REPORT

2020 Load Impact Evaluation of San Diego Gas and Electric's AC Saver Day Of Program

Prepared for:
San Diego Gas and Electric Company Co. (SDG&E)

Prepared by:
Candice Potter, *Vice President*
George Jiang, *Managing Consultant*
Chris Ramee, *Project Analyst*

CALMAC Study ID SDG0330
April 1, 2021

Contents

1 Executive Summary

San Diego Gas and Electric Company's (SDG&E) AC Saver Day Of program is a demand response resource based on central air conditioner (CAC) load control that is implemented through an agreement between SDG&E and Itron, Inc. AC Saver Day Of was previously marketed to SDG&E customers as the Summer Saver program – the program name changed to AC Saver Day Of in 2018. This report provides ex post load impact estimates for the 2020 AC Saver Day Of program and ex ante load impact forecasts for 2021–2031.

The AC Saver Day Of program is available to residential and commercial customers in the SDG&E territory. There are two enrollment options for both residential and commercial customers. Residential customers can choose between 50% or 100% cycling and commercial customers can choose between 30% and 50% cycling. The incentive paid for each option varies and is based on the number of CAC tons under control at each premise. Load control is enabled through devices installed on enrolled CAC units that receive dispatch signals from the program's control system, delivered through a public paging network. The AC Saver Day Of season runs from April 1 through October 31. An AC Saver Day Of 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 2020, there were 14,268 customers enrolled in the program with a total cooling capacity of 71,584 tons. These counts represent all the customers that were enrolled at some point during the 2020 season. For the 2020 program year, there were 10,884 residential customers, representing approximately 76% of AC Saver Day Of participants, and 42,412 cooling tons, accounting for about 59% of the program's total tonnage. In the commercial customer class, there were 3,384 participants and 29,173 cooling tons enrolled. Among residential participants, 28% selected the highest cycling option (100% cycling); among commercial participants, 79% selected the 50% cycling option over the 30% option.

A total of 20 regular program events were called in 2020 with event hours ranging between 12 PM and 9 PM. Two of these events were called on weekends. The COVID-19 pandemic resulted in higher residential reference loads and subsequently higher load impacts due to increased home occupancy. Similarly, the pandemic caused commercial customer reference loads and load impact estimates to be lower as a result of decreased occupancy and operations. Event hours varied but the most common event period was 6 to 8 PM, which comprised 11 of the 20 events. The event period from 6 to 8 PM is used for reporting Average Event Day load impacts. Ex post load impacts are estimated using a statistically-matched control group for the residential and commercial customers. Table 1-1 shows the overall 2020 AC Saver Day Of residential ex post load impacts and maximum event window temperatures. The average aggregate demand reduction for residential customers totaled 0.94 MW, or 0.13 kW per premise. The largest load reduction was 3.0 MW on the September 5 event. As shown in Table 1-2, the aggregate load reduction for commercial customers was roughly 0.15 MW, or 0.05 kW per premise. The largest load reduction for commercial customers totaled 0.68 MW and occurred on the August 18 event. It should be noted that the maximum number of 20 events was reached in early September, with eight weeks remaining in the summer season. Therefore, no events could be called during the heatwave that occurred in October 2020.

There were two periods of exceptionally hot temperatures, August 16 to August 20 and September 3 to September 8, when heat waves caused reliability issues for electricity systems across California. AC Saver Day Of was called upon to provide load reductions during these periods. Five AC Saver Day Of events were dispatched during the heat wave emergencies, contributing to the statewide demand response efforts to mitigate the resultant system load spikes. These five events saw the highest aggregate impacts of the entire 2020 control season, ranging from 1.48 MW to 3.02 MW. The final two events on September 5 and 6 were also weekend events, which saw the highest impacts of the season by far.

Table 1-1: 2020 AC Saver Day Of Average Residential Ex Post Load Impacts

Date	Impact				Max Event Window Temperature (°F)
	Per Ton (kW)	Per Device (kW)	Per Premise (kW)	Aggregate (MW)	
6/2/2020	0.01	0.03	0.03	0.24	74
6/3/2020	0.03	0.11	0.12	0.82	76
6/10/2020	0.05	0.18	0.20	1.37	85
6/22/2020	0.00	0.01	0.01	0.09	71
7/8/2020	0.01	0.04	0.05	0.38	80
7/9/2020	0.01	0.04	0.05	0.38	77
7/10/2020	0.04	0.15	0.17	1.27	83
7/13/2020	0.04	0.15	0.17	1.29	79
7/27/2020	0.01	0.04	0.05	0.38	75
7/29/2020	0.01	0.04	0.05	0.35	74
7/30/2020	0.02	0.07	0.08	0.60	79
7/31/2020	0.05	0.17	0.20	1.47	85
8/14/2020	0.05	0.18	0.21	1.26	91
8/17/2020	0.06	0.21	0.23	1.48	88
8/18/2020	0.08	0.26	0.29	1.84	87
8/19/2020	0.07	0.22	0.26	1.61	85
8/21/2020	0.05	0.18	0.21	1.31	87
8/27/2020	0.05	0.18	0.20	1.27	83
9/5/2020	0.11	0.39	0.44	3.02	98
9/6/2020	0.11	0.37	0.42	2.89	99
Average*	**0.03**	**0.12**	**0.13**	**0.94**	**80**

* Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day of event

Table 1-2: 2020 AC Saver Day Of Average Commercial Ex Post Load Impacts

Date	Impact				Max Event Window Temperature (°F)
	Per Ton (kW)	Per Device (kW)	Per Premise (kW)	Aggregate (MW)	
6/2/2020	0.01	0.02	0.05	0.17	73
6/3/2020	0.00	0.01	0.03	0.10	75
6/10/2020	0.01	0.03	0.07	0.24	85
6/22/2020	0.00	0.01	0.02	0.06	70
7/8/2020	0.01	0.05	0.12	0.34	78
7/9/2020	0.01	0.02	0.04	0.13	76
7/10/2020	0.01	0.03	0.07	0.20	82
7/13/2020	0.01	0.02	0.05	0.15	78
7/27/2020	0.00	0.01	0.03	0.09	74
7/29/2020	0.01	0.02	0.05	0.16	73
7/30/2020	0.01	0.02	0.05	0.15	78
7/31/2020	0.01	0.03	0.06	0.19	82
8/14/2020	0.01	0.05	0.12	0.36	89
8/17/2020	0.02	0.07	0.16	0.53	86
8/18/2020	0.02	0.09	0.21	0.68	85
8/19/2020	0.01	0.04	0.09	0.31	84
8/21/2020	0.00	0.01	0.03	0.11	85
8/27/2020	0.00	0.00	0.01	0.04	81
9/5/2020	0.00	0.00	0.00	-0.01	96
9/6/2020	0.01	0.03	0.08	0.24	96
Average*	**0.01**	**0.02**	**0.05**	**0.15**	**79**

* Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day of 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 California Independent System Operator (CAISO) system peaks. Based on ex post results, it is established that AC Saver Day Of load impacts increase with temperature. In the ex ante forecasts, the largest impacts are observed on the September monthly system peak days when the temperature scenarios are the hottest.

In 2021, on a typical event day under 1-in-2 year SDG&E-specific peaking conditions, aggregate load impacts are forecasted to equal 1.17 MW for residential customers and 0.26 MW for commercial customers, for a total program load reduction of 1.43 MW. In 2021, under 1-in-10 year SDG&E-specific peaking conditions, estimated impacts on the typical event day are forecasted to equal 1.88 MW and 0.3 MW for residential and commercial customers, respectively, or 2.18 MW in total. This is about 50% greater than on a typical event day under 1-in-2 year weather conditions. These estimates in 2021 incorporate a COVID timing effect variable provided by SDG&E, which dictates the degree to which COVID is expected to influence residential and commercial load throughout the ex ante forecast horizon. From a full 1.0 in December 2020, the effects of COVID are projected to linearly decrease by 0.0727 each month in 2021.

In the case of the residential segment, August 2021 enrollments are forecasted to be 8,320 participants. In the case of the commercial segments, August 2021 enrollments are forecasted to be 3,065 participants. Over the next five years, the residential population is projected to increase by 1.2% per year while the commercial population is projected to decrease by 2.6% per year.

2 Introduction and Program Summary

San Diego Gas and Electric Company's (SDG&E) AC Saver Day Of program is a demand response resource based on central air conditioner (CAC) load control that is implemented through an agreement between SDG&E and Itron, Inc.[1] This report provides 2020 ex post load impact estimates and ex ante load impact estimates for an 11-year forecast horizon (2021–2031) as required by the California Public Utilities Commission (CPUC) Load Impact Protocols.[2]

The AC Saver Day Of program is classified as a day-of demand response program and is available to both residential and commercial customers. AC Saver Day Of events may only be called during the months of April through October. Under the current program framework, events can be triggered up to 80 hours per year, 24 hours per month, and three consecutive days at maximum with a total of no more than 20 events 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 commercial customers alike.

Relatively new to the program design is the current program event triggering mechanism. Previously, an event was triggered by system conditions, specifically when day-ahead forecasted system load reaches 4,000 MW. Under program design changes that took place in 2017, event triggers vary by month. During the program operational season, an AC Saver Day Of event can be triggered by any of the following criteria:

- Generator heat rates reaching or exceeding 35,000 Btu[3] per kWh in April, May, June, or October; or 25,000 Btu per kWh in July, August, or September;
- Imminent statewide or local emergencies, extreme conditions, and/or local distribution needs; or
- Upon the award of a bid into the California Independent System Operator (CAISO) wholesale market.

AC Saver Day Of events may be called between 12 PM and 9 PM, and each event may last from a minimum of two to a maximum of four hours in duration. Prior to 2017, an AC Saver Day Of event could be called between 12 PM and 8 PM, and each event could last one to four hours.

There are two enrollment options for both residential and commercial 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 $10.35 per ton per year of CAC capacity and the 100% cycling option pays $27 per ton per year. A residential customer

---

[1] AC Saver Day Of was previously marketed to SDG&E customers as the Summer Saver program. The program name changed to AC Saver Day Of in 2018.

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

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

with a four-ton CAC unit would be paid the following in the form of an annual credit on their SDG&E bill:

- $41.40 for 50% cycling; or
- $108 for 100% cycling.

Commercial customers have the option of choosing 30% or 50% cycling. The incentive payment for 30% cycling is $4.50 per ton per year and $7.50 per ton per year for the 50% cycling option. A commercial customer with five tons of air conditioning would be paid the following in the form of an annual credit on their SDG&E bill:

- $22.50 for 30% cycling; or
- $37.50 for 50% cycling.

