	8,167	10,113	36,767
	Total	20,900	24,975	88,879
Grand Total		**25,469**	**35,738**	**130,338**

2.1 Report Structure

The remainder of this report is organized as follows. Section 3 summarizes the data and methods that were used to develop ex post and ex ante load impact estimates and the validation tests that were applied to assess their accuracy. Section 4 contains the ex post load impact estimates and Section 5 presents the ex ante estimates. Section 5 also provides details concerning differences between the 2016 and the 2015 ex ante load impacts—in addition to differences between ex post and ex ante load impacts.

3 Data and Methodology

This section describes the datasets and analysis methods used to estimate load impacts for each event in 2016 and for ex ante weather and event conditions. Ex post results were calculated using control and treatment groups. In the case of the residential segment within a randomized control trial framework, whereby with random assignment to treatment and control status and reasonably large sample sizes (2,000 residential participants), any differences in the average hourly electric loads of the treatment and control group may be reliably assumed to be due to Summer Saver load control and free of estimation bias. In the case of the nonresidential segment, most of the nonresidential program participants were all statistically matched to a control group of nonparticipants. The methodology used to estimate ex ante load impacts differs this year relative to previous evaluation years. Two separate sets of models are run for the residential and nonresidential segments. For residential customers, the ex post load impact estimates from 2015 and 2016 were used to estimate models relating temperature to load reductions that were then used in conjunction with ex ante weather data to estimate ex ante load impacts. For nonresidential customers, the average load impacts from 2015 and 2016 were used to estimate ex ante impacts without modeling weather sensitivity. A more detailed discussion is provided in Section 3.3.

3.1 Data

Five Summer Saver events were called in 2016. Table 3-1 shows the date, day of week, and the start and end time for each event. All residential and nonresidential participants were called for each event, except for the control group customers that were held back for measurement and evaluation purposes. All five Summer Saver events in 2016 lasted for four hours and took place between 3 and 7 PM. Unlike in 2015 when three events took place on weekends, all 2016 events occurred on weekdays.

Table 3-1: Summary of 2016 Summer Saver Events

Date	Day of Week	Start Time	End Time
6/20/2016	Monday	3:00 PM	7:00 PM
7/22/2016	Friday	3:00 PM	7:00 PM
8/15/2016	Monday	3:00 PM	7:00 PM
9/26/2016	Monday	3:00 PM	7:00 PM
9/27/2016	Tuesday	3:00 PM	7:00 PM

Table 3-2 shows the distribution of CAC tonnage by cycling option and climate zone for the residential participant population as of October 2016 and for the residential sample used for the ex post analysis. The differences between the fraction of residential customer tonnage in the residential sample and population cells are small, as are the differences across climate zones and cycling options. These results are also consistent with the residential distribution seen in 2015. Similar to previous years' evaluations, sample weights were applied during the analysis so that average load impacts reflect the program's enrollment across climate zones for each cycling strategy.

Table 3-2: Distribution of CAC Tonnage by Program Option and Climate Zone Residential Population

Cycling Option	Group	Climate Zone 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Total
50%	Population	6%	1%	0.1%	51%	59%
	Sample	6%	0%	0%	47%	53%
100%	Population	9%	1%	0%	31%	41%
	Sample	9%	0%	0%	38%	47%
Total	**Population**	**16%**	**2%**	**0.1%**	**82%**	**100%**
	Sample	**15%**	**0%**	**0%**	**85%**	**100%**

3.2 Methodology

The primary task in developing ex post load impacts is to estimate a reference load for each event. The reference load is a measure of what participant demand would have been in the absence of the CAC cycling during an event. The primary task in estimating ex ante load impacts—which is often of more practical concern—is to make the best use of historical data on loads and load impacts to predict future program performance. The data and models used to estimate ex post impacts are typically the key inputs to the ex ante analysis.

Two separate approaches were used for estimating the reference loads: a randomized controlled trial (RCT) design and a propensity score matching (PSM) design. Residential customer impacts were estimated using an RCT. The nonresidential customer impacts were estimated with a PSM study. Under the randomized controlled trial, random samples of residential Summer Saver customers were selected for each cycling strategy. During each event, half of the sample did not have their CAC units cycled so that these customers could be used to provide a reference load for those who did have their units cycled. Under the PSM design, a matched control group was selected for most of the nonresidential Summer Saver program participants.[5]

3.2.1 Ex Post Methodology

An RCT is an experimental research approach in which customers are randomly assigned to treatment and control conditions so that the only difference between the two groups, other than random chance, is the existence of the treatment condition. In this context, half of the roughly 2,000 customers in the residential sample had their CAC unit cycled while the remaining customers served as the control group. The group that received the event signal alternated from event to event. This design has significant advantages in providing fast, reliable impact estimates if sample sizes are large enough.

Consistent with the methodology used in the 2015 evaluation, a matched control group was selected for the nonresidential program population—whereby one matched nonparticipant was

[5] A small end-use sample of the nonresidential program population was subject to an RCT (n < 150 in treatment and control) and was excluded from the analysis.

selected for each participant on each event. The entire SDG&E small commercial customer population was made available for the statistical matching analysis. Each matched customer was chosen because they most closely resembled their matched participant in terms of their propensity score, where the propensity score calculates the likelihood that a customer is a Summer Saver participant based on certain characteristics. In this case, those characteristics were typical peak demand on hot nonevent days and demand in the morning and early afternoon prior to the event. This approach minimizes the differences between participants and matched nonparticipants.[6]

Ex post event impacts for each cycling option were estimated for each hour of each event for both RCT and PSM customers by averaging the load of the participants in the group that experienced the event and subtracting it from the average adjusted load of the group that did not receive the event. The adjustment was based on the ratio of usage between the treatment and control groups an hour prior to the event start. For example, if the average usage in the treatment group during the hour preceding an event is 1.2 kW and the average usage in the control group is 1.3 kW, the ratio would equal 0.92 (1.2/1.3=0.92) and the control group load for the entire day would be multiplied by 0.92 to more closely match treatment group load. This adjustment is referred to as a same-day adjustment and is an effective way of accounting for small differences in load that can arise between randomly assigned treatment and control groups.

Hourly impact estimates for the residential and nonresidential Summer Saver population were calculated by taking a weighted average of the impact estimates for each cycling option, with weights determined by the number of tons enrolled on each cycling option. Similar weighting was done to calculate cycle percentage level impacts. For cycle percentage level impacts, weights were determined by the number of tons enrolled in each climate zone. Impacts for the average event day were calculated from treatment and control group load shapes averaged across all five 2016 Summer Saver events.

3.2.2 Ex Post Validation Analysis

[6] Event day, pre-event demand is not typically included in propensity score models for calculating event impacts, but it was included here because less than 15 nonresidential Summer Saver participants were notified of events in advance and so they should have no effect of being treated until the event occurred.

Table 3-3 compares the sample size, average CAC tonnage, and cycling option for the randomly chosen test groups for residential participants. As seen, the two groups are very similar along the dimensions of CAC tonnage and cycling option.

Table 3-3: Residential A and B Group Comparison Sample Size, Tonnage, and Cycling Options

Group	Sample Size	Average CAC Tonnage per Household	% of Customers on 50% Cycling
A	1,026	4.3	53%
B	1,017	4.3	54%
Total/Average	2,043	4.3	54%

Even though random assignment and propensity score matching should produce two groups with similar characteristics, it is still important to compare the two groups based on electricity consumption when Summer Saver events are not in effect since, in the absence of very large samples, differences in energy consumption between them can still occur—due to chance in an RCT and due to a heterogeneous control pool with PSM. In 2016, the absolute hourly differences between the residential A and B groups for both cycling strategies combined on hot, nonevent days are 5% or less. For nonresidential customers, a sample of approximately 300 customers was randomly assigned to A and B groups for performance based estimates (PBE); however, these customers were removed from the ex post analysis because of the analytical challenges involved in resolving a matched control group with an RCT. Additionally, the PBE customers contribute small impacts relative to the rest of the nonresidential Summer Saver participants. For the remaining nonresidential participants, matched nonparticipants were selected from the overall SDG&E small commercial population. The absolute hourly differences between the nonresidential control and treatment (i.e., Summer Saver participants) on hot, nonevent days are less than 4%.

Figures Figure 3-1 and Figure 3-2 illustrate these differences on five hot nonevent days in 2016. As the figures show, the two groups are quite similar with respect to load shape and reflect the magnitude of hourly differences summarized above. Figures Figure 3-3 and Figure 3-4 show the comparison of groups A and B, as well as treatment and matched control, further segmented by cycling option. At the cycling level, residential A and B groups show more substantial hourly differences for both the cycling options compared to the differences between nonevent loads when both cycles are combined. The differences are slightly larger for 50% cycling than for 100%. The nonresidential participant and matched control groups for the 50% and 30% cycling options also show small differences in consumption. These differences are comparable to those observed in 2015 and reflect the larger sample size that the matching approach affords. A detailed description of the out-of-sample-testing can be found in the 2015 Summer Saver evaluation report.[7] The same methodology was applied in this year's evaluation.

[7] Appendix A. http://www.calmac.org/publications/Summer_Saver_Load_Impact_Evaluation_Report_Year_2015ES.pdf

Figure 3-1: Residential A and B Group Comparison Average Load on the Five Hottest 2016 Nonevent Days[8]

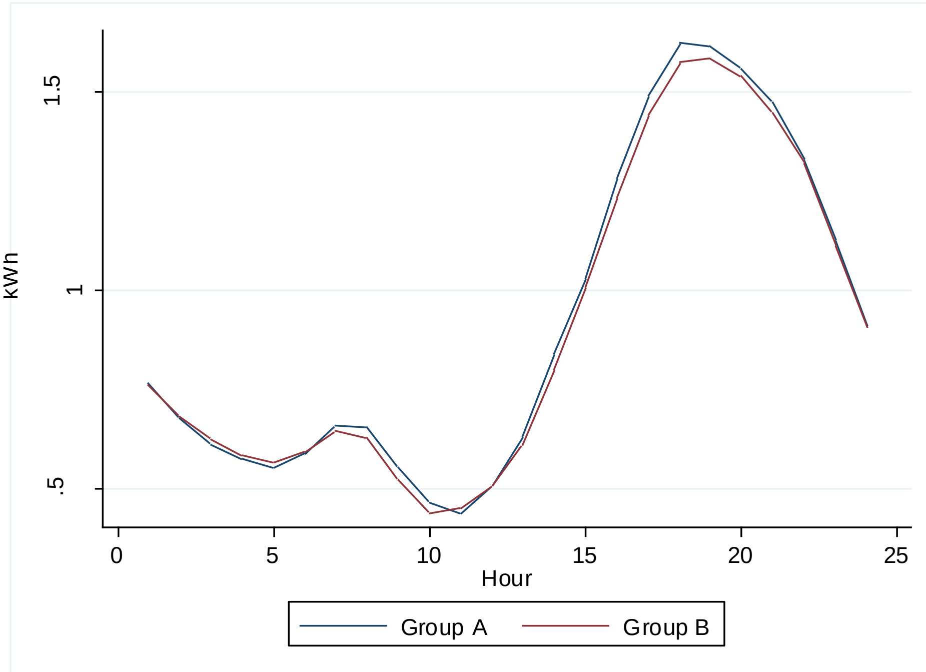
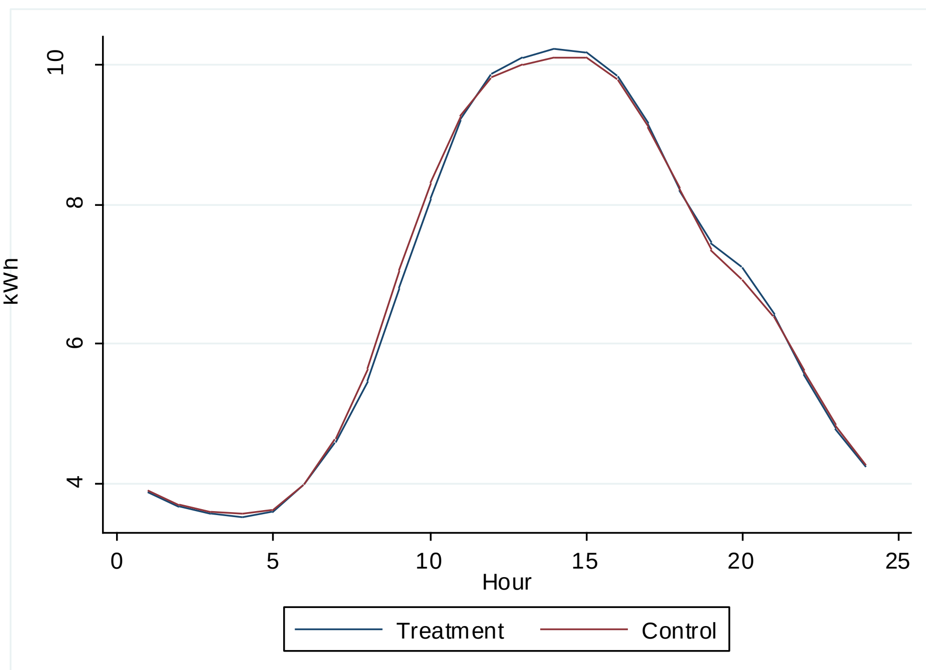