Customer enrollment in the AC Saver Day Of program is summarized in Table 2-1. The table includes all customers who were enrolled at any point during the 2020 season. There were 14,268 customers enrolled in the program, representing 71,584 tons of CAC capacity in aggregate. For the 2020 program year, residential customers represented approximately 76% of AC Saver Day Of participants and accounted for about 59% of the program's total cooling tons. About 72% of residential customers selected the 50% cycling option and approximately 79% of commercial customers chose the 50% cycling option, which represent the higher of the two cycling strategies offered to those customer segments. Total enrollment—as measured by number of customers, number of devices, and CAC capacity (in tons)—has decreased for commercial customers since 2017 due to a program change to drop residential program participants with a net energy metering (NEM) agreement with SDG&E, as well as minimal marketing to attract new participants to the program. In spring of 2020, over 2,000 residential participants were added to the program, the vast majority under the 50% cycling option. These participants were customers that had moved into a premise with a previously deactivated AC Saver Day Of switch. This addition of residential participants resulted in a year-over-year increase in enrollment for the first time since 2017. However, because of implementation issues discussed in Section 3.2, these customers were not included in event dispatches during the 2020 program season. Nevertheless, their participation is counted in the enrollment counts shown below as well as the ex ante enrollment forecast since we expect Itron to resolve these implementation issues in 2021.

Table 2-1: AC Saver Day Of Enrollment

Customer Type	Cycling Option	Enrolled Customers	Enrolled Control Devices	Enrolled Tons
Residential	50%	7,839	8,909	30,028
	100%	3,045	3,575	12,384
	Total	10,884	12,484	42,412
Commercial	30%	708	2,016	7,374
	50%	2,676	5,828	21,799
	Total	3,384	7,844	29,173
Grand Total		**14,268**	**20,328**	**71,584**

The global COVID-19 pandemic began to impact North American economies in March of 2020, leading to the cessation or severe curtailment of many sectors of economic activity, including education, travel, and arts and entertainment. The SDG&E service territory was subject to stay-at-home orders and other state-mandated social distancing measures during the entirety of the 2020 load control season. In terms of program operations, there were no COVID-19 related changes to the AC Saver Day Of program. However, we observed changes in hourly energy usage profiles for both commercial and residential participants that are reasonably ascribed to the pandemic. Our reference load estimates reflect higher residential weekday loads that are most likely due to increased weekday home occupancy resulting from childcare and education occurring in the home in addition to adults conducting work activities at home or spending time at home due to furlough or unemployment. Likewise, our commercial customer reference load estimates reflect lower commercial weekday loads for the same reasons. We refer to these changes in reference loads as “COVID-19 effects” and we discuss how we address these effects in reference load later in this report.

The PY 2020 evaluation also covers a period of time in which the state of California experienced to significant weather heat storm events that precipitated reliability issues for electricity systems across California. AC Saver Day Of was called upon to provide load reductions during these periods. Five AC Saver Day Of events were dispatched during the heat wave emergencies, contributing to the statewide demand response efforts to mitigate the resultant system load spikes.

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. Section 5 presents the ex ante estimates and also provides details concerning the differences between the 2020 and the 2019 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 2020 and for ex ante weather and event conditions. Ex post results were calculated using control and treatment groups, where a matched control group was used for both the residential and commercial segments. For ex ante, the average load impacts from 2019 and 2020 were used to estimate models relating temperature to load reductions. Ex post impacts from 2019 and 2020 were compared in order to specify an ex ante model that accounted for the effects of COVID-19 on reference loads. A more detailed discussion is provided in Section 3.3.

3.1 Data

A total of 20 AC Saver Day Of events were called in 2020. Table 3-1 shows the date, day of week, start time, end time, and temperature metrics for each event. It also identifies if an event occurred during the weekend. The event hours varied from 12 PM to 9 PM across the events in 2020.

Table 3-1: Summary of 2020 AC Saver Day Of Events

Date	Day of Week	Start Time	End Time	Mean17 (°F)	Max. Event Window Temperature (°F)
6/2/2020	Tuesday	6:00 PM	8:00 PM	68	74
6/3/2020	Wednesday	6:00 PM	8:00 PM	73	76
6/10/2020	Wednesday	6:00 PM	8:00 PM	76	85
6/22/2020	Monday	7:00 PM	9:00 PM	68	71
7/8/2020	Wednesday	12:00 PM	2:00 PM	70	80
7/9/2020	Thursday	6:00 PM	8:00 PM	68	77
7/10/2020	Friday	6:00 PM	8:00 PM	73	83
7/13/2020	Monday	6:00 PM	8:00 PM	75	79
7/27/2020	Monday	6:00 PM	8:00 PM	70	75
7/29/2020	Wednesday	6:00 PM	8:00 PM	68	74
7/30/2020	Thursday	6:00 PM	9:00 PM	70	79
7/31/2020	Friday	5:00 PM	8:00 PM	75	85
8/14/2020	Friday	5:00 PM	9:00 PM	80	91
8/17/2020	Monday	5:00 PM	8:00 PM	78	88
8/18/2020	Tuesday	4:00 PM	8:00 PM	81	87
8/19/2020	Wednesday	6:00 PM	8:00 PM	80	85
8/21/2020	Friday	6:00 PM	8:00 PM	79	87
8/27/2020	Thursday	6:00 PM	8:00 PM	76	83
9/5/2020*	Saturday	5:00 PM	8:00 PM	83	98
9/6/2020*	Sunday	5:00 PM	8:00 PM	89	99

* Reflects a weekend event

California experienced notable statewide heat events in the summer of 2020. There were two periods of exceptionally hot temperatures, August 16 to August 20 and September 3 to September 8, when heat emergencies were declared by Governor Newsom for the state of California. There were three events called during the heat emergency in August and two events during the September heat emergency. The events on September 5 and 6 were by far the hottest events in 2020, with temperatures reaching 99 °F during the event window.

Table 3-2 shows the distribution of CAC tonnage by cycling option and climate zone for the residential participant population as of October 2020. Due to the small populations of participants in the Mountain and Desert Climate Zones, they are combined into the Coastal and Inland Climate Zones, respectively, in our ex post and ex ante analyses.

Table 3-2: Distribution of CAC Tonnage by Program Option and Climate Zone 2020 Residential Population

Group	Cycling Option	Group	Climate Zone				Total
			Coastal	Inland	Desert	Mountain	
Residential	50%	Population	10%	60%	0.1%	1.0%	71%
	100%	Population	7%	22%	0.0%	0.2%	29%
	Total	**Population**	**17.0%**	**81.7%**	**0.1%**	**1.2%**	**100%**
Commercial	30%	Population	12%	13%	0.0%	0.2%	25%
	50%	Population	37%	38%	0.0%	0.1%	75%
	Total	**Population**	**49.2%**	**50.5%**	**0.0%**	**0.3%**	**100%**

3.2 Methodology

The primary task in developing ex post load impacts is to estimate the reference load for each event. The reference load represents the counterfactual—a measure of what hourly participant demand would have been in the absence of CAC cycling during an event. The primary task in estimating ex ante load impact forecasts—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. Ex post impacts, enrollment forecasts, and assumed weather conditions are typically the key inputs to the ex ante analysis.

Two distinct approaches for estimating the ex post reference loads have usually been used in prior load impact evaluations of AC Saver Day Of: a randomized controlled trial (RCT) design and a statistical matching design. The program's capabilities in individually addressing load control devices can be leveraged to facilitate the RCT approach, whereby 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. This approach requires a subset of the program participants to be withheld from program event dispatch to serve as the control group and as such, RCTs are usually only implemented in programs that are large enough to warrant the tax on load impacts delivered by the program that they impose. For that reason, the RCT approach has historically only been used for evaluating the residential program segment, which is much larger than the commercial segment.

Prior to the first event of the 2020 control season, roughly 1,600 customers in the residential sample were assigned to one or more control groups (groups A, B, and C). The group serving as the control group alternates from month to month throughout the course of the summer of 2020, while the remainder of residential participants have their CAC units cycled during events. This design has significant advantages in providing quickly obtainable, reliable impact estimates. However, the design of this RCT framework was not successfully carried out in 2020. The AC Saver technology relies on pagers to signal the load control devices. Paging issues resulted in failures in addressing the load control devices and their assignment to the three control groups. The RCT evaluation approach was therefore not possible for the 2020 program year ex post analysis and as a result, the statistical matching design was used for both the residential ex post analysis and the commercial ex post analysis. The statistical matching approach has historically been the approach of choice for the commercial segment due to the relatively small number of participants in that segment.

3.2.1 Ex Post Methodology

3.2.1.1 Implementation Issues in Program Year 2020

Once it became apparent that the random assignments of residential participants to control groups were not completely implemented due to paging issues, Nexant needed to determine which load control devices likely received the signal from Itron to cycle CAC load on event days. Nexant used data provided by Itron identify the "last known cycling strategy" to determine the cycling strategy that was in place for each participant prior to June 2020. In general, load control devices were assumed to have the same cycling strategy as they had in 2019. In the course of examining event-day participant loads to validate this approach, Nexant determined that Itron's reported schedule for which groups were cycled on which event days was not accurate. Table 3-2 shows Nexant's validated schedule of event dates and the research groups that were included for load control during each event. For example, on the first event day of 2020, June 2, research groups B and C of the 50% cycling segment were not dispatched for cycling and research groups A and C of the 100% cycling segment were not dispatched for cycling. In our analysis for June 2, only 50% cycling customers that are not assigned to any research group or group A were included and only 100% cycling customers that not assigned to any research group or group B were included. As seen in Table 3-2, the research groups included for cycling during program events changes from month to month, and as such our ex post load impacts reflect associated fluctuations in the number of participating customers over the course of the summer.

An additional consequence to the paging issues is that a group of over 2,000 residential customers with legacy AC Saver Day Of switches that were intended to be added in spring 2020 did not receive the activation signal to be able to participate in the program in 2020. Our ex post analysis did not include those customers since their device addressing is known to have failed. The participation counts shown in Table 3-2 have approximately 1,650 fewer customers at the end of the control season than what was expected if the addition of those participants had succeeded. Our ex ante estimates, however, include those customers under the assumption that the paging issues are resolved, and these customers can successfully be added to the program before the 2021 control season.

We note that commercial participants were largely unaffected by the paging issues encountered in 2020 since they are not evaluated using control groups and these participants rarely change cycling strategies.

Table 3-2: Summary of Customer Counts for Each 2020 Event Day

Event Date	Total Customers Cycled	Commercial Customers Cycled	Residential Customers Cycled	Residential 50% Research Group Cycled	Residential 100% Research Group Cycled
6/2/2020	10,089	3,206	6,883	A	B
6/3/2020	10,018	3,198	6,820	A	B
6/10/2020	10,017	3,198	6,819	A	B
6/22/2020	10,057	3,199	6,858	A	B
7/8/2020	10,436	2,933	7,503	A	A and B
7/9/2020	10,435	2,932	7,503	A	A and B
7/10/2020	10,298	2,871	7,427	A	A and B
7/13/2020	10,299	2,872	7,427	A	A and B
7/27/2020	10,572	3,113	7,459	A	A and B
7/29/2020	10,610	3,145	7,465	A	A and B
7/30/2020	10,636	3,164	7,472	A	A and B
7/31/2020	10,649	3,193	7,456	A	A and B
8/14/2020*	9,069	3,111	5,958	A	None
8/17/2020	9,591	3,275	6,316	A	None
8/18/2020	9,585	3,274	6,311	A	None
8/19/2020	9,581	3,273	6,308	A	None
8/21/2020	9,587	3,277	6,310	A	None
8/27/2020	9,585	3,279	6,306	A	None
9/5/2020	9,928	3,130	6,798	A	B
9/6/2020	9,916	3,123	6,793	A	B
Average**	**10,099**	**3,124**	**6,975**	-	-

* Reflects a date with rolling blackouts due to CAISO system emergency

** Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day of event

A last circumstance of note specific to 2020 is that a single AC Saver Day Of event occurred during a CAISO system emergency on August 14. Some program participants experienced an electric service outage due to rolling blackouts. These participants were not included in the ex post analysis, and program participant counts for the August 14 event are slightly lower because of the rolling blackouts. In total, 362 residential and 166 commercial customers were affected by the outages.

3.2.1.2 Statistical Matching Framework

Consistent with the methodology used since the 2015 AC Saver Day Of evaluation, a matched control group was selected for the commercial program population whereby one nonparticipant was selected as a match for each participant on each event. The entire SDG&E small and medium business (SMB) customer population was made available for the statistical matching analysis. The same method was used for residential participants, but the eligible control pool of residential customers was not the entire residential customer population, but rather a subset selected based on geography and monthly usage characteristics.

Each matched customer was chosen because they most closely resembled their matched participant in terms of the dissimilarity statistic described in Equation 3-1. The dissimilarity statistic measures how similar each match candidate is to any given participant customer based on how well (or not) their energy usage characteristics match those of the participant on both the event day and other hot non-event days in 2020, called proxy days. The characteristics used in the dissimilarity statistic are:

- Average demand during the event window hours on the average proxy day;
- Average demand from midnight to 10 AM on the event day; and
- Average demand from 10 AM to the start of the event for each event day.

Equation 3-1: Dissimilarity Statistic for Commercial Matching

$$Dissimilarity_i = \left(PeakProxy_i - PeakProxy_j\right)^2 + \left(EventMorn_i - EventMorn_j\right)^2 + \left(EventMidday_i - EventMidday_j\right)^2$$

Variable	Definition
$PeakProxy$	Average demand across the 2020 proxy days during the event window hours
$EventMorn$	Average demand on the event day from midnight to 10 AM
$EventMidday$	Average demand on the event day from 10 AM to the start of the event
j	Commercial AC Saver Day Of participant to be matched
i	Index of the pool of control customers

This dissimilarity statistic was chosen as the optimal metric for matching among four alternately specified metrics and following an out-of-sample testing exercise with many alternative matching models. The best metric was chosen based on pre-treatment balance measures.

Matches were chosen such that only customers in the same industry (for commercial customers) and climate zone would be matched to one another. Likewise, NEM customers were only matched to other NEM customers (for commercial customers). This approach minimizes the differences between participants and matched nonparticipants while allowing for good estimates for program subsegments of interest.

The matching process proceeds, one participant at a time, by selecting the non-participant with the same industry (commercial only), climate zone, and NEM status (commercial only) with the smallest dissimilarity statistic. Individual non-participants may be selected more than once as a matched control customer.

During the 2020 control season, SDG&E implemented several Public Safety Power Shutoffs (PSPS) to mitigate potential wildfires during adverse weather conditions. None of the PSPS days occurred during AC Saver Day Of events. However, one PSPS event on September 9th did coincide with a proxy day used in the ex post load impact analysis. All customers on affected circuits were excluded from calculations on this proxy day. In total, zero participants experienced shutoffs on this day, while 186 residential and 356 commercial matched control customers were dropped.

3.2.1.3 Load Impact Estimation

Ex post event impacts were estimated for a broad collection of program segments and subsegments including customer class, cycling strategy, NEM status, climate zone, industry, and status of dual-enrollment in other pricing and demand response programs at SDG&E.

Within each of these program segments, load impacts were estimated for each hour of each event day for matched customers using two approaches:

First, we simply calculate the difference between the average demand for those customers who were cycled (the treatment group) and those who were not (the matched control group). We refer to this simple difference in average hourly load as an “unadjusted” load impact.

However, since matching can leave some residual differences between the treatment and control groups that is not due to the CAC cycling, we also estimate what we refer to as the “adjusted” load impact that takes into account the relatively small differences between treatment and control group usage and thereby improves the accuracy and precision of the estimate. This adjusted estimate of load impacts is determined by a lagged dependent variable (LDV) regression model.

The regression, described in Equation 3-2, essentially uses variation among the group that was not cycled to establish the relationship between the demand before the event and on proxy days and the demand during the event window and afterward. The regression can then make a prediction for all of the cycled customers based on that simple model. This is very similar to how a ratio adjustment works. A ratio adjustment multiplies event day demand for the control group by the ratio between the cycled and control demands in the hours prior to the event window. An

LDV model with one variable does the same thing, but it allows the adjustment to account for differences between the cycled and control group on proxy days as well.[4]

Equation 3-2: LDV Model for Estimating Impacts

$$Demand_i = a + t * Cycled_i + b * Proxy_i + c * ProxyWindow_i + d * ProxyEve_i + e * EventMorn1_i + f * EventMorn2_i + g * EventMorn3_i + h * PreEvent_i + u_i$$

Variable	Definition
$Demand$	Average demand in the event hour being studied
$Cycled$	An indicator for whether customer i was cycled
$Proxy$	Average demand in the hour being studied on the average proxy day
$ProxyWindow$	Average demand in the event window on the average proxy day
$ProxyEve$	Average demand after the event window on the average proxy day
$EventMorn1$	Average demand from midnight to 7 AM on the event day
$EventMorn2$	Average demand from 7 AM to 10 AM on the event day
$EventMorn3$	Average demand from 10 AM to four hours before the event on the event day
$PreEvent$	Average demand during the four hours before the event
i	Customer index
t	Estimated impact
$a - h$	Estimated regression coefficients
u	Error term

For estimating treatment effects, as we are doing in this setting, the adjustments from the LDV only change the estimate of the treatment effect if there are differences between the group that was cycled and the group that was not cycled on proxy days or in the hours leading up to the event. These differences should be relatively small for most of the important treatment effect estimates since the matching performed well (we discuss our matching validation in the next section of this report). In cases such as this, where the matching performs well, the treatment effect estimates with and without the adjustment will look similar, but the confidence intervals

[4] Such an LDV model would be specified as

$$Demand_i = a_2 + t_2 * Cycled_i + h_2 * PreEvent_i + u_i$$

will be much smaller for the adjusted version because the LDV model uses the data more efficiently.

Hourly impact estimates for the entire residential AC Saver Day Of 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 and enrolled within each climate zone for each cycling option.

3.2.2 Matched Control Group Validation

Even though statistical matching should produce research groups with similar characteristics, it is still important to compare the groups based on electricity consumption when AC Saver Day Of events are not in effect. In the absence of very large samples, differences in energy consumption between the groups can still occur due to a heterogeneous control pool with statistical matching. The hourly differences between the treatment group (i.e., AC Saver Day Of participants) and the control group (i.e., non-participants) across all non-event proxy days tested average to less than 1% across event hours for both residential and commercial groups.

Figure 3-1 and Figure 3-2 illustrate these differences, showing the treatment group and matched control group loads averaged across 33 non-event proxy days from 2020. As the figures show, the load shapes for residential and commercial matched control and treatment customers are similar, and the closeness of the plotted lines reflects the magnitude of hourly differences. On average, for the entire residential customer program segment, the average percentage difference between the treatment and matched control groups is -0.2% across all 24 hours. In terms of absolute differences, the percentage differences in the residential customer class range from 0.1% to 3.1%. The largest differences occur during the early afternoon hours when demand is highest. However, during the Resource Adequacy (RA) window of 4 PM to 9 PM, in which all but one of the 2020 AC Saver Day Of events were called, the average difference is -0.7%. Similarly, for the commercial customer class, the average percentage difference between the treatment and matched control groups is -0.4% across all 24 hours. The absolute differences range from 0.01% to 2.6%. From 4 PM to 9 PM, the average difference is -0.2%. Because the load shapes of the treatment and matched control groups are very similar, the LDV model described in the previous section will be effective in adjusting for the differences.

Figure 3-3 and Figure 3-4 show the treatment and matched control residential and commercial customers, further segmented by cycling option. At the cycling level, residential groups show larger hourly differences for each cycling option compared to the differences between non-event loads when both cycling options are combined. The average percentage difference between the treatment and matched control groups is 0.6% for the 50% cycling group and -1.8% for the 100% cycling group across all 24 hours. The absolute value percentage differences are no more than 4.9% for the 50% cycling group and 5.7% for the 100% cycling group. The commercial participant and matched control groups for the 50% and 30% cycling options, however, show approximately the same level of error as the combined groups. The average percentage difference between the commercial treatment and matched control groups is -0.8% for the 30% cycling group and -0.3% for the 50% cycling group across all 24 hours. The absolute percentage differences are no more than 3.8% for the 30% group and 2.3% for the 50% group. As shown in Table 2-1, the populations of some of these cycling subgroups are relatively small, which explains why the differences are greater between the treatment and matched control customers in the subgroups than in the general customer classes.