Figure 3-2: Nonresidential Matched Control and Treatment Group Comparison Average Load on the Five Hottest 2016 Nonevent Days



8 The five nonevent days used for this analysis are 7/28, 9/28, 9/29, 9/30, and 10/21/2016.

Figure 3-3: Residential A and B Group Comparison Average Load on the Five Hottest 2016 Nonevent Days by Cycling Option

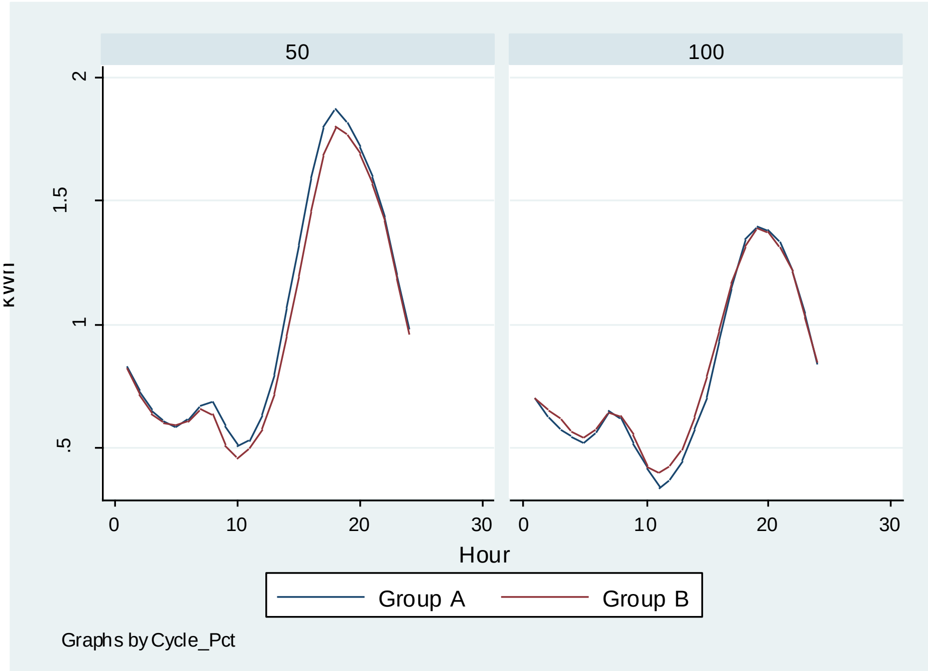
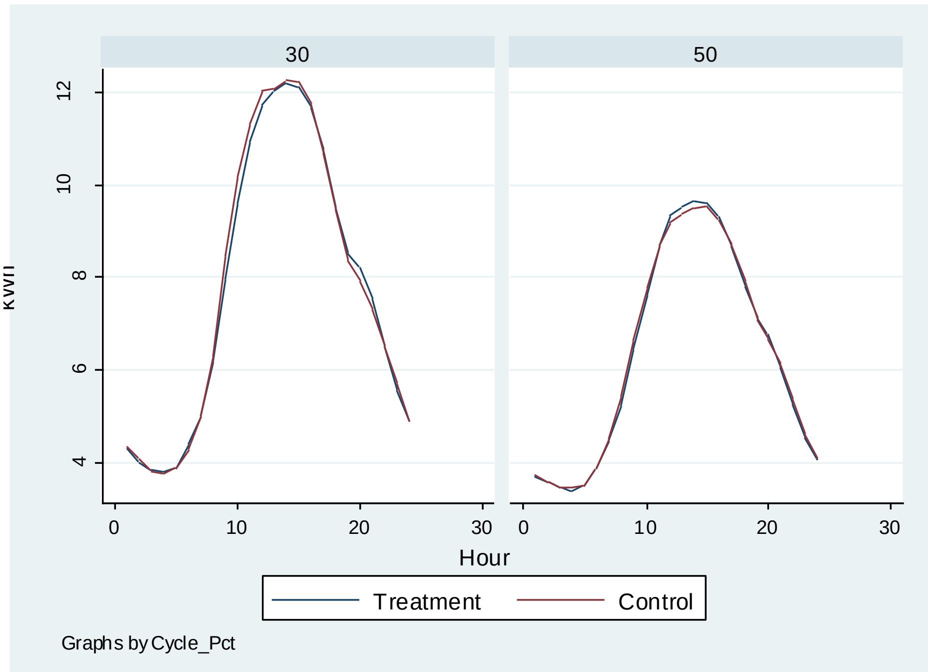


Figure 3-4: Nonresidential Matched Control and Treatment Group Comparison Average Load on the Five Hottest 2016 Nonevent Days by Cycling Option



3.3 Ex Ante Impact Estimation Methodology

The methodology for the 2016 evaluation differs from that used in previous years' evaluations in a number of ways. The changes, described below, are driven by declining ex post impacts for both customer segments from 2010 to 2016, lower observed impacts for both customer segments later in the summer (September and October), and anticipated program changes that will significantly alter the composition of the residential Summer Saver population in future years.

Ex ante load impacts were developed using the available ex post data. For both residential and nonresidential customers, load impacts for a common set of hours across all ex post events from 2015 and 2016 were used in the estimation database for developing the ex ante model. Unlike in 2015, where ex post events from 2010 to 2014 were included in the ex ante model, the 2016 evaluation restricts the ex post events to only 2015 and 2016 to better reflect the current state of the Summer Saver program. As in the 2015 evaluation, only the hours from 2 to 5 PM were used for the analysis because these hours were common across the greatest number of ex post event days. September 20, 2015 was excluded from the ex ante regression analysis because this was an emergency event that was called between 1:35 to 3:35 PM.

Unlike in previous years' evaluations, the methodology for estimating ex ante impacts in 2016 differs slightly between residential and nonresidential participants. For residential customers, the average load reduction from 2 to 5 PM was modeled as a function of the average temperature for the first 17 hours of each event day—midnight to 5 PM (mean17). This 17-hour average was used to capture the impact of heat buildup leading up to and including the event hours. Per ton load impacts were used so that the load impacts would be scalable to ex ante scenarios where the tonnage and number of devices per premise may be different. The models were run separately for events taking place in May through August and for events taking place in September and October. Estimating two different models better captures the difference in customer responses to events called earlier in the summer relative to those called towards the end of the summer. This behavioral shift is reflected in the consistently observed differences in the magnitude of impacts from events earlier in the summer, relative to events that occur later in the summer.

The estimated parameters from the models were used to predict load impacts under 1-in-2 and 1-in-10 year ex ante weather conditions. The final regressions only included one explanatory variable because more complicated models were not found to perform better in cross-validations done in previous Summer Saver evaluations. The model that was used to predict average ex post impacts was:

$$impact_d = b_0 + b_1 \cdot mean17_{\mathrm{d}} + \varepsilon_d$$

Table 3-4: Ex Ante Regression Variables

Variable	Description
$Impact_d$	Average per ton ex post load impact for each event day from 2 to 5 PM
b_0	Estimated constant
b_1	Estimated parameter coefficient
$mean17_d$	Average temperature over the 17 hours prior to the start of the event for each event day
ε_d	The error term for each day *d*

Finally, for residential customers, the ex ante methodology described above was applied twice, once to estimate impacts for 2017, and again to estimate ex ante impacts for 2018 through the end of the forecast horizon. This is done to reflect the changes SDG&E anticipates implementing over the next two program years. In 2017, the bottom 30% of residential users will be dropped from the Summer Saver population, and starting in 2018, residential solar customers will no longer be able to participate in the program, shedding an additional proportion of the residential population.

Figures Figure 3-5 and Figure 3-6 show the ex post impacts from 2015 and 2016 by customer type and cycling strategy as a function of mean17. The figures also contain the ex ante predictions that were developed based on the regression models of average 2 to 5 PM ex post impacts as functions of mean17, in addition to the ex ante predictions developed for the 2015 evaluation. Two ex ante models were developed, where one used ex post impacts from May through August events, and the second used ex post impacts from September and October events. Figures Figure 3-5 and Figure 3-6 represent the ex ante predictions for 2017 only, which reflects the first change to the residential Summer Saver population—dropping the bottom 30% of users. Because the ex ante estimates are based on ex post, the ex post impacts shown in Figures 3-5 and 3-6 are adjusted to reflect the drop in the bottom 30% of users in both the 2015 and 2016 Summer Saver populations. Figures Figure 3-7 and 3-8 show the same information, except the ex post impacts reflect the drop of both 30% users and solar customers, which is also reflected in the ex ante predictions.