Figure 3-1: Residential Matched Control and Treatment Group Comparison Average Load across All 2020 Proxy Days

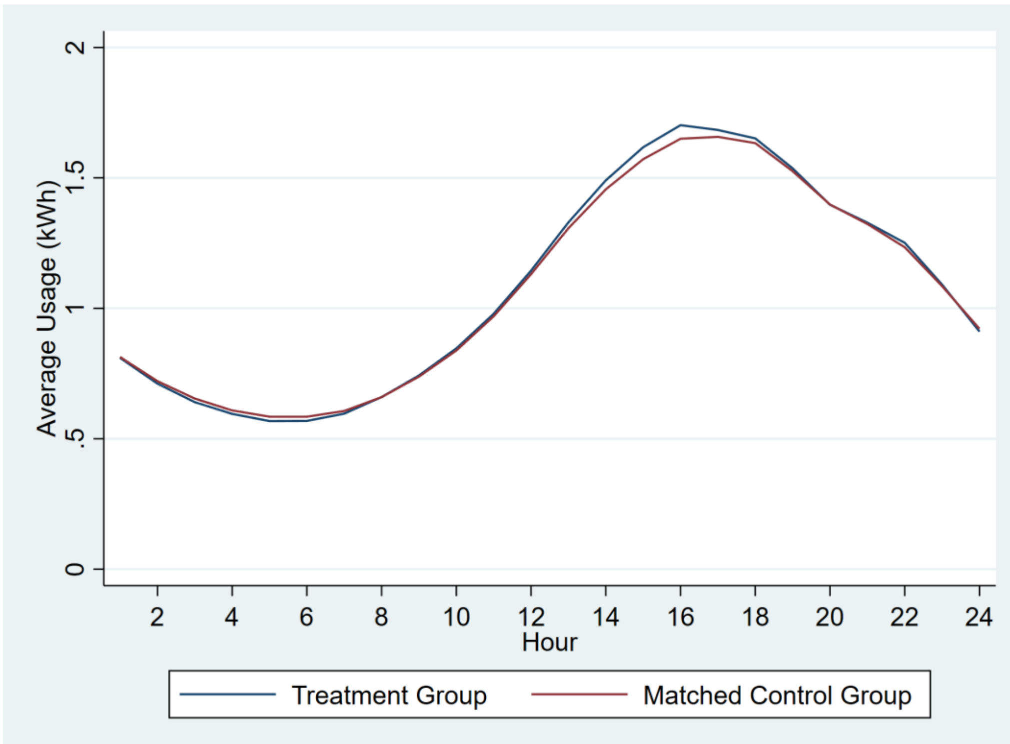


Figure 3-2: Commercial Matched Control and Treatment Group Comparison Average Load across All 2020 Proxy Days

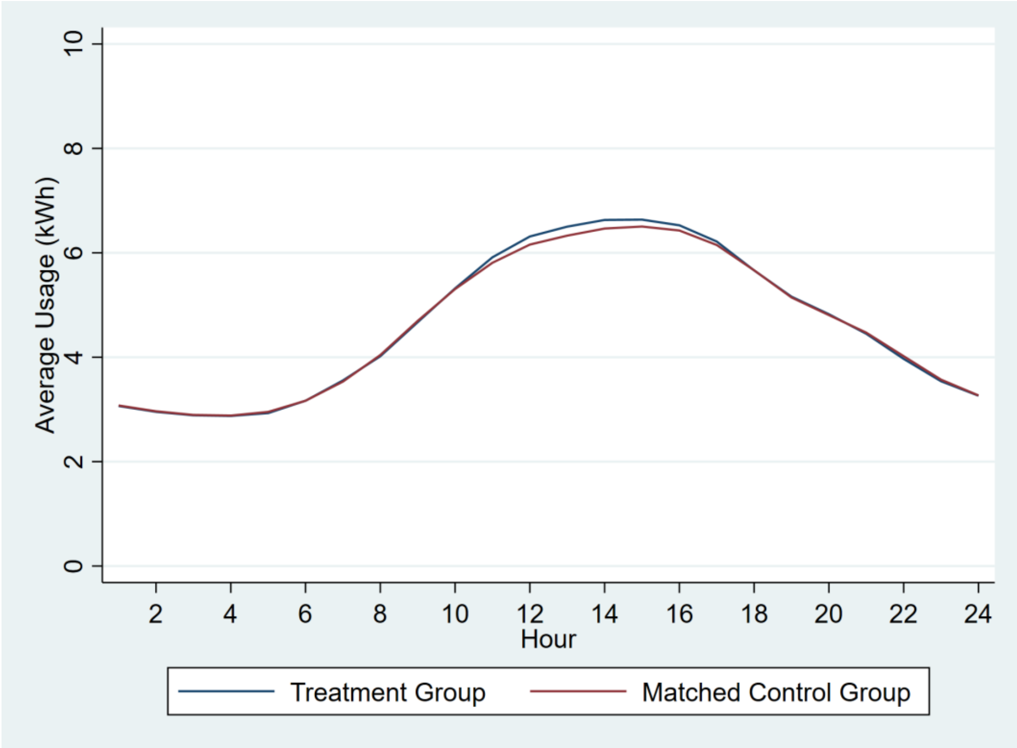


Figure 3-3: Residential Matched Control and Treatment Group Comparison Average Load Across all 2020 Proxy Days by Cycling Option

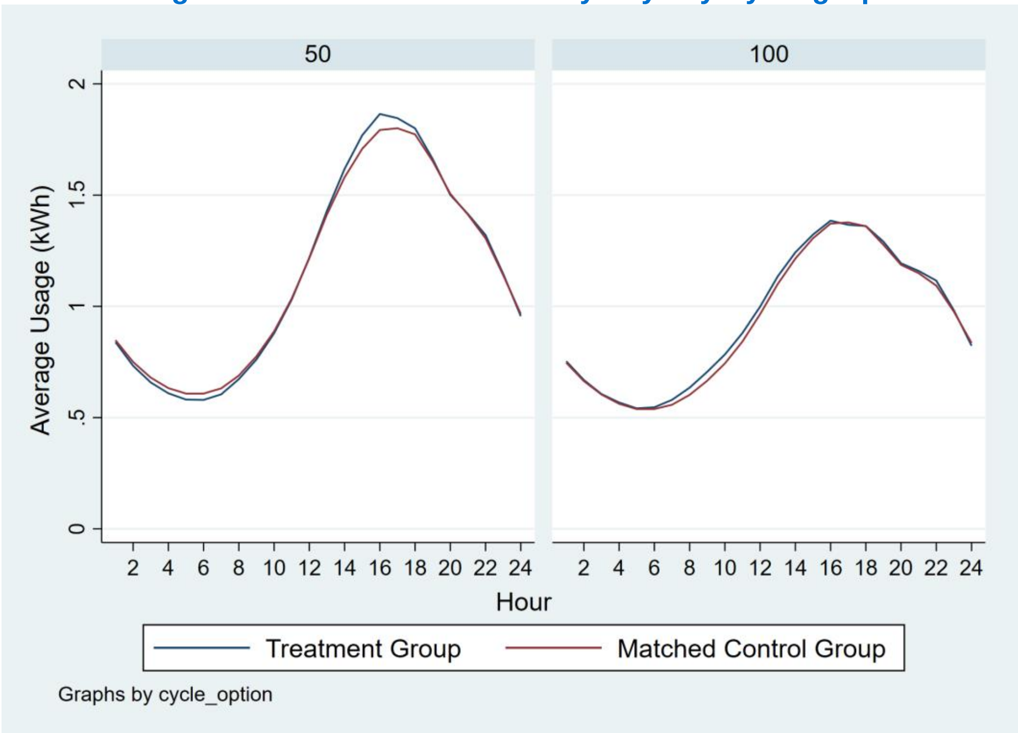
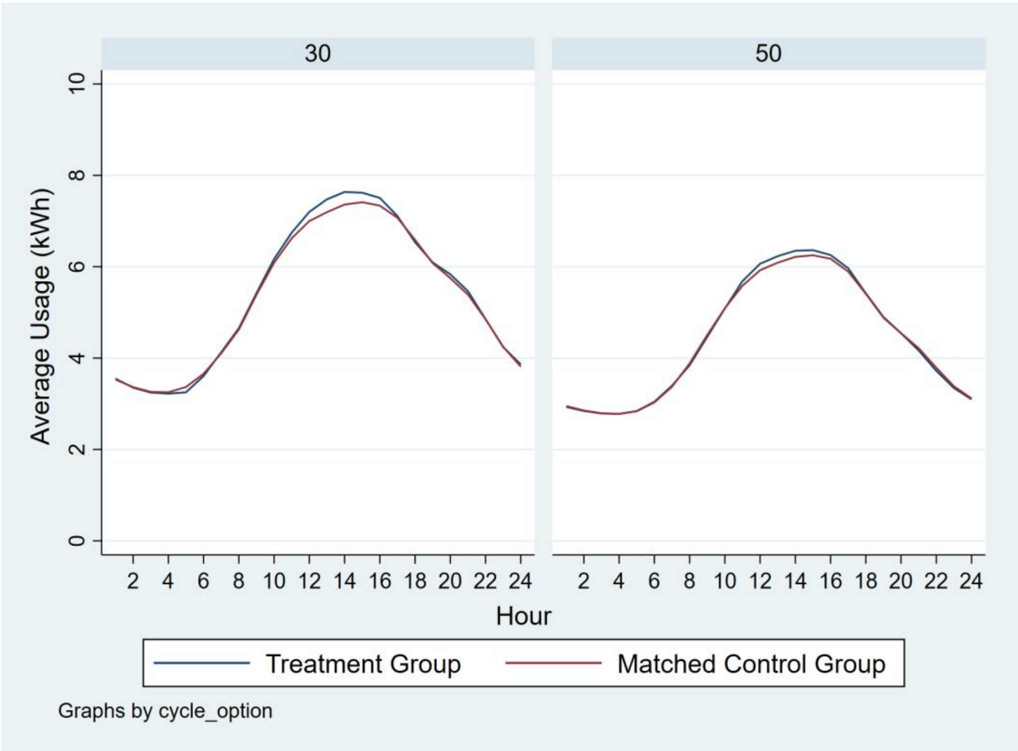


Figure 3-4: Commercial Matched Control and Treatment Group Comparison Average Load Across all 2020 Proxy Days by Cycling Option



3.3 Ex Ante Impact Estimation Methodology

The ex ante load impacts were developed using methodology that is modified from that which has been used in prior evaluations of AC Saver Day Of. Our modified methodology accounts for the effects of COVID-19 pandemic that are expected to still be in effect in 2021 and beyond. Ex ante impacts have traditionally been developed using two years of historical ex post load impacts, where ex post results from the current evaluation (2020) and the prior evaluation (2019) are used to model reference loads and kW impacts. However, for the current evaluation, directly combining the results from 2019 and 2020 was not feasible because the COVID-19 pandemic caused the reference loads to shift considerably in 2020 for both residential and commercial customers. These differences resulted in an adapted ex ante methodology that takes into account the effect COVID-19 has on reference loads and load impacts.