Figure 3-5: Average 2015–2016 2 to 5 PM Ex Post Load Impacts[9] and 2017 Ex Ante Predictions for Residential 50% Cycling Participants

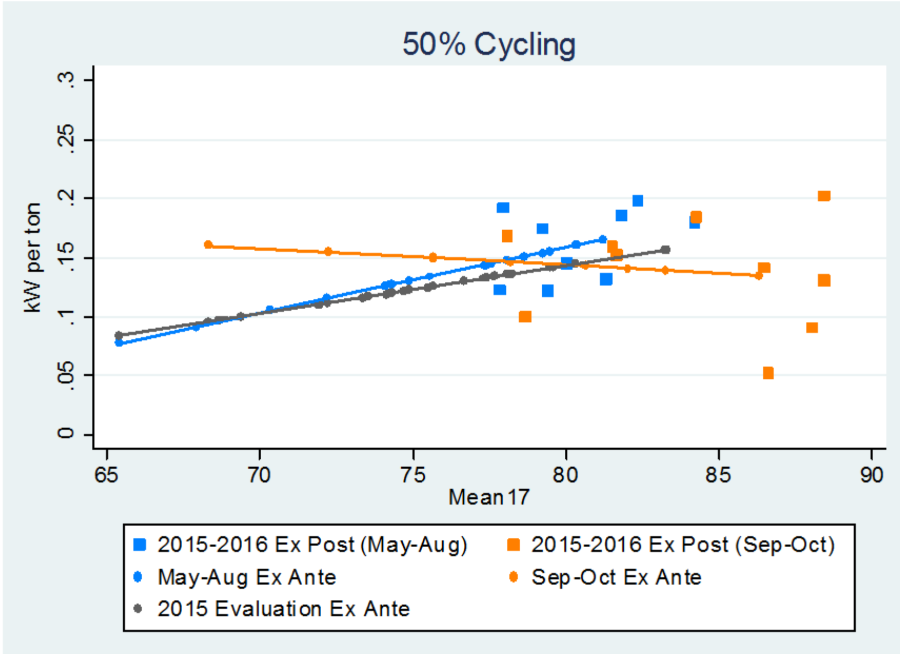
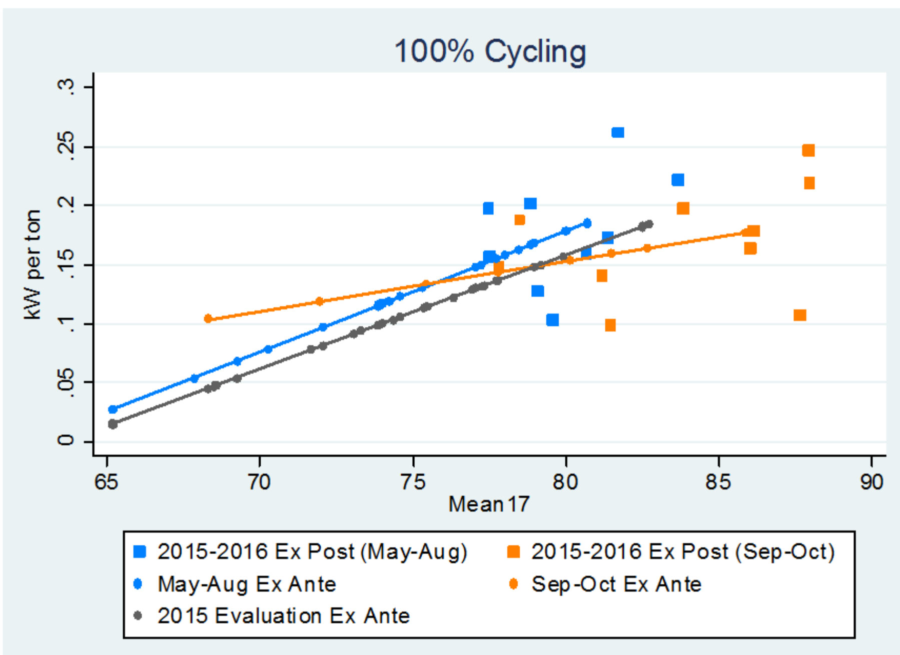


Figure 3-6: Average 2015–2016 2 to 5 PM Ex Post Load Impacts[10] and 2017 Ex Ante Predictions for Residential 100% Cycling Participants



[9] These ex post load impacts are adjusted to reflect the drop of the bottom 30% of residential users.

[10] Ibid.

Figure 3-7: Average 2015–2016 2 to 5 PM Ex Post Load Impacts[11] and 2018–2022 Ex Ante Predictions for Residential 50% Cycling Participants

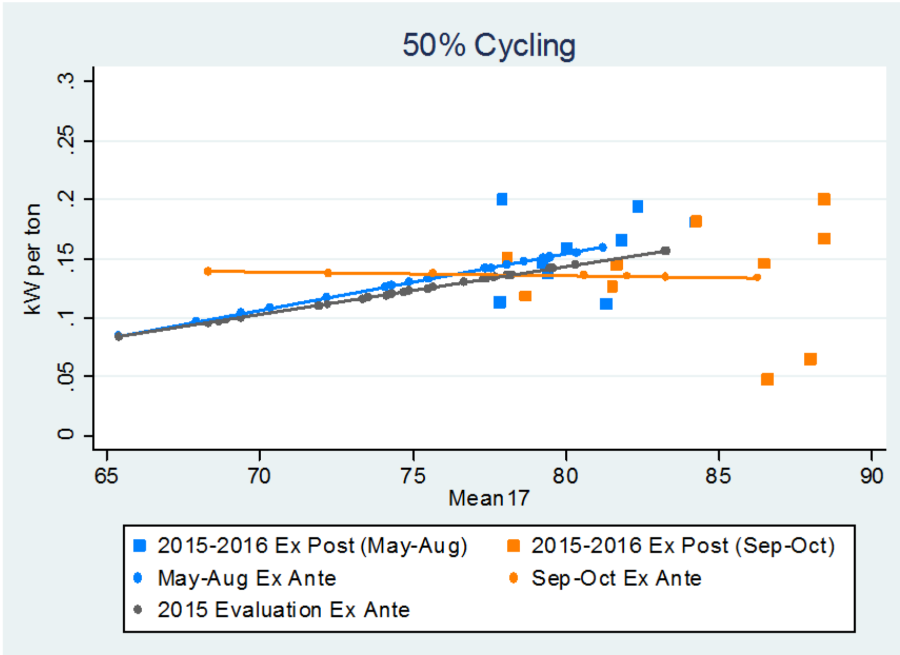
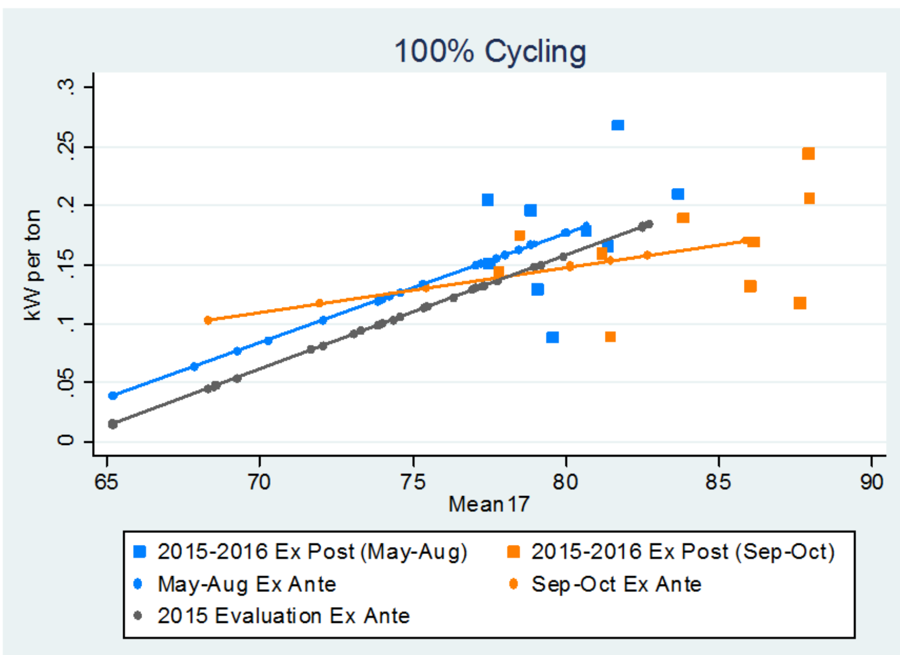


Figure 3-8: Average 2015–2016 2 to 5 PM Ex Post Load Impacts[12] and 2018–2022 Ex Ante Predictions for Residential 100% Cycling Participants



[11] These ex post load impacts are adjusted to reflect the drop of the bottom 30% of residential users and solar customers.

[12] Ibid.

In 2016 and in recent previous program years, the nonresidential impacts at the end of the summer (September and October) have been substantially smaller than impacts observed in May through August, even under similar and sometimes hotter temperatures. Additionally, nonresidential ex post impacts have been observed to be much less weather sensitive than impacts for residential customers. To better reflect the behavior of nonresidential impacts throughout the summer, the 2016 evaluation will use only the average 2 to 5 PM ex post impacts from May through August and from September through October to generate impacts for the corresponding ex ante months. In other words, the ex ante impacts for nonresidential customers will no longer be weather sensitive.

Figures Figure 3-9 and Figure 3-10, show the nonweather sensitive ex ante estimates that are based on the average 2 to 5 PM ex post impacts from May through August events, and separately for September through October events. The ex ante predictions from the 2015 evaluation are also shown for comparison. As expected, the ex ante impacts for September and October are lower than those developed for May through August.

Figure 3-9: Average 2015–2016 2 to 5 PM Ex Post Load Impacts and Nonweather Sensitive Ex Ante Estimates for Nonresidential 30% Cycling Participants

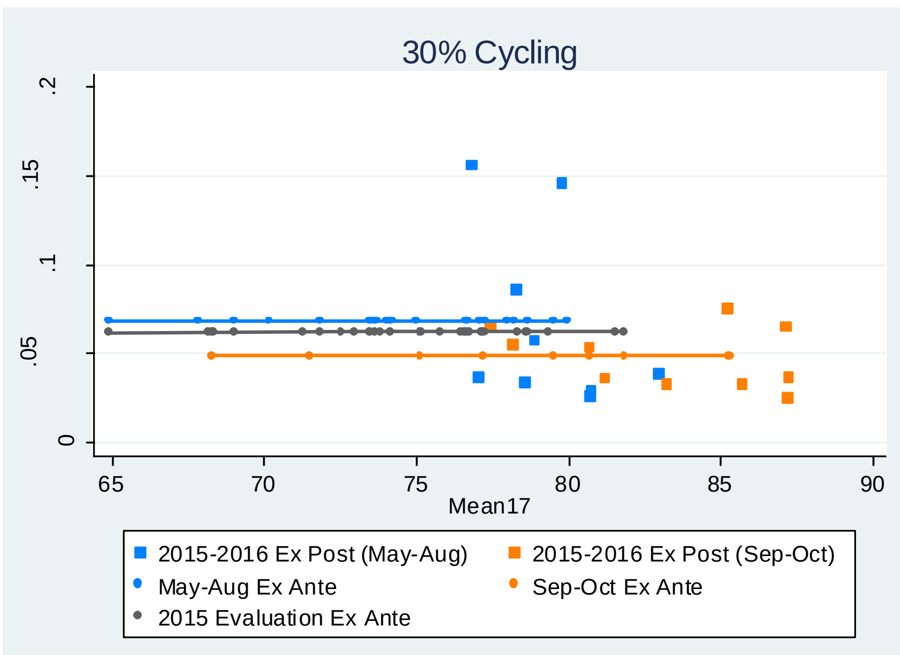
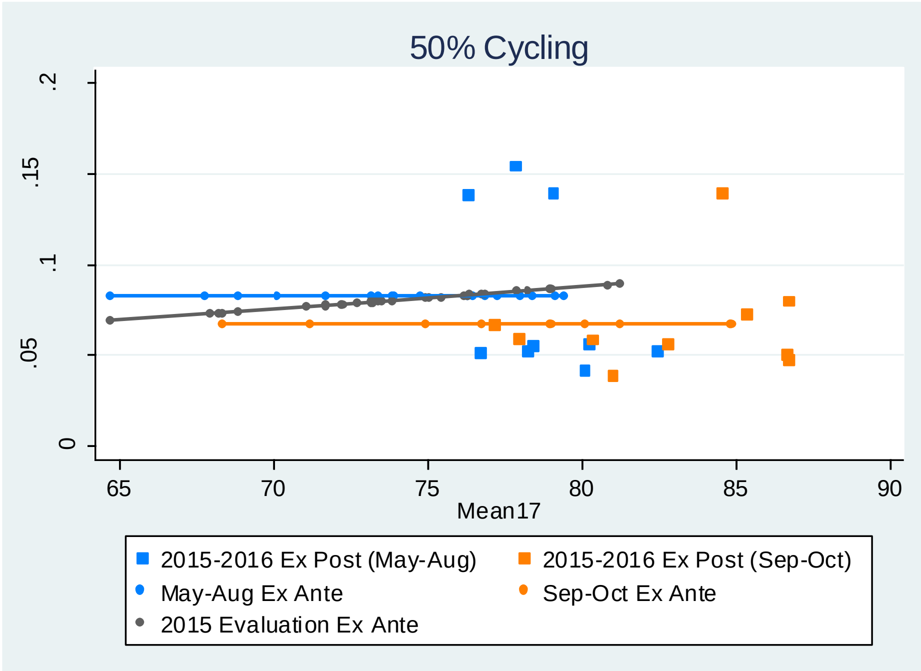


Figure 3-10: Average 2015–2016 2 to 5 PM Ex Post Load Impacts and Nonweather Sensitive Ex Ante Estimates for Nonresidential 50% Cycling Participants



After the ex ante impacts have been estimated for what would be expected on average during the 2 to 5 PM period, the next step is to predict impacts specifically for hours covered by the CPUC resource adequacy window, 1 to 6 PM. Hourly ex post impact estimates for each event from 2015 and 2016 were expressed as a fraction of the average impact from 2 to 5 PM. This process was done separately for May through August events and for September and October events. As an illustration, Table 3-5 shows the ratios for the hours ranging from 1 to 6 PM for the 100% residential cycling group calculated for the May through August events. The first column of ratios in Table 3-5 shows how the average event impact for each hour compares with the average impact from 2 to 5 PM. The second column shows the product of the values in the first column multiplied by 0.12 kW/ton, which is the average predicted impact from 2 to 5 PM for residential 100% cycling customers during a typical event day under CAISO 1-in-2 year weather conditions. For example, to calculate the estimated impact for 1 to 2 PM, multiply 0.12 kW/ton by 0.86 to yield an impact of 0.10 kW/ton. Recall from the discussion above that, in this example, the 0.86 kW was estimated with a regression that determines a weather relationship for average 2 – 5 PM ex post load impacts. That weather relationship was estimated for average load impacts – this process extends those average load impacts to load impacts across hours. The 0.12 kw/ton represents the predicted impact for the typical event day under CAISO 1-in-2 weather conditions, based on the relationship between the average ex post 2 to 5 PM impacts and temperature. The same strategy was applied for all five hours of the ex ante event window for each cycling option and customer class.

Table 3-5: Hourly Load Impacts Compared to Average Impact from 2 to 5 PM Residential 100% Cycling

Hour of Event	Ratio of Hourly Ex Post Impact to Average 2-5 PM Impact*	Hourly Impact for Typical CAISO Event Day, 1-in-2 Weather (kW/Ton)	Hourly Impact for Typical SDG&E Event Day, 1-in-2 Weather (kW/Ton)
1-2 PM	0.86	0.10	0.11
2-3 PM	1.11	0.13	0.15
3-4 PM	1.15	0.14	0.15
4-5 PM	1.11	0.13	0.15
5-6 PM	1.15	0.14	0.15

*Reflects a multiyear dataset containing ex post impacts from 2015-2016

This method constrains the relative size of event impacts across different hours to be the same for each event. Event impacts vary with weather, as usual, but in this model the ratio of the impact at 4 PM to the impact at 5 PM, for example, is always the same. A separate ex ante model could be used for each event hour. Such a strategy would have the virtue of independently identifying the effect of weather on event impacts at different times of day. However, when there are only a moderate number of events and, for some hours, many fewer events than for other hours, that strategy risks fitting spurious trends to individual hours or trends across hours that conflict with one another. Given the highly auto-correlated nature of the data, the differential impact of weather on different event hours is likely to be difficult to measure compared with the primary effect of temperature on average event impacts.

As discussed above, average ex ante load impacts were estimated directly based on ex post impacts. However, the CPUC Load Impact Protocols require that ex ante reference loads also be estimated even though they may not always be necessary for load impact estimation, as is true here. To meet this requirement, reference loads were estimated in a manner similar to the approach used for ex ante impact estimation. Models for estimating reference loads were estimated separately by customer type and cycling strategy. The following steps were used:

- Average control group usage during the 2 to 5 PM time period on 2015 and 2016 event days was modeled as a function of mean17;
- The parameters from this regression were used to predict average usage from 2 to 5 PM under ex ante weather conditions;
- A ratio between each ex ante prediction and average 2015–2016 control group usage from 2 to 5 PM across all days was calculated (separately for May–August and for September–October); and
- Average control group load profiles for the entire average event day for 2015–2016 were adjusted by the ratio specific to each set of ex ante weather conditions to produce the final ex ante reference loads.

Finally, estimates of the ex ante snapback effect were developed in a similar manner, and calculated separately for May–August events and for September–October events. Snapback refers to the increase in load following termination of a load control event as a result of the increased temperature that occurs in buildings when air conditioning is cycled. As with load impacts and reference loads, snapback for residential customers was calculated by cycling strategy. The calculation consisted of the following steps:

1. Average the snapback values across the six hours after each ex post event;
2. Develop a ratio between snapback in each hour and snapback in the first hour;
3. Multiply the snapback value in the first hour by the ratios previously used to scale the ex post reference load to ex ante weather conditions; and
4. Multiply the adjusted snapback values for each set of ex ante weather conditions by the snapback ratios to get snapback values for the six hours after each ex ante event.

Nonresidential snapback was assumed to be zero as there is little prior evidence of CAC snapback after Summer Saver events for nonresidential participants.

4 Ex Post Load Impact Estimates

This section contains the ex post load impact estimates for program year 2016. Residential load impacts are presented first, followed by nonresidential load impacts.

4.1 Residential Ex Post Load Impact Estimates

Five Summer Saver events were called in 2016, and each one lasted for four hours and took place between 3 and 7 PM. Table 4-1 presents ex post load impacts for the residential program segment for program years 2016 and 2015, for comparison. Aggregate load impacts ranged from a low of 4.3 MW on September 27, 2016 to a high of 17.8 MW on July 22, 2016. The five 2016 Summer Saver events produced an average load reduction of 8.6 MW. The 2016 load impacts were, on average, lower than those observed in 2015; however, observed temperatures during event and pre-event hours were lower than those observed in 2015. All 2016 Summer Saver residential impacts are statistically significant at the 90% confidence level.

Table 4-1: Summer Saver Residential Ex Post Load Impact Estimates

Year	Date	Impact			Mean17 (°F)
		Per CAC Unit (kW)	Per Premise (kW)	Aggregate (MW)	
2015	8/13/2015	0.42	0.50	10.52	78
	8/14/2015	0.36	0.43	9.05	79
	8/16/2015	0.70	0.84	17.75	82
	8/26/2015	0.35	0.42	8.95	80
	8/27/2015	0.54	0.64	13.65	82
	8/28/2015	0.59	0.70	14.90	84
	9/9/2015	0.68	0.81	17.22	88
	9/10/2015	0.45	0.54	11.39	86
	9/11/2015	0.51	0.61	13.02	84
	9/20/2015	0.34	0.41	8.71	84
	9/24/2015	0.48	0.58	12.23	78
	9/25/2015	0.40	0.47	10.05	79
	10/9/2015	0.43	0.51	10.84	81
	10/10/2015	0.45	0.54	11.35	88
	10/13/2015	0.30	0.36	7.59	82
	Average*	0.53	0.63	13.34	83
2016	6/20/2016	0.27	0.32	6.20	82
	7/22/2016	0.56	0.67	12.87	80
	8/15/2016	0.45	0.54	10.39	80
	9/26/2016	0.34	0.40	7.69	80
	9/27/2016	0.18	0.21	4.06	84
	Average**	0.36	0.42	8.13	81

* Reflects the average 3–7 PM weekday 2015 Summer Saver event

** Reflects the average 2016 Summer Saver event

Table 4-2 shows the average per premise reference loads, load impacts, and percent impact for residential customers by cycling option. On the average event day, the reference load for the 50% cycling strategy group was nearly 43% higher than the reference load for the 100% cycling strategy. Put another way, customers who use their CAC units more are less likely to select the 100% cycling option. So, even though the cycling percentage between these groups differs by a factor of two, load impacts for the 100% group are only about 37% higher than that of the 50% cycling segment.

Table 4-2: Summer Saver Residential Average (kW per Premise) Reference Load, Impacts and Percent Impacts by Cycling Option

Event Date	Average Reference Load per Premise* (kW)		Average Load Impact per Premise* (kW)		Average Percent Impact	
	100%	50%	100%	50%	100%	50%
6/20/2016	1.49	2.09	0.51	0.19	35%	9%
7/22/2016	1.76	2.84	0.68	0.66	39%	23%
8/15/2016	1.80	2.50	0.69	0.44	38%	18%
9/26/2016	1.52	2.13	0.52	0.32	34%	15%
9/27/2016	1.37	1.78	0.34	0.13	25%	8%
Average**	1.59	2.26	0.54	0.34	34%	15%

*Reflects the average hour in event window

** Reflects the average 2016 Summer Saver event

Table 4-3 shows the estimated load impacts for residential participants on each event day segmented by cycling option. At the per premise level, load impacts for 100% cycling range from a high of 0.69 kW to a low of 0.34 kW. Load impacts for 50% cycling range from 0.13 kW to 0.66 kW per premise

Table 4-3: Summer Saver Residential Average (kW per Premise) and Aggregate (MW) Load Impacts by Cycling Option

Event Date	Average Load Impact per Premise (kW)		Aggregate Load Impact (MW)	
	100%	50%	100%	50%
6/20/2016	0.51	0.19	3.99	2.21
7/22/2016	0.68	0.66	5.30	7.58
8/15/2016	0.69	0.44	5.38	5.05
9/26/2016	0.52	0.32	4.06	3.68
9/27/2016	0.34	0.13	2.61	1.51
Average*	0.54	0.34	4.22	3.92

* Reflects the average 2016 Summer Saver event

Table 4-4 shows estimated event impacts for residential customers segmented by usage quintiles, and Table 4-5 shows the same, but segmented by usage deciles. Each customer was placed into 1 of 5 quintiles (or one of 10 deciles, in the case of Table 4-5) based on their average usage during peak hours from 11 AM to 6 PM on hot nonevent weekdays in 2016. Impact estimates were calculated separately for each quintile and decile using the treatment group loads during the average event hour of the average 2016 Summer Saver event.

Tables Table 4-4 and

Table 4-5 show both the average impact as well as the standard error of the estimates for each quintile by cycle. Load impacts increase across the quantiles, likely reflecting an underlying pattern, but the estimates at the quintile and decile level have fairly large standard errors. Similar to previous years, the bottom quintile and the bottom two to three deciles have negative load impacts.