The series of figures below illustrate the differences in the weather sensitivity of these metrics between 2019 and 2020. Figure 3-5 and Figure 3-6 show a comparison between the reference loads on average event days for the two years. In Figure 3-5, residential customers have higher reference loads in 2020 than 2019, even though the range of temperatures experienced by these customers is similar to those they experienced in 2019. It is reasonable to assume that more people were staying at home due to pandemic restrictions and thus using more electricity in 2020. On the other hand, commercial reference loads are lower in 2020, even at similar temperatures than were present in 2019, presumably because more business were shut down or running partial operations during the pandemic, as shown in Figure 3-6. The x-axis for these figures as well as the remaining scatterplots in this section represents the average temperature over the first 17 hours of each event day (midnight to 5 PM), or mean17, a measure of heat buildup prior to the onset of events. Since we observe higher residential reference loads and lower commercial loads in 2020 that we ascribe to the COVID-19 pandemic, we take them into account into our ex ante load impact estimates, as we describe later in this section.

Figure 3-5: Residential Reference Loads on Average Event Days (6 PM – 8 PM)

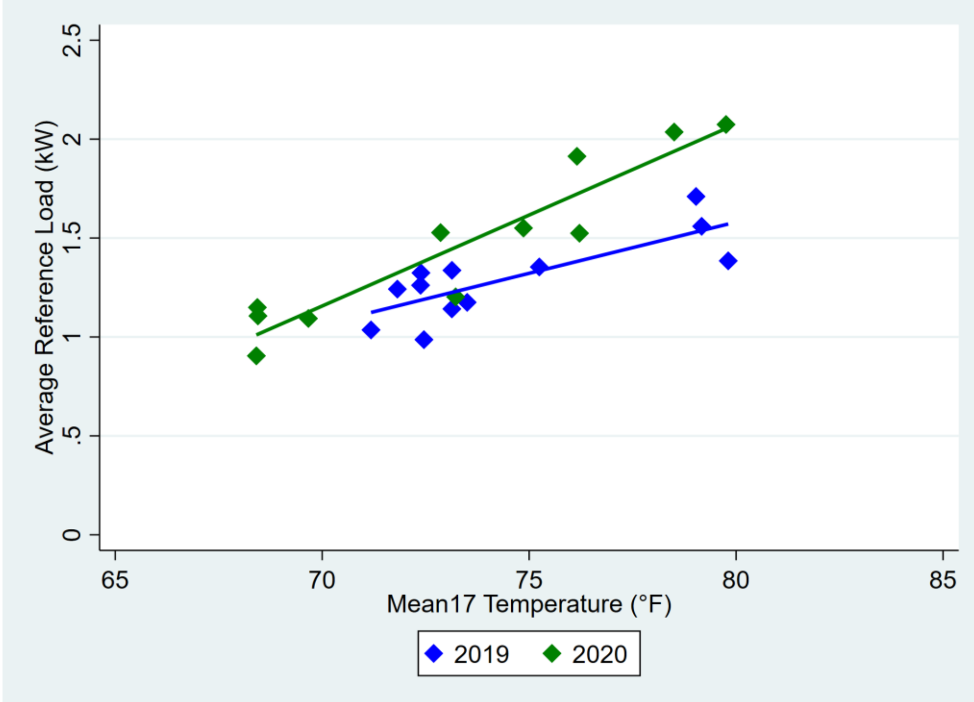
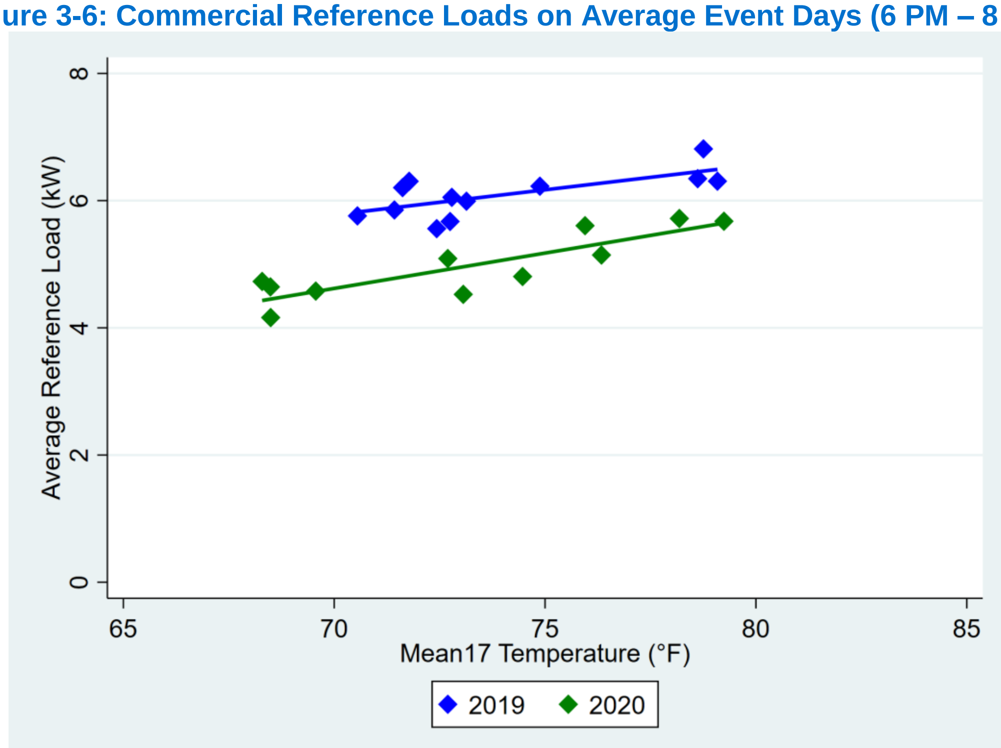


Figure 3-6: Commercial Reference Loads on Average Event Days (6 PM – 8 PM)



There was also a similar change in the kW impacts from 2019 to 2020 due to COVID-19. Generally, customers with higher reference loads will produce larger kW impacts because they have more load to shed. In 2020, residential customers had higher kW impacts than 2019 because they had higher reference loads. The opposite was true for commercial customers who had lower kW impacts in 2020 because their reference loads decreased. These results are shown in Figure 3-7 and Figure 3-8. The relationship of load impacts to temperature does not show enough change in 2020 relative to 2019 to convince us that COVID-19 enhanced or degraded load impacts through any other mechanism than simply increasing reference load. We note in Figure 3-7 that a stronger relationship of impacts to temperature is seen in 2020, but the events at the lowest temperatures are highly influential in that relationship – note that the residential participants did not face temperatures that low in 2019. If they had, there is a reasonable possibility that impacts at those temperatures in 2019 would result in an impacts-to-temperature relationship very similar to that seen in 2020. Therefore, our ex ante estimates only assume changes to reference load due to COVID-19, and not changes in load impacts independent of reference load.

Figure 3-7: Residential Ex Post kW Impacts on Average Event Days (6 PM – 8 PM)

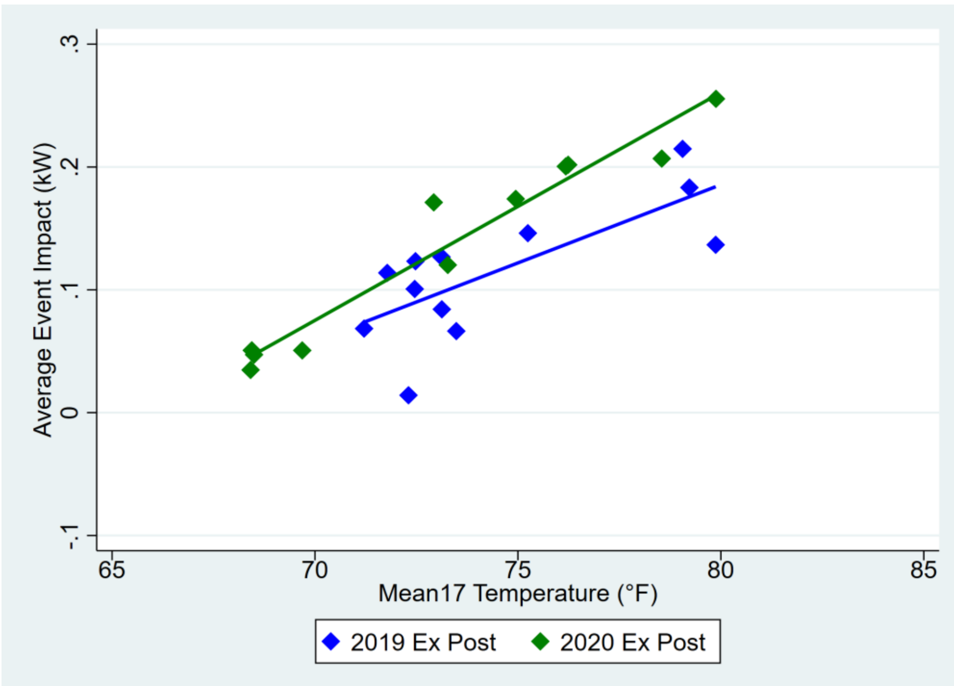
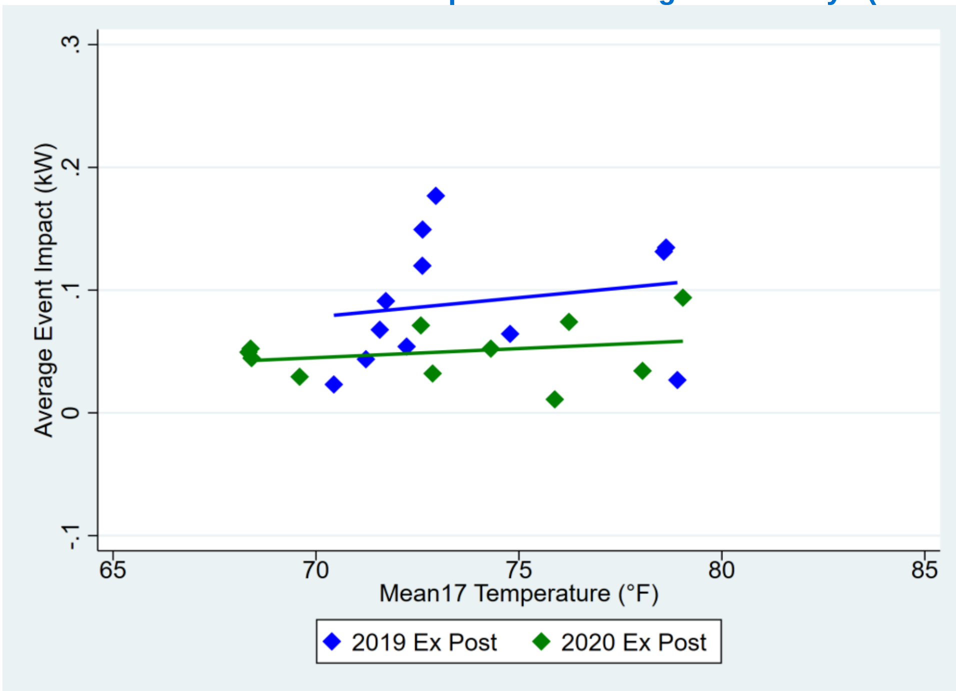