Table 4-4: Summer Saver Residential Average (kW per Premise) Load Impacts by Usage Quintile and Cycling Option

Quintile	Residential Customers			
	50% Cycling		100% Cycling	
	Average* Per Premise Load Impact (kW)	Load Impact Standard Error (kW)	Average* Per Premise Load Impact (kW)	Load Impact Standard Error (kW)
1	-0.93	0.11	-0.83	0.10
2	0.03	0.11	0.14	0.10
3	0.45	0.11	0.47	0.10
4	0.76	0.11	0.92	0.10
5	1.45	0.11	2.02	0.10

*Reflects the average 2016 Summer Saver event

Table 4-5: Summer Saver Residential Average (kW per Premise) Load Impacts by Usage Decile and Cycling Option

Decile	Residential Customers			
	50% Cycling		100% Cycling	
	Average* Per Premise Load Impact (kW)	Load Impact Standard Error (kW)	Average* Per Premise Load Impact (kW)	Load Impact Standard Error (kW)
1	-1.59	0.11	-1.60	0.10
2	-0.14	0.11	-0.05	0.10
3	-0.09	0.11	0.15	0.10
4	0.12	0.11	0.13	0.10
5	0.43	0.11	0.45	0.10
6	0.49	0.11	0.48	0.10
7	0.58	0.11	0.73	0.10
8	0.93	0.11	1.16	0.10
9	1.11	0.11	1.42	0.10
10	1.79	0.11	2.63	0.10

*Reflects the average 2016 Summer Saver event

4.2 Nonresidential Ex Post Load Impact Estimates

Table 4-6 presents ex post load impact estimates for nonresidential customers for each 2016 event day and an average event day across the five 2016 Summer Saver events. Table 4-4 also shows the 2015 ex post load impacts for comparison. Nonresidential customers represent nearly 18% of total Summer Saver participants and approximately 32% of enrolled CAC tonnage. Nonresidential aggregate impacts varied from a low of 0.5 MW on September 27 to a high of 1.7 MW on June 20. Nonresidential load impacts experienced their peaks and lows differently than the residential segment. While all of the events in 2016 took place between 3 and 7 PM, the 2015 events help to demonstrate when nonresidential customers experience their peaks. In 2015, the three events with the latest event hours, 4 to 8 PM, show average load impacts of 0.16 kW per premise; the nine events with event hours 3 to 7 PM show an average load impact of 0.31 kW, while the two events with event hours of 2 to 6 PM show the highest load impacts averaging 0.50 kW per premise, even though the temperatures recorded before and during those events are among the coolest across all events. On average, the premise level impact observed in 2016 was 0.28 kW, which took place under slightly cooler temperatures than the average 3 to 7 PM in 2015. While nonresidential load impacts are not very weather sensitive, they do demonstrate sensitivity to whether or not the event includes more or fewer standard business hours. The 2016 impacts are comparable to those observed in 2015, and neither year had average event impacts that were statistically significant at the 90% confidence level. In other words, the confidence interval around each impact includes zero.

Table 4-6: Summer Saver Nonresidential Ex Post Load Impact Estimates

Year	Date	Impact			Mean17 (°F)
		Per CAC Unit (kW)	Per Premise (kW)	Aggregate (MW)	
2015	8/13/2015	0.12	0.28	1.26	77
	8/14/2015	0.08	0.19	0.85	78
	8/16/2015	0.12	0.29	1.32	80
	8/26/2015	0.09	0.21	0.95	79
	8/27/2015	0.12	0.30	1.34	80
	8/28/2015	0.10	0.25	1.12	83
	9/9/2015	0.11	0.26	1.17	87
	9/10/2015	0.15	0.36	1.66	85
	9/11/2015	0.14	0.34	1.56	83
	9/20/2015	0.06	0.14	0.62	83
	9/24/2015	0.23	0.54	2.45	77
	9/25/2015	0.20	0.47	2.12	78
	10/9/2015	0.14	0.34	1.55	80
	10/10/2015	0.15	0.35	1.58	87
	10/13/2015	0.04	0.08	0.38	81
	Average*	0.13	0.30	1.38	82
2016	6/20/2016	0.16	0.39	1.72	80
	7/22/2016	0.16	0.37	1.66	79
	8/15/2016	0.13	0.31	1.38	79
	9/26/2016	0.10	0.24	1.08	81
	9/27/2016	0.04	0.10	0.45	84
	Average**	0.12	0.28	1.26	81

* Reflects the average 3-7 PM weekday 2015 Summer Saver event

** Reflects the average 2016 Summer Saver event

A comparison of average impacts per CAC unit in Tables Table 4-1 and 4-6 shows that the impact for nonresidential customers is roughly 33% of the value for residential customers, on average. Much of the difference is certainly due to the lower average cycling options used for nonresidential customers, but per CAC unit load impacts can be compared across residential and nonresidential participants on the same cycling strategy to determine if other factors may be at play.

Table 4-7 shows the comparison of average load impact per CAC for 50% cycling residential and 50% nonresidential customers, respectively. Prior Summer Saver evaluations, except for 2014, have found larger overall differentials between residential and nonresidential 50% cycling load impacts. On average across all 2016 Summer Saver events, the average load impacts per CAC unit are more than twice as large for residential 50% cycling, compared to nonresidential 50% cycling.

Table 4-7: Comparison of Residential and Nonresidential Summer Saver 50% Cycling Load Impacts

Event Date	Average Load Impact per CAC Unit (kW)	
	Residential 50%	Nonresidential 50%
6/20/2016	0.17	0.19
7/22/2016	0.57**	0.15
8/15/2016	0.38**	0.17
9/26/2016	0.28**	0.14
9/27/2016	0.11	0.04
Average*	0.29	0.14

* Reflects the average 2016 Summer Saver event

** Indicates the impact is statistically significant at the 90% confidence level

Figure 4-1 shows the reference and observed loads for residential and nonresidential 50% cycling customers. As shown, the difference in impacts between residential and nonresidential customers on the 50% cycling strategy can be explained by the relative behaviors of the reference loads during the event hours, highlighted in pink. For residential customers, reference loads (denoted by the blue curve) are increasing during the average event window, whereas nonresidential reference loads (denoted by the green curve) are decreasing during this period.

Figure 4-1: Reference and Observed Loads for the Average Event Day – Residential and Nonresidential 50% Cycling

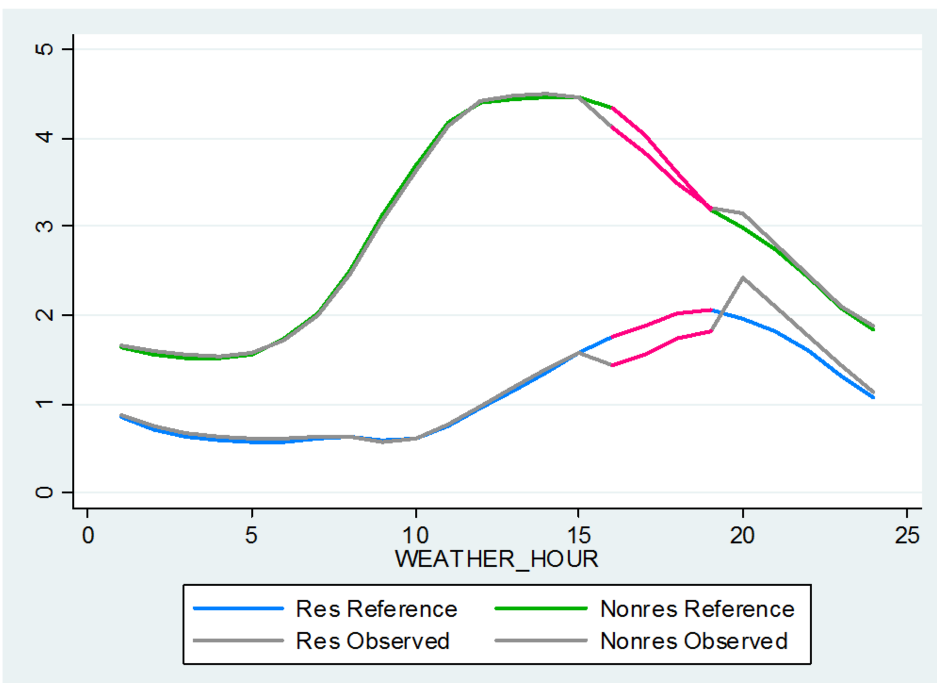


Table 4-8 shows the estimated load impacts for nonresidential participants on each event day segmented by cycling strategy. On a per premise basis, load impacts for the 50% cycling option range from 0.08 kW to 0.42 kW. Per premise load impacts for the 30% cycling option range from

0.08 kW to 0.48 kW. On the average event day, load impacts for 50% cycling were approximately 30% higher than those produced by the 30% cycling strategy. None of the impacts reported below are statistically significant at the 90% confidence level.

Table 4-8: Summer Saver Nonresidential Average (kW per Premise) and Aggregate (MW) Load Impacts by Cycling Option

Event Date	Average Impact per Premise (kW)		Aggregate Impact (MW)	
	30%	50%	30%	50%
6/20/2016	0.28	0.42	0.29	1.43
7/22/2016	0.49	0.34	0.52	1.14
8/15/2016	0.14	0.37	0.15	1.24
9/26/2016	0.06	0.30	0.06	1.02
9/27/2016	0.17	0.08	0.18	0.26
Average*	0.23	0.30	0.24	1.02

* Reflects the average 2016 Summer Saver event

Tables Table **4-9** and Table **4-10** show the estimated event impacts for nonresidential customers segmented by usage quintiles and deciles, respectively, using the same methodology used to segment residential customers. The tables show both the average impact as well as the standard error of the estimates for each quintile by cycle. Load impacts increase across the quantiles, likely reflecting an underlying pattern, but the estimates at the quintile and decile level have fairly large standard errors. Similar to previous years, the bottom quintile and the bottom two deciles have negative load impacts.

Table 4-9: Summer Saver Nonresidential Average (kW per Premise) Load Impacts by Usage Quintile and Cycling Option

Quintile	Nonresidential Customers			
	30% Cycling		50% Cycling	
	Average* Per Premise Load Impact (kW)	Load Impact Standard Error (kW)	Average* Per Premise Load Impact (kW)	Load Impact Standard Error (kW)
1	-0.14	0.09	-0.11	0.09
2	0.05	0.13	0.01	0.06
3	0.14	0.19	0.27	0.08
4	0.41	0.32	0.31	0.12
5	0.68	2.04	1.02	1.17

*Reflects the average 2016 Summer Saver event

Table 4-10: Summer Saver Nonresidential Average (kW per Premise) Load Impacts by Usage Decile and Cycling Option

Decile	Nonresidential Customers			
	30% Cycling		50% Cycling	
	Average* Per Premise Load Impact (kW)	Load Impact Standard Error (kW)	Average* Per Premise Load Impact (kW)	Load Impact Standard Error (kW)
1	-0.15	0.10	-0.02	0.16
2	-0.14	0.13	-0.14	0.05
3	0.02	0.21	0.00	0.09
4	0.10	0.14	0.01	0.08
5	0.32	0.18	0.21	0.09
6	-0.03	0.30	0.32	0.11
7	0.35	0.30	0.22	0.13
8	0.46	0.43	0.40	0.17
9	0.68	0.70	0.73	0.25
10	0.68	3.42	1.31	2.00

*Reflects the average 2016 Summer Saver event

4.3 Free Riders

An important issue for the cost-effectiveness of the Summer Saver program is the fraction of customers who sign up for the program, but who do not use their CAC unit much or at all. These customers are compensated for their enrollment in the program, but are likely to provide little load impact. Sub-meter and logger data can be used to estimate the fraction of each program segment that had little CAC usage in 2016. Sub-metered and logger data were collected from a sample of 269 residential and 184 nonresidential CAC units divided approximately evenly among cycling options.

Table 4-11 shows the fraction of CAC units with zero or small CAC usage. First, customers with sub-metered usage equal to 0 kW on hot nonevent days[13] in 2016 were considered across the entire summer. The residential program segment shows a significantly higher incidence of 0 kW usage than the nonresidential program segment.

A second check was conducted for customers with sub-metered usage equal to nearly 0 kW, with thresholds of 0.02 kW and 0.05 kW, respectively. Residential 100% cycling participants were more likely to show very low CAC usage than 50%, and nonresidential participants in the 50% cycling segment are more likely to have very low CAC usage as nonresidential participants in the 30% cycling segment. The lower incidence of zero or very low CAC usage in the

[13] Hot nonevent days in 2016 were selected for analysis if the average temperature between 11 AM and 6 PM was greater than 80°F.

nonresidential segment likely reflects the fact that nonresidential cooling needs and preferences are usually less flexible than those of residential customers.

Table 4-11: Fraction of CAC Units with Low Average Usage Sub-meter Sample – Hot Nonevent Days in 2016

Average Usage	Residential		Non-Residential	
	50%	100%	30%	50%
0 kW	14%	19%	4%	4%
<0.02 kW	15%	39%	9%	12%
<0.05 kW	19%	45%	11%	17%

4.4 Control Device Communications Failure

Summer Saver load control switches rely on radio signals for activating load control during program events. If the switch is broken, if the signal is blocked, or if the signal is sent on a frequency that the device is not set up to receive, then load control will not occur for that device. This is referred to as *control device communication failure*.

While there was no direct verification of control device communication failure for the 2016 evaluation, the sub-sample of Summer Saver participants (see Section 4.3) with sub-metered or logger data is available to provide some limited information on the prevalence of control device communication failure. The sub-sample includes 136 participants on the 100% cycling option. The sub-metered data from these customers[14] on event days should show load reductions very close to 100%; otherwise, they can be presumed to be affected by communication failure. Of the 136 participants in the sub-sample, 58 customers (42.7%) had zero kWh during all of the event hours, 119 customers (87.5%) had zero kWh during at least 50% of all event hours, and 2 customers (1.47%) had complete signal failure and experienced nonzero kWh during all event hours.

Since there is no obvious reason why customers on 100% cycling should have different communication failure rates from residential customers on other cycling options, this analysis likely reflects communication across the residential Summer Saver population. Commercial Summer Saver customers may have different rates of communication failure due to differing building types and switch locations.

As shown in Table 4-12, an analysis of the number of customers in the 100% cycling group that had nonzero load during each event hour of 2016 revealed that communication failure was variable in 2016, but averaged around 18% after the first hour of the event. The higher percentage (26%) of nonzero loads in the first hour can be attributed to the fact that for each customer, events actually begin sometime in the first half-hour of the event, rather than immediately at the top of the hour.

[14] About half of these 136 customers are held back from load control during each event, so the number of sub-metered CAC units available for this analysis is about half that for each event.

Table 4-12: Percentage of Premises on 100% Cycling with Nonzero Load during Each Event Hour in 2016

Event Date	Event Hour			
	1	2	3	4
6/20/2016	35%	32%	30%	31%
7/22/2016	30%	28%	27%	23%
8/15/2016	29%	14%	15%	14%
9/26/2016	21%	11%	12%	12%
9/27/2016	17%	6%	8%	6%
Average	**26%**	**18%**	**18%**	**17%**

5 Ex Ante Load Impact Estimates

This section presents ex ante load impact estimates for SDG&E's Summer Saver program. Residential ex ante estimates are provided first, followed by estimates for nonresidential customers. The last subsection provides a detailed discussion of the differences between ex post and ex ante estimates.

5.1 Ex Ante Estimates

The models described in Section 3 were used to estimate load impacts based on ex ante event weather conditions and enrollment projections for the years 2017–2027. Unlike in previous program years, enrollment in the Summer Saver program is expected to change substantially in the early years of the forecast horizon, so the tables in this section will show predictions for specific years in the 2017–2027 forecast horizon, based on the assumptions for how the program will change in future years. The most significant changes will occur on the residential side, with the bottom 30% of users being dropped from the program in 2017 and with solar customers no longer allowed to participate starting in 2018.

The Protocols require that ex ante load impacts be estimated assuming weather conditions associated with both normal and extreme utility operating conditions. Normal conditions are defined as those that would be expected to occur once every 2 years (1-in-2 conditions) and extreme conditions are those that would be expected to occur once every 10 years (1-in-10 conditions). Since 2008, the California IOUs have based the ex ante weather conditions on system operating conditions specific to each individual utility for estimating demand response load impacts. However, ex ante weather conditions could alternatively reflect 1-in-2 and 1-in-10 year operating conditions for the CAISO rather than the operating conditions for each IOU. While the protocols are silent on this issue, a letter from the CPUC Energy Division to the IOUs dated October 21, 2014 directed the utilities to provide impact estimates under two sets of operating conditions starting with the April 1, 2015 filings: one reflecting operating conditions for each IOU and one reflecting operating conditions for the CAISO system.

In order to meet this new requirement, California's IOUs contracted with Nexant to develop ex ante weather conditions based on the peaking conditions for each utility and for the CAISO system. The previous ex ante weather conditions for Pacific Gas and Electric Co. and Southern California Edison Co. were developed in 2009; the previous ex ante weather conditions were developed in 2012 for SDG&E. These scenarios were updated this year along with the development of the new CAISO-based conditions. Both sets of estimates used a common methodology, which is documented in a report delivered to the IOUs.[15]

The extent to which utility-specific ex ante weather conditions differ from CAISO ex ante weather conditions largely depends on the correlation between individual utility and CAISO peak loads. Based on CAISO and SDG&E system peak loads for the top 25 CAISO system load days each year from 2006 to 2013, the correlation coefficient for SDG&E is 0.56, indicating that there are many days on which the CAISO system loads are high while SDG&E loads are more modest. This correlation for SDG&E tends to be weakest when CAISO loads have been below

[15] See *Statewide Demand Response Ex Ante Weather Conditions*. Nexant, Inc. January 30, 2015.

46,000 MW. CAISO loads often reach 43,000 MW when loads in the Los Angeles area are extreme but San Diego loads are moderate—or vice-versa. However, whenever CAISO loads have exceeded 45,000 MW, loads typically have been high across all three IOUs. For this year's evaluation, the SDG&E ex ante weather conditions were updated to reflect the weather conditions corresponding to the top system load days from 2007 to 2016.

Table 5-1 shows the Summer Saver residential enrollment-weighted average temperature from midnight to 5 PM (mean17) for the typical event day and the monthly system peak day under the four sets of weather conditions for which load impacts are estimated. The differences in mean17 values based on SDG&E peak conditions and CAISO peak conditions, and also based on normal and extreme weather, can be quite large. There are also large differences across months. As seen later, even small differences in the value of mean17 can have large impacts on aggregate load impacts. As discussed in Section 3.3, the nonresidential estimates are no longer modeled with weather sensitivity, and instead are calculated based on the average 2 to 5 PM ex post impact for May through August and for September through October.

Table 5-1: Summer Saver Enrollment-weighted Ex Ante Weather Values (mean17)

Customer Type	Cycle	Day Type	CAISO Based Weather		SDG&E Based Weather	
			1-in-2	1-in-10	1-in-2	1-in-10
Residential	50%	Typical Event Day	74	78	76	81
		May Peak Day	65	74	70	79
		June Peak Day	69	74	68	79
		July Peak Day	72	75	74	79
		August Peak Day	77	78	79	80
		September Peak Day	78	83	81	86
		October Peak Day	68	76	72	82
	100%	Typical Event Day	74	77	75	81
		May Peak Day	65	74	70	78
		June Peak Day	69	74	68	79
		July Peak Day	72	75	74	78
		August Peak Day	77	78	79	80
		September Peak Day	78	83	80	86
		October Peak Day	68	75	72	81

Unlike in previous years' evaluations, the enrollment forecast was not assumed to be constant over the forecast horizon. Table 5-2 shows the enrollment forecast for each customer segment for the summer months of each year of the next program cycle 2017–2022.[16] The residential enrollment reflects the exclusion of the bottom 30% of users in 2017 and solar customers starting in 2018, as well as a roughly 1% month to month decrease. The nonresidential enrollment only reflects an assumed month to month decrease of approximately 1%.

[16] Enrollment is assumed to be flat from 2023–2027, using the end of year enrollment numbers from 2022.

Table 5-2: 2017–2018 Summer Saver Enrollment Forecast

Customer Type	Forecast Year	Forecast Month					
		May	June	July	August	September	October
Residential	2017	15,123	15,067	15,011	14,956	14,901	14,846
	2018	12,974	12,929	12,884	12,839	12,795	12,751
	2019	12,454	12,413	12,372	12,331	12,291	12,252
	2020	11,983	11,945	11,909	11,872	11,836	11,800
	2021	11,556	11,522	11,489	11,456	11,423	11,390
	2022	11,170	11,139	11,109	11,079	11,049	11,019
Nonresidential	2017	3,654	3,648	3,641	3,635	3,628	3,622
	2018	3,226	3,220	3,215	3,209	3,204	3,198
	2019	3,162	3,157	3,152	3,147	3,142	3,137
	2020	3,104	3,099	3,095	3,090	3,085	3,081
	2021	3,050	3,046	3,042	3,038	3,034	3,030
	2022	3,002	2,998	2,994	2,990	2,986	2,982

While Summer Saver events can be called any time between noon and 8 PM, ex ante load impacts reported here represent the average load impact across the hours from 1 to 6 PM, reflecting the peak period as defined by the CPUC for determining resource adequacy requirements.

Tables Table 5-3 and Table 5-4 summarize the average and aggregate load impact estimates per premise under SDG&E-specific peaking conditions and CAISO peaking conditions for 2017 and for 2018, respectively. For residential customers, these transitional years reflect the most significant changes to enrollment and population usage characteristics.

Table 5-3: Ex Ante Load Impact Estimates by CAISO and SDG&E-specific Weather and Day Type (1 to 6 PM) for 2017

Customer Type	Day Type	Per Premise Impact (kW)				Aggregate Impact (MW)			
		CAISO 1-in-2	SDGE 1-in-2	CAISO 1-in-10	SDGE 1-in-10	CAISO 1-in-2	SDGE 1-in-2	CAISO 1-in-10	SDGE 1-in-10
Residential	Typical Event Day	0.56	0.60	0.67	0.79	8.4	9.0	10.0	11.8
	May Monthly Peak	0.26	0.43	0.56	0.71	3.9	6.5	8.4	10.7
	June Monthly Peak	0.39	0.35	0.55	0.73	5.9	5.2	8.3	11.0
	July Monthly Peak	0.49	0.56	0.58	0.70	7.4	8.5	8.7	10.5
	August Monthly Peak	0.66	0.73	0.69	0.76	9.9	10.9	10.3	11.4
	September Monthly Peak	0.62	0.63	0.64	0.65	9.2	9.4	9.5	9.7
	October Monthly Peak	0.59	0.60	0.61	0.63	8.7	8.9	9.1	9.4
Non-Residential	Typical Event Day	0.59	0.59	0.59	0.59	2.2	2.2	2.2	2.2
	May Monthly Peak	0.59	0.59	0.59	0.59	2.2	2.2	2.2	2.2
	June Monthly Peak	0.59	0.59	0.59	0.59	2.2	2.2	2.2	2.2
	July Monthly Peak	0.59	0.59	0.59	0.59	2.2	2.2	2.2	2.2
	August Monthly Peak	0.59	0.59	0.59	0.59	2.2	2.2	2.2	2.2
	September Monthly Peak	0.51	0.51	0.51	0.51	1.9	1.9	1.9	1.9
	October Monthly Peak	0.51	0.51	0.51	0.51	1.9	1.9	1.9	1.9

Table 5-4: Ex Ante Load Impact Estimates by CAISO and SDG&E-specific Weather and Day Type (1 to 6 PM) for 2018