Figure 3-8: Commercial Ex Post kW Impacts on Average Event Days (6 PM – 8 PM)



Our assumption that COVID-19 effects on program load impacts can be isolated to changes in reference load implies that we may convert absolute load impacts (kW) to load reductions as a percentage of reference load (%) and use both 2019 and 2020 ex post percent load reductions to model the weather responsiveness of AC Saver Day Of load impacts.

Since the overall objective of our ex ante load impact analysis is to produce projected load impacts for the RA window of 4:00 PM to 9:00 PM, we use ex post load impacts for events from 2019 and 2020 that are as similar as possible to the RA window. The event window of 6:00 PM to 8:00 PM was most frequently used in both 2019 and 2020, so we select the collection of load impacts from all weekday events called in 2019 and 2020 for the period 6:00 PM to 8:00 PM to form the basis of our ex ante analysis. Load impacts as a percentage of reference load for those events from 2019 and 2020 are presented in Figure 3-9 and Figure 3-10. The black line in both Figures represents the relationship of percent load reduction to Mean17 temperatures. This is the same ex ante analytical basis as has been used in many prior evaluations of the AC Saver Day Of program, but modified here with the use of percent load reductions rather than absolute load reductions. This basic relationship of program impact to weather is the starting point for developing hourly load reductions for the entire RA window, which we explain later in this section.

Figure 3-9: Residential Ex Post Percent Impacts on Average Event Days (6 PM – 8 PM)

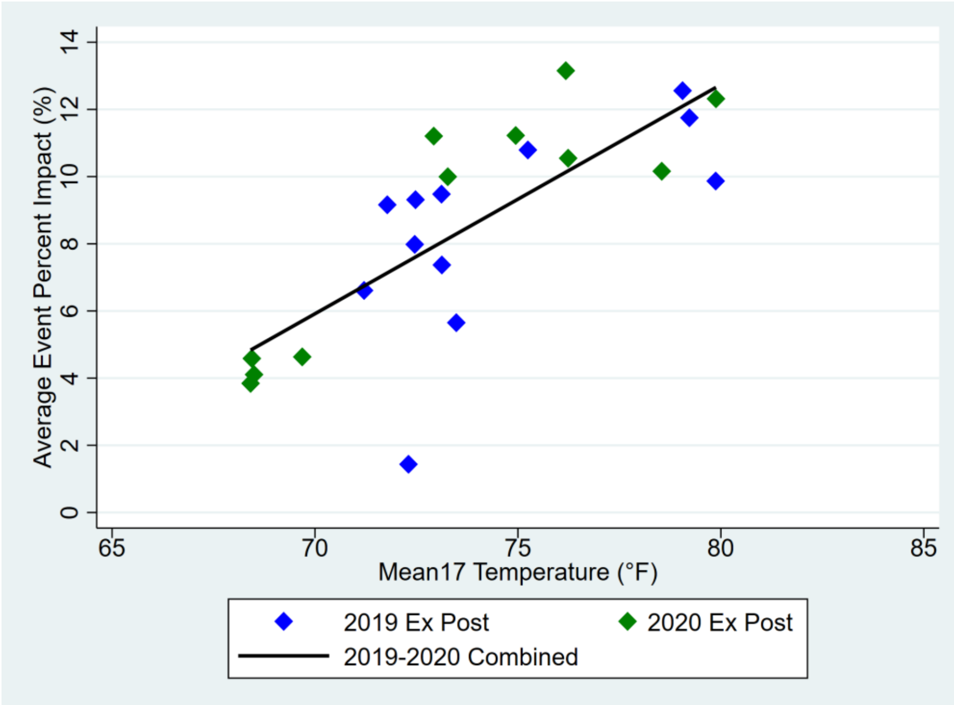
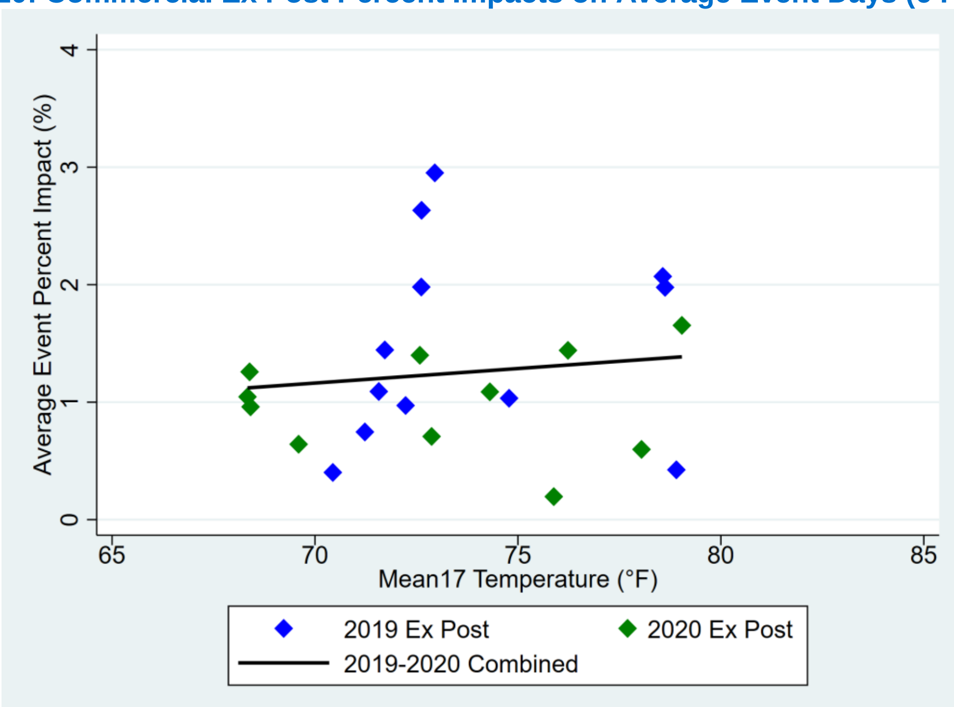


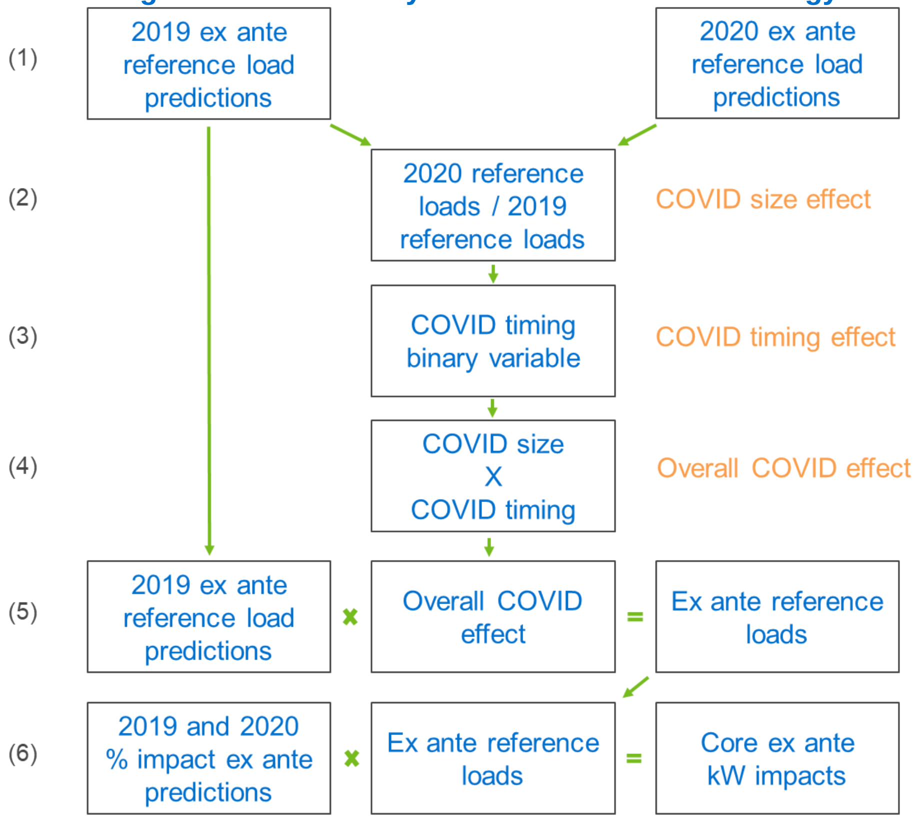
Figure 3-10: Commercial Ex Post Percent Impacts on Average Event Days (6 PM – 8 PM)



After converting our ex ante analysis's basis to percentage load reductions, our evaluation also included an additional change from prior years; the development of a "base case" reference load, which reflects economic conditions absent the COVID-19 pandemic, a COVID-19 factor which represents an hourly scalar multiplier that can be applied to base case reference load to obtain "COVID-19-impacted reference load", and the application of a "timing" scalar that can be used to roll off the COVID-19 factor over time during the 11-year period of our ex ante forecast window. The flow chart presented in Figure 3-11 illustrates how these analysis elements are combined and used.

- First, hourly reference loads for 2019 and 2020 are separately modeled using a simple regression comparing the reference load on each average event day (6 PM to 8 PM) and the mean17 temperature for that day (1);
- Next, a ratio was calculated that relates how much larger or smaller the reference loads were in 2020 relative to 2019 – the "COVID-19 factor" (2);
- Then, a monthly "timing" factor provided by SDG&E was incorporated to determine how quickly the effect of COVID-19 should be decreased. For example, the timing factor indicates the COVID-19 effect is at a maximum in April 2020, and slowly decreases throughout 2021. By 2022, the COVID-19 timing factor indicates there will no longer be a COVID-19 effect on reference loads (3);
- Next, the COVID-19 and timing factors are combined to create an overall COVID-19 effect (4).
- Then, reference loads as estimated using 2019 data are used as a baseline to which the overall COVID-19 effect is applied. This yields ex ante reference loads that take into account the effect of COVID-19 on reference loads in addition to SDG&E's expectations as to how long and to what extent that effect will last in the future (5).
- Finally, 2019 and 2020 percent impacts are combined in a regression model to create percent impact predictions which are applied to the ex ante reference loads (6). This results in ex ante kW impacts that are used to create the ex ante estimates. We refer to these initial estimates of load impacts (kW) as "core" load impacts since the reflect the average hourly load impact for a weekday event during the period of 6 PM to 8 PM. (6)

Figure 3-11: Summary of 2020 Ex Ante Methodology



The regressions that are used for modeling 2019 reference loads, 2020 reference loads, and their combined percentage impacts only include one explanatory variable (Mean17); In the case of modeling load impacts as a function of weather, more complicated models have not been found to perform significantly better in prior AC Saver Day Of evaluations owing mostly to the relatively limited dataset of ex post results that is available for ex ante estimation. In the case of reference load estimation, the same simple models have been sufficient as well owing to the fact that AC Saver Day Of is only offered during the summer season, cannot be dispatched on holidays, and is only dispatchable during the period 12:00 Noon to 9:00 PM. Additionally, we estimate reference loads explicitly in the context of event-like days, when reference load is strongly influenced by cooling load. If AC Saver Day Of were a DR program that was less weather dependent, or was dispatchable in the wintertime, or was available during a greater diversity of hours, a more complex reference load regression specification would be required for obtaining reliable reference loads estimates. In the absence of those complicating factors, the hourly reference load models we use (and historically have used in prior evaluations) offers the added benefit of being easily interpretable and understandable.

As alluded to earlier, we ensure that load impacts included in ex ante estimation are comparable – events from both 2019 and 2020 are included, but only those that were dispatched on weekdays for the period 6:00 PM to 8:00 PM. A total of 11 of the 20 program events in called in 2020 fit these criteria, as well as 12 of the 20 events dispatched in 2019.

Equation 3-3 presents the model that is used to estimate reference load and load impacts as a function of weather. This model is estimated separately by customer class (residential and commercial) and cycling strategy. The estimated parameters from the models are used to predict reference loads under 1-in-2 and 1-in-10-year ex ante weather conditions for all months of the year that the program may be dispatched.

Equation 3-3: Ex Ante Model for Reference Loads and Load Impacts

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

Variable	Definition
ref_d	**Reference Load**: Average reference load during the period 6 to 8 PM during all events called at that time in 2019-2020 **Load Impacts**: Average ex post load impacts (% load reduction) for events called 6 to 8 PM in 2019 and 2020
b_0	Estimated constant
b_1	Estimated parameter coefficient
$mean17_d$	Average temperature over the first 17 hours of the day for each event day
ε_d	The error term for each day d

After the ex ante impacts have been estimated based on the methodology outlined above, the final step to produce hourly impacts for each of the five hours covered by the CPUC Resource Adequacy (RA) window of 4:00 to 9:00 PM.

To estimate hourly ex ante load impacts, we develop a set of shaping ratios using historic load impacts from the 2017 and 2020 program seasons. We select the set of four-hour events from those program years, and calculate the average relationship, or ratio, of the first hour, second hour, third hour, and fourth hour load impacts to the average load impacts in the middle two hours. These two years were used because 2017 had the most 4-hour events (14) and 2020 has the most recent data (but only two 4-hour events). 2019 did not have any 4-hour events and 2018 only had two. The ratios are calculated separately for residential and commercial segments and for each cycling option. When applied to the predicted ex ante average load impact, they provide a consistent hourly shape to ex ante load impacts. Since there are no 5-hour AC Saver Day Of events, an additional hour is created between the second and third hours that is a linear interpolation of the ratios of the two surrounding hours.

This method constrains the relative size of event impacts across the hours of the RA window to be the same for all ex ante estimates. The magnitude of event impacts varies with weather, but with this approach the ratio of the impact between specific RA hours (e.g., 4 PM and 5 PM) is always the same. The ratios for each customer type and cycling option are shown in Table 3-3. The commercial shaping ratios show greater variability between RA hours, with high relative impacts in the first hour of the RA window. As shown in Section 4.2 below, events that coincide with traditional business hours (9 AM to 5 PM) result in larger load impacts for commercial participants. Almost all of the 4-hour events that are used in calculating the shaping ratios began at 4 PM or 5 PM, resulting in relatively large impacts in this first hour as businesses were more likely to be operational at this time.

Table 3-3: Ex Ante Shaping Ratios for Each Customer Type and Cycling Option

Hour of Event	Hourly Impact / Average Core Impact			
	Residential 50%	Residential 100%	Commercial 30%	Commercial 50%
4-5 PM	1.02	0.81	3.96	1.57
5-6 PM	1.14	1.09	1.51	1.13
6-7 PM	1.00	1.00	1.00	1.00
7-8 PM	0.86	0.91	0.49	0.87
8-9 PM	0.52	0.77	0.41	0.61

Table 3-4 illustrates how the ratio approach for estimating the hourly shape of average load impacts works in estimating the ex ante load impacts for the RA window. For the case of residential 100% cycling, the load impacts for the 1-in-10 scenario are higher than those for 1-in-2, reflecting the model's prediction for higher average load impacts under hotter weather conditions, but the relationship between the hourly load impacts and the average load impacts are constant across the 1-in-2 and 1-in-10 load impacts.

Table 3-4: Hourly Load Impacts Compared to Average Impacts (kW/Ton) for Residential 100% Cycling

Hour of Event	Hourly Impact/ Average Core Impact	Hourly Impact for Typical SDG&E Event Day, 1-in-2 Weather (kW/Ton)	Hourly Impact for Typical SDG&E Event Day, 1-in-10 Weather (kW/Ton)
4-5 PM	0.81	0.04	0.06
5-6 PM	1.09	0.05	0.08
6-7 PM	1.00	0.05	0.08
7-8 PM	0.91	0.04	0.07
8-9 PM	0.77	0.03	0.06

Estimates of the ex ante snapback effect were developed in a similar manner. Snapback refers to the increase in load following termination of a load control event as a result of the increased temperature that often 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:

- Average the snapback values across the three hours after each ex post event;
- Develop a ratio between snapback in each hour and snapback in the first hour after the event;
- Multiply the snapback value in the first hour after the event by the ratio used to scale the ex post impact to ex ante weather conditions; and
- Multiply the adjusted snapback values for each set of ex ante weather conditions by the snapback ratios to get snapback values for the three hours after each ex ante event.

Commercial snapback is assumed to be zero as there is little evidence in this and prior evaluations of CAC snapback after AC Saver Day Of events for commercial participants.

4 Ex Post Load Impact Estimates

This section contains the ex post load impact estimates for program year 2020. Residential load impacts are presented first, followed by commercial load impacts.

4.1 Residential Ex Post Load Impact Estimates

A total of 20 AC Saver Day Of events were called in 2020 including two weekend events. Table 4-1 presents ex post load impacts for the residential program segment for each event. The rows highlighted in green represent weekday events from 6 PM to 8 PM that are used in the calculation of the Average Event Day. The rows highlighted in orange represent the two weekend events.

Aggregate residential load impacts ranged from a low of 0.09 MW on June 22, 2020 to a high of 3.02 MW on September 5, 2020. The low result on June 22 is likely explained by low temperatures. The “mean17” heat buildup metric is the average temperature from midnight to 5 PM – was only 68 °F and the maximum temperature during the event window was only 71 °F, very likely leading to low cooling loads. Conversely, five events occurred during statewide heat wave emergencies on August 17-19 and September 5-6. These five events saw the highest aggregate impacts of the entire 2020 control season, ranging from 1.48 MW to 3.02 MW. The highest impact event on September 5 had a mean17 of 83 °F. This mean17 indicates that this event was one of the hottest events of the season. It was also a weekend day, which usually enhances load impacts relative to weekday events for AC Saver Day Of residential load impacts. The next day, September 6, was also a hot, weekend event that had large impacts. All 2020 AC Saver Day Of residential impacts are statistically significant at the 90% confidence level.

For this ex post evaluation, “Average Event Day” load impacts are calculated using only events with the same event duration, at the same time of day, and only for weekday events. These criteria were selected because hourly load impacts for the direct load control of CAC units are sensitive to whether or not the hour in question is the first hour of an event, the second hour, the third hour, and so on. AC Saver Day Of load impacts from events that have different start and end times should not be directly compared. In the case of the 2020 program year, the average event day load impacts are calculated using the events on June 2, 3, and 10, July 9, 10, 13, 27, and 29, and August 19, 21, and 27. All 11 of these events were dispatched from 6 PM to 8 PM. The 11 AC Saver Day Of 2020 events included in the Average Event Day estimate yield an aggregate load reduction of 0.94 MW.