Customer Type	Day Type	Per Premise Impact (kW)				Aggregate Impact (MW)			
		CAISO 1-in-2	SDGE 1-in-2	CAISO 1-in-10	SDGE 1-in-10	CAISO 1-in-2	SDGE 1-in-2	CAISO 1-in-10	SDGE 1-in-10
Residential	Typical Event Day	0.57	0.61	0.67	0.77	7.3	7.8	8.6	9.9
	May Monthly Peak	0.31	0.46	0.57	0.70	4.0	5.9	7.4	9.1
	June Monthly Peak	0.43	0.38	0.57	0.72	5.5	5.0	7.3	9.3
	July Monthly Peak	0.51	0.57	0.59	0.69	6.6	7.4	7.6	8.9
	August Monthly Peak	0.66	0.72	0.68	0.75	8.5	9.2	8.7	9.6
	September Monthly Peak	0.59	0.60	0.61	0.63	7.5	7.7	7.8	8.1
	October Monthly Peak	0.54	0.56	0.57	0.61	6.8	7.1	7.3	7.7
Non-Residential	Typical Event Day	0.59	0.59	0.59	0.59	1.9	1.9	1.9	1.9
	May Monthly Peak	0.59	0.59	0.59	0.59	1.9	1.9	1.9	1.9
	June Monthly Peak	0.59	0.59	0.59	0.59	1.9	1.9	1.9	1.9
	July Monthly Peak	0.59	0.59	0.59	0.59	1.9	1.9	1.9	1.9
	August Monthly Peak	0.59	0.59	0.59	0.59	1.9	1.9	1.9	1.9
	September Monthly Peak	0.51	0.51	0.51	0.51	1.6	1.6	1.6	1.6
	October Monthly Peak	0.51	0.51	0.51	0.51	1.6	1.6	1.6	1.6

For a typical event day in a 1-in-2 year, SDG&E-specific weather conditions, the impact per premise is 0.60 kW for residential customers in 2017 and increases slightly to 0.61 kW in 2018. The 1-in-10 year typical event day estimates are 31% and 27% higher in 2017 and 2018, respectively. Under 1-in-2 CAISO peak conditions, the typical event day residential load impact per premise is 0.56 kW in 2017 and 0.57 in 2018. Under CAISO 1-in-10 weather conditions, per premise impacts are 20% and 17% higher in 2017 and 2018, respectively. These large differences between 1-in-2 and 1-in-10 load impacts are driven by the larger differences in mean17, which vary by 5 or 6 degrees across some of the above conditions; a difference of 5 degrees on average over 17 hours represents a very large difference in temperature conditions and air conditioning requirements.

Because nonresidential ex ante estimates are only based off of the average 2 to 5 PM ex post impacts for May through August events and separately for September through October, there is no variation in estimated load impacts between CAISO and SDG&E weather conditions, 1-in-2 and 1-in-10 conditions, or by month. The only difference seen is between May through August months, which have an estimated per premise load impact of 0.59 kW versus September and October, which have a load impact of 0.51 kW.

The aggregate program load reduction potential for residential customers is 9.0 MW for a typical event day under SDG&E-specific 1-in-2 year weather conditions in 2017, and 7.8 MW in 2018. Under SDG&E-specific 1-in-10 year weather conditions, the aggregate impacts for 2017 and 2018 are 11.8 MW and 9.9 MW, respectively. The aggregate impacts under CAISO weather conditions are slightly lower for both weather year types. For nonresidential customers, the aggregate impacts for May through August are 2.2 MW in 2017 and 1.9 MW in 2018. For September and October, the aggregate impacts are 1.9 MW and 1.6 MW for 2017 and 2018, respectively.

5.1.1 Comparison of Ex Ante Load Impacts by Month

September ex ante conditions are much hotter than typical event day conditions; however, because the analysis for residential customers is segmented between May through August and September through October, the largest monthly ex ante impacts are actually observed in August. In 2017, the residential program is estimated to provide an average impact of 11.4 MW over the 5 hour event window from 1 to 6 PM on a 1-in-10 September monthly system peak day and 10.9 MW on the August monthly system peak day under 1-in-2 year weather conditions for SDG&E-specific peaking conditions. Under CAISO peak conditions, residential aggregate load reduction on an August monthly system peak day is 9.9 MW for 1-in-2 and 10.3 MW for 1-in-10.

There is significant variation in load impacts across months and weather conditions for residential customers. Based on 1-in-2 year weather, the low temperatures in May and June typically experienced in San Diego result in the smallest average and aggregate load impacts. The May and June 1-in-2 year impacts for residential customers are only about 59% and 48% of the August estimate, respectively, which is the highest of any month under 1-in-2 year weather conditions. For residential customers, the May and June 1-in-10 year estimates are on average 1.9 times greater than the 1-in-2 year estimates as a result of the 1-in-10 year temperatures being much warmer than the 1-in-2 year temperatures for May and June.

Tables Table 5-5 and Table 5-6 provide ex ante impact estimates on an hourly basis for residential and nonresidential customers, respectively. The hours reflect the peak period as defined by the CPUC resource adequacy requirements, 1 to 6 PM. Residential impacts peak in the hour from 4 to 5 PM, while nonresidential impacts are relatively flat across these hours.

Table 5-5: 2017 Summer Saver Ex Ante Load Impact Estimates (MW) by Weather Year, Day Type and Hour – Residential Customers – SDG&E Peaking Conditions

Weather Year	Day Type	Hour of Day					Average (MW)
		1 to 2 PM (MW)	2 to 3 PM (MW)	3 to 4 PM (MW)	4 to 5 PM (MW)	5 to 6 PM (MW)	
1-in-2	Typical Event Day	7.7	9.3	9.3	9.3	9.3	9.0
	May Monthly Peak	5.6	6.7	6.7	6.7	6.7	6.5
	June Monthly Peak	4.5	5.4	5.4	5.4	5.4	5.2
	July Monthly Peak	7.2	8.8	8.8	8.8	8.8	8.5
	August Monthly Peak	9.2	11.3	11.3	11.3	11.3	10.9
	September Monthly Peak	8.2	9.0	10.2	10.2	9.1	9.4
	October Monthly Peak	8.1	8.7	9.7	9.7	8.5	8.9
1-in-10	Typical Event Day	10.0	12.2	12.3	12.2	12.3	11.8
	May Monthly Peak	9.1	11.1	11.1	11.1	11.1	10.7
	June Monthly Peak	9.3	11.4	11.4	11.4	11.4	11.0
	July Monthly Peak	8.9	10.9	10.9	10.9	10.9	10.5
	August Monthly Peak	9.7	11.8	11.9	11.8	11.9	11.4
	September Monthly Peak	8.3	9.3	10.6	10.6	9.5	9.7
	October Monthly Peak	8.2	9.1	10.3	10.3	9.1	9.4

Table 5-6: 2018 Summer Saver Ex Ante Load Impact Estimates (MW) by Weather Year, Day Type and Hour – Residential Customers – SDG&E Peaking Conditions

Weather Year	Day Type	Hour of Day					Average (MW)
		1 to 2 PM (MW)	2 to 3 PM (MW)	3 to 4 PM (MW)	4 to 5 PM (MW)	5 to 6 PM (MW)	
1-in-2	Typical Event Day	6.6	8.0	8.1	8.0	8.1	7.8
	May Monthly Peak	5.0	6.1	6.2	6.1	6.2	5.9
	June Monthly Peak	4.2	5.1	5.2	5.1	5.2	5.0
	July Monthly Peak	6.3	7.6	7.7	7.6	7.7	7.4
	August Monthly Peak	7.8	9.5	9.6	9.5	9.6	9.2
	September Monthly Peak	7.0	7.5	8.3	8.3	7.3	7.7
	October Monthly Peak	6.6	6.9	7.6	7.6	6.6	7.1
1-in-10	Typical Event Day	8.4	10.2	10.3	10.2	10.3	9.9
	May Monthly Peak	7.7	9.4	9.5	9.4	9.5	9.1
	June Monthly Peak	7.9	9.6	9.7	9.6	9.7	9.3
	July Monthly Peak	7.6	9.2	9.3	9.2	9.3	8.9
	August Monthly Peak	8.1	9.9	10.0	9.9	10.0	9.6
	September Monthly Peak	7.2	7.8	8.8	8.8	7.7	8.1
	October Monthly Peak	7.0	7.5	8.4	8.4	7.3	7.7

Table 5-7 provides program-level ex ante aggregate estimates for each hour. In 2017, the program is expected to provide its highest impact under 1-in-10 year conditions in August. Under those conditions, the average impact over the event window is expected to be 13.6 MW, with an hourly peak of 14.2 MW from 2 to 3 PM and from 4 to 5 PM.

Table 5-7: 2017 Summer Saver Ex Ante Load Impact Estimates (MW) by Weather Year, Day Type and Hour – All Customers – SDG&E Peaking Conditions

Weather Year	Day Type	Hour of Day					Average (MW)
		1 to 2 PM (MW)	2 to 3 PM (MW)	3 to 4 PM (MW)	4 to 5 PM (MW)	5 to 6 PM (MW)	
1-in-2	Typical Event Day	10.6	11.7	10.9	11.7	10.9	11.2
	May Monthly Peak	8.5	9.1	8.3	9.1	8.3	8.6
	June Monthly Peak	7.4	7.8	6.9	7.8	6.9	7.4
	July Monthly Peak	10.1	11.2	10.3	11.2	10.3	10.6
	August Monthly Peak	12.1	13.7	12.9	13.7	12.9	13.0
	September Monthly Peak	10.5	11.3	12.1	12.1	10.2	11.2
	October Monthly Peak	10.3	11.0	11.5	11.5	9.7	10.8
1-in-10	Typical Event Day	12.9	14.6	13.8	14.6	13.8	14.0
	May Monthly Peak	12.0	13.5	12.7	13.5	12.7	12.9
	June Monthly Peak	12.3	13.8	13.0	13.8	13.0	13.2
	July Monthly Peak	11.8	13.3	12.5	13.3	12.5	12.7
	August Monthly Peak	12.6	14.2	13.4	14.2	13.4	13.6
	September Monthly Peak	10.5	11.6	12.5	12.5	10.6	11.5
	October Monthly Peak	10.4	11.4	12.1	12.1	10.3	11.3

5.2 Comparison of 2015 Ex Ante Load Impacts to 2016 Ex Ante Load Impacts

Given the changes to the Summer Saver program, the residential ex ante load impacts from this year's evaluation will be substantially different from the 2015 ex ante load impacts because of the lower enrollment forecasts and the changes to the composition of residential Summer Saver population that will take effect in 2017 and 2018.

For the 2017 forecast year, average per premise load impacts for residential customers on the typical event day under SDG&E-specific 1-in-2 conditions increased relative to 2015 (from 0.43 kW to 0.60 kW). This is likely due to the load reduction gains from dropping the bottom 30% of users. Under 1-in-10 conditions, 2016 ex ante estimates for 2017 were about 30% larger than 2015 estimates for the typical event day (0.79 kW compared to 0.58 kW). In 2017, residential enrollment will decrease by 30% with the drop of bottom users. Taken together with the increases in average per premise load impact, the aggregate load impacts for the typical event day in 2017 under SDG&E 1-in-2 conditions are only 4% less than the ex ante impacts in 2015. Under the 1-in-10 weather conditions, the aggregate impacts show a comparable decrease and are approximately 6% less than impacts in 2015. Under CAISO peaking conditions, aggregate load impacts for 1-in-2 and 1-in-10 CAISO peak conditions on the typical event day are approximately 14% lower than impacts projected in 2015.

Under SDG&E-specific peaking conditions, the nonresidential segment shows that average per premise load impacts decreased by 6% under 1-in-2 conditions for the typical event day relative to 2015. Under the 1-in-10 weather conditions, the per premise impacts decreased by 12%

relative to 2015 projected impacts. The larger decrease under 1-in-10 conditions is a result of removing the weather sensitivity from the estimation model for nonresidential ex ante impacts. Nonresidential enrollment also decreased by approximately 22% relative to 2015, which is slightly less than the change in residential enrollment. Altogether, aggregate nonresidential load impacts under the 1-in-2 year scenario decreased by 24% under SDG&E-specific 1-in-2 conditions and decreased by 29% under 1-in-10 conditions.