Table 4-1: Residential Ex Post Load Impact Estimates

Date	Impact			Mean17 (°F)	Max. Event Window Temperature (°F)	Event Hours	Statistically Significant at 90% Level
	Per CAC Unit (kW)	Per Premise (kW)	Aggregate (MW)				
6/2/2020	0.03	0.03	0.24	68	74	6PM - 8PM	Yes
6/3/2020	0.11	0.12	0.82	73	76	6PM - 8PM	Yes
6/10/2020	0.18	0.20	1.37	76	85	6PM - 8PM	Yes
6/22/2020	0.01	0.01	0.09	68	71	7PM - 9PM	Yes
7/8/2020	0.04	0.05	0.38	70	80	12PM - 2PM	Yes
7/9/2020	0.04	0.05	0.38	68	77	6PM - 8PM	Yes
7/10/2020	0.15	0.17	1.27	73	83	6PM - 8PM	Yes
7/13/2020	0.15	0.17	1.29	75	79	6PM - 8PM	Yes
7/27/2020	0.04	0.05	0.38	70	75	6PM - 8PM	Yes
7/29/2020	0.04	0.05	0.35	68	74	6PM - 8PM	Yes
7/30/2020	0.07	0.08	0.60	70	79	6PM - 9PM	Yes
7/31/2020	0.17	0.20	1.47	75	85	5PM - 8PM	Yes
8/14/2020*	0.18	0.21	1.26	80	91	5PM - 9PM	Yes
8/17/2020	0.21	0.23	1.48	78	88	5PM - 8PM	Yes
8/18/2020	0.26	0.29	1.84	81	87	4PM - 8PM	Yes
8/19/2020	0.22	0.26	1.61	80	85	6PM - 8PM	Yes
8/21/2020	0.18	0.21	1.31	79	87	6PM - 8PM	Yes
8/27/2020	0.18	0.20	1.27	76	83	6PM - 8PM	Yes
9/5/2020	0.39	0.44	3.02	83	98	5PM - 8PM	Yes
9/6/2020	0.37	0.42	2.89	89	99	5PM - 8PM	Yes
Average**	**0.12**	**0.13**	**0.94**	**73**	**80**	**6PM - 8PM**	**Yes**

* Reflects a date with rolling blackouts due to CAISO system emergency
** Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day Of event (green rows)

The residential Average Event Day load impacts per premise in 2019 and 2020 were 0.11 kW and 0.13 kW, respectively. These averages between program years were calculated using events with identically timed event windows (6 PM to 8 PM). Figure 4-1 shows the relationship between mean17 and impact for all events in 2019 and 2020. The dark circles show the average event mean17 between the two program years. The average event days are very similar, but 2020 had slightly larger impacts, even with a slightly cooler mean17 than 2019. Additionally, the two 2020 events that produced the highest impacts were the two weekend events (September 5 and 6), which were called on extremely hot days.

As explained in Section 3.3, reference loads for residential customers were higher in 2020 due to COVID-19. Subsequently, per-premise impacts were also higher in 2020 compared to 2019 due to the strong relationship of load impacts to reference loads for this program. This can be seen in Figure 4-1 where the 2020 impacts (green diamonds) are slightly higher than 2019 impacts (blue diamonds) at comparable temperatures.

Figure 4-1: Residential 2019 and 2020 Ex Post Load Impacts vs. Temperature

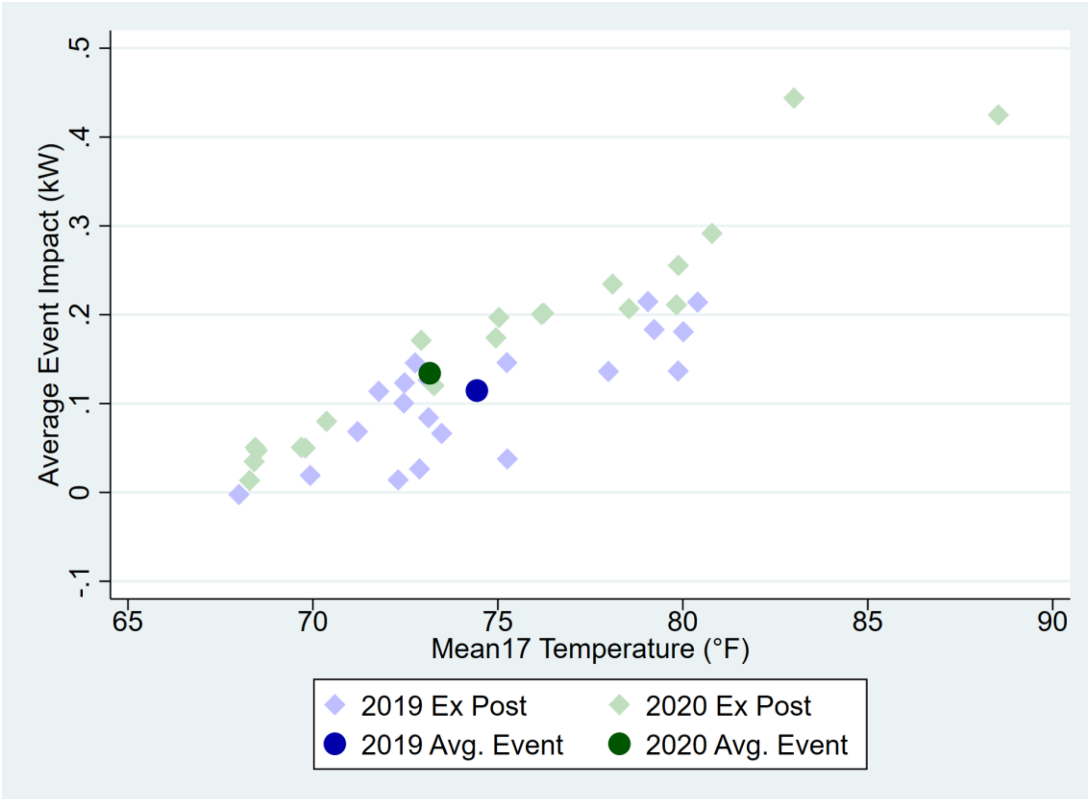


Table 4-2 presents a table comparing the Average Event Day for 2019 and 2020. The per-premise impacts are 0.02 kW higher in 2020, which leads to aggregate impacts that are 0.03 MW higher. The aggregate impacts are larger despite approximately 1,000 fewer customers called in 2020 due to both paging issues and attrition. It also should also be noted that the 2020 reference loads are on average 0.15 kW higher, likely because the COVID-19 pandemic led to more residential program participants to be at home during events in 2020 than in the previous year.

Table 4-2: Residential 2019 vs. 2020 Ex Post Impacts

Year	Avg. Event Hours	Customers Called	Mean17 Avg. Temp. (°F)	Avg. Reference Load (kW)	Impact (kW)	Impact (%)	Snapback (kW)	Aggregate Impact (MW)
2019 Average Event Day	6 – 8 PM	7,913	74	1.29	0.11	8.9%	-0.03	0.91
2020 Average Event Day	6 – 8 PM	6,975	73	1.44	0.13	9.3%	-0.04	0.94

Table 4-3 shows the average per-premise reference loads, load impacts, and percent impacts for residential customers by cycling option. On the Average Event Day, the reference load for the 50% cycling group was approximately 25% higher than the reference load for the 100% cycling group, with reference loads of 1.58 and 1.17 kW per premise, respectively. This suggests that customers who use their CAC units more are less likely to select the 100% cycling option. This difference helps explain why, even though the 100% group is cycled twice as much as the 50% group, the load impacts for the 100% group (0.13 kW per premise) are a little bit smaller than those of the 50% cycling group (0.14 kW per premise): the 50% group has commensurately higher reference loads. Load impacts are at their highest for the 50% group and 100% group on September 5 at 0.38 kW and 0.58 kW per premise, respectively.

Table 4-3: Residential Average (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	
	50%	100%	50%	100%	50%	100%
6/2/2020	0.96	0.79	0.04	0.02	4%	2%
6/3/2020	1.30	0.99	0.12	0.12	9%	13%
6/10/2020	1.65	1.25	0.18	0.24	11%	19%
6/22/2020	0.99	0.82	0.02	0.01	2%	1%
7/8/2020	1.04	0.83	0.05	0.05	5%	6%
7/9/2020	1.21	0.95	0.04	0.07	3%	7%
7/10/2020	1.69	1.27	0.18	0.16	10%	13%
7/13/2020	1.72	1.29	0.19	0.15	11%	12%
7/27/2020	1.20	0.93	0.05	0.06	4%	6%
7/29/2020	1.28	0.95	0.05	0.04	4%	4%
7/30/2020	1.52	1.15	0.06	0.11	4%	9%
7/31/2020	2.05	1.53	0.18	0.22	9%	14%
8/14/2020	2.20	1.67	0.20	0.24	9%	15%
8/17/2020	2.28	1.74	0.25	0.20	11%	12%
8/18/2020	2.41	1.91	0.27	0.35	11%	18%
8/19/2020	2.20	1.74	0.25	0.28	11%	16%
8/21/2020	2.16	1.69	0.21	0.19	10%	11%
8/27/2020	2.04	1.56	0.21	0.18	10%	11%
9/5/2020	2.88	2.34	0.38	0.58	13%	25%
9/6/2020	2.84	2.36	0.36	0.56	13%	24%
Average*	**1.58**	**1.17**	**0.14**	**0.13**	**9%**	**11%**

* Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day Of event

Aggregate ex post load impacts for the residential portion of AC Saver Day Of are presented in Table 4-4 for each event day, segmented by cycling option. On the Average Event Day, the 50% cycling participants deliver about 0.64 MW of load reduction while the 100% cycling participants contribute about 50% of that at 0.30 MW.

Table 4-4: Residential Average (per Premise) and Aggregate Load Impacts by Cycling Option

Event Date	Average Load Impact per Premise (kW)		Aggregate Load Impact (MW)	
	50%	100%	50%	100%
6/2/2020	0.04	0.02	0.20	0.04
6/3/2020	0.12	0.12	0.55	0.27
6/10/2020	0.18	0.24	0.85	0.52
6/22/2020	0.02	0.01*	0.07	0.02*
7/8/2020	0.05	0.05	0.23	0.14
7/9/2020	0.04	0.07	0.18	0.20
7/10/2020	0.18	0.16	0.80	0.47
7/13/2020	0.19	0.15	0.86	0.43
7/27/2020	0.05	0.06	0.21	0.17
7/29/2020	0.05	0.04	0.24	0.11
7/30/2020	0.06	0.11	0.29	0.30
7/31/2020	0.18	0.22	0.84	0.63
8/14/2020	0.20	0.24	0.87	0.39
8/17/2020	0.25	0.20	1.14	0.34
8/18/2020	0.27	0.35	1.25	0.59
8/19/2020	0.25	0.28	1.14	0.47
8/21/2020	0.21	0.19	0.99	0.31
8/27/2020	0.21	0.18	0.97	0.30
9/5/2020	0.38	0.58	1.75	1.26
9/6/2020	0.36	0.56	1.66	1.22
Average**	**0.14**	**0.13**	**0.64**	**0.30**

* Indicates impacts that are not statistically significant at the 90% confidence level
** Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day Of event

Table 4-5 shows estimated event impacts for residential