While year-to-year enrollment fluctuations in a mature load control program such as Summer Saver are not unusual, significant changes in per premise load impacts are of interest. The increase in residential ex ante per premise load impacts is driven by the change in composition of the population. By dropping the bottom 30% of users in 2017 and restricting the program to non-solar customers in 2018, the observed reference loads will be larger, which provides more load reduction potential.

5.3 Relationship between Ex Post and Ex Ante Estimates

Ex post and ex ante load impacts may differ for a variety of reasons, including differences in weather conditions, the timing and length of the event window, and other factors such as changes in expected enrollment. Table 5-8 presents an overall comparison of 2016 ex post load impacts and the ex ante load impacts as estimated for 2017. Only the months of June through September are shown for comparison, since there were no events taking place in May or October 2016. It is important to note that the 2017 ex ante impacts reflect the drop of the bottom 30% of residential users, as well as month-to-month enrollment decreases of approximately 1% for both residential and nonresidential customers. Additionally, the 2017 ex ante impacts reflect the new estimation methodology that estimates impacts for May through August separately from September through October.

Table 5-8: Comparison of 2016 Ex Post Load Impacts to 2017 Ex Ante Load Impacts by Month

Month	2016 Ex Post Average Aggregate Impacts* (MW)	2017 Ex Ante Impact** SDG&E 1-in-2 (MW)
June	8.7	7.4
July	14.6	10.6
August	12.2	13.0
September	6.5	11.2

*Average of 2016 events by month

**For RA hours of 1-6 PM

Tables Table **5-9** and Table **5-10** show how aggregate load impacts for the two residential cycling strategies change as a result of differences in the factors underlying ex post and ex ante estimates. Tables Table 5-11 and Table 5-12 show the same information for nonresidential customers.

Columns A through E describe the particular circumstances of each 2016 Summer Saver load control event. Each event is denoted by its date, shown in Column A. Column B shows the time of the event window, and column C shows the average hourly ex post load impact for that event aggregated to the 2016 enrollment population. Column D shows the average hourly ex post load impact as shown in column C, but aggregated to the 2017 projected enrollment population.

Column F presents the load impacts that the ex ante model predicts for the ex post event window (Column B) and for the ex post weather conditions (Column E). Column G makes a final adjustment to the predicted load impacts shown in Column F by recalculating the predicted load impacts for the ex ante event window, which is always 1 to 6 PM.

Columns H and I compare Column G with the 2017 ex ante load impact estimates given the SDG&E-specific ex ante weather conditions for 1-in-2 and 1-in-10 year system peaking scenarios. Columns H and I are divided into two rows: orange and blue. The orange rows represent the August monthly system peak day ex ante estimates, which is most comparable to the values in Column G, which represent events in June, July, and August. The blue rows show the September monthly system peak day ex ante estimates, which are most representative of the September events.

Columns J through K show the 2017 ex ante load impacts for 1-in-2 and 1-in-10 year conditions for CAISO peaking conditions.

Taken together, Tables Table **5-9** through Table 5-12 demonstrate the following information on how 2015 load impacts relate to the projected ex ante impacts that are based on measured load impacts from 2015 and 2016:

- Comparing Columns C and D, the load impacts reflect the substantial change to residential enrollment starting in 2017. For nonresidential, the load impacts reflect negligible changes to projected enrollment, as nonresidential enrollment is expected to decline by approximately 1% month after month.
- For residential customers, comparing Columns D and G demonstrates the effect of dropping the bottom 30% of users. For both 50% and 100% cycling strategies, dropping that group substantially raises the per premise load impacts to outweigh the decrease in enrollment between 2016 and 2017.
- For residential customers, comparing Columns C, D, and G demonstrates that the method of estimating load impacts separately for May through August and September through October better captures the weather sensitivity for those months. The impacts shown in Column G reflect the temperature relationship on would expect, where impacts are higher at higher temperatures.

Table 5-9: Differences in 2016 Ex Post and 2017 Ex Ante Load Impacts Due to Key Factors – Residential 50% Cycling

Date	2016 Ex Post				2016 Ex Ante Model – Forecast for 2017					
	Event Window	Ex-Post Aggregate Impacts (MW)	Ex-Post Aggregate Impacts using SDG&E Forecast (MW)	Mean17 using KSAN KNKX Only (°F)	Ex-Ante Impact with Ex-Post Event Window and Weather (MW)	Ex-Ante Impact (1PM-6PM) using Ex Post Weather (MW)	Ex-Ante Impact SDG&E 1-in-2 (MW)	Ex-Ante Impact SDG&E 1-in-10 (MW)	Ex-Ante Impact CAISO 1-in-2 (MW)	Ex-Ante Impact CAISO 1-in-10 (MW)
A	B	C	D	E	F	G	H	I	J	K
6/20/2016	3-7 PM	2.2	1.7	81	6.6	6.4	5.9 (79°F)	6.2 (80°F)	5.5 (77°F)	5.7 (78°F)
7/22/2016	3-7 PM	7.6	6.0	78	5.8	5.7				
8/15/2016	3-7 PM	5.0	4.0	79	6.1	5.9				
9/26/2016	3-7 PM	3.7	1.3	87	4.9	4.9	5.2 (81°F)	5.0 (86°F)	5.4 (78°F)	5.1 (83°F)
9/27/2016	3-7 PM	1.5	1.2	88	4.8	4.9				

Table 5-10: Differences in 2016 Ex Post and 2017 Ex Ante Impacts Due to Key Factors – Residential 100% Cycling

Date	2016 Ex Post				2016 Ex Ante Model– Forecast for 2017					
	Event Window	Ex-Post Aggregate Impacts (MW)	Ex-Post Aggregate Impacts using SDG&E Forecast (MW)	Mean17 using KSAN KNKX Only (°F)	Ex-Ante Impact with Ex-Post Event Window and Weather (MW)	Ex-Ante Impact (1PM-6PM) using Ex Post Weather (MW)	Ex-Ante Impact SDG&E 1-in-2 (MW)	Ex-Ante Impact SDG&E 1-in-10 (MW)	Ex-Ante Impact CAISO 1-in-2 (MW)	Ex-Ante Impact CAISO 1-in-10 (MW)
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
6/20/2016	3-7 PM	4.0	3.1	81	5.8	5.5	4.9 (79°F)	5.2 (80°F)	4.3 (77°F)	4.5 (78°F)
7/22/2016	3-7 PM	5.3	4.1	77	4.7	4.5				
8/15/2016	3-7 PM	5.4	4.2	79	5.1	4.9				
9/26/2016	3-7 PM	4.1	3.1	86	5.4	4.7	4.1 (80°F)	4.7 (86°F)	3.8 (78°F)	4.4 (83°F)
9/27/2016	3-7 PM	2.6	2.0	88	5.6	4.9				

Table 5-11: Differences in 2016 Ex Post and 2017 Ex Ante Impacts Due to Key Factors – Nonresidential 30% Cycling

<table>
<tr><th rowspan="2">Date</th><th colspan="4">2016 Ex Post</th><th colspan="6">2016 Ex Ante Model– Forecast for 2017</th></tr>
<tr><th>Event Window</th><th>Ex-Post Aggregate Impacts (MW)</th><th>Ex-Post Aggregate Impacts using SDG&E Forecast (MW)</th><th>Mean17 using KSAN KNKX Only (°F)</th><th>Ex-Ante Impact with Ex-Post Event Window and Weather (MW)</th><th>Ex-Ante Impact (1PM-6PM) using Ex Post Weather (MW)</th><th>Ex-Ante Impact SDG&E 1-in-2 (MW)</th><th>Ex-Ante Impact SDG&E 1-in-10 (MW)</th><th>Ex-Ante Impact CAISO 1-in-2 (MW)</th><th>Ex-Ante Impact CAISO 1-in-10 (MW)</th></tr>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th><th>G</th><th>H</th><th>I</th><th>J</th><th>K</th></tr>
<tr><td>6/20/2016</td><td>3-7 PM</td><td>0.3</td><td>0.2</td><td>80</td><td>0.4</td><td>0.5</td><td rowspan="3">0.5
(79°F)</td><td rowspan="3">0.5
(80°F)</td><td rowspan="3">0.5
(77°F)</td><td rowspan="3">0.5
(77°F)</td></tr>
<tr><td>7/22/2016</td><td>3-7 PM</td><td>0.5</td><td>0.4</td><td>77</td><td>0.4</td><td>0.5</td></tr>
<tr><td>8/15/2016</td><td>3-7 PM</td><td>0.1</td><td>0.1</td><td>78</td><td>0.4</td><td>0.5</td></tr>
<tr><td>9/26/2016</td><td>3-7 PM</td><td>0.1</td><td>0.0</td><td>85</td><td>0.3</td><td>0.4</td><td rowspan="2">0.4
(80°F)</td><td rowspan="2">0.4
(85°F)</td><td rowspan="2">0.4
(77°F)</td><td rowspan="2">0.5
(82°F)</td></tr>
<tr><td>9/27/2016</td><td>3-7 PM</td><td>0.2</td><td>0.1</td><td>87</td><td>0.3</td><td>0.4</td></tr>
</table>

Table 5-12: Differences in 2016 Ex Post and 2017 Ex Ante Impacts Due to Key Factors – Nonresidential 50% Cycling

Date	2016 Ex Post				2016 Ex Ante Model– Forecast for 2017					
	Event Window	Ex-Post Aggregate Impacts (MW)	Ex-Post Aggregate Impacts using SDG&E Forecast (MW)	Mean17 using KSAN KNKX Only (°F)	Ex-Ante Impact with Ex-Post Event Window and Weather (MW)	Ex-Ante Impact (1PM-6PM) using Ex Post Weather (MW)	Ex-Ante Impact SDG&E 1-in-2 (MW)	Ex-Ante Impact SDG&E 1-in-10 (MW)	Ex-Ante Impact CAISO 1-in-2 (MW)	Ex-Ante Impact CAISO 1-in-10 (MW)
A	B	C	D	E	F	G	H	I	J	K
6/20/2016	3-7 PM	1.4	1.2	79	1.4	1.6	1.6 (78°F)	1.6 (79°F)	1.6 (76°F)	1.6 (77°F)
7/22/2016	3-7 PM	1.1	0.9	76	1.4	1.6				
8/15/2016	3-7 PM	1.2	1.0	78	1.4	1.6				
9/26/2016	3-7 PM	1.0	0.8	85	1.2	1.4	1.4 (79°F)	1.4 (85°F)	1.4 (77°F)	1.4 (81°F)
9/27/2016	3-7 PM	0.3	0.2	87	1.2	1.4				

6 Recommendation

As seen in previous years' evaluations, nonresidential load impacts are much less weather sensitive than residential load impacts, and recently the relationship between nonresidential load impacts and temperature has become slightly negative. In other words, the load impacts observed at higher temperatures, typically at the end of the summer, are lower than impacts observed at more moderate temperatures. A similar trend can be seen for the residential segment, as lower load impacts are observed for hot days towards the end of the Summer Saver season.

Since Summer Saver events are triggered by temperature or system load conditions, events typically occur on the hottest days of the summer, which limits the predictive power that estimates a relationship between load impacts and temperature. One way to test the weather sensitivity of load impacts would be to call events on cooler days, which would provide data points at lower temperatures. These additional data points would better inform the regression models used estimate ex ante impacts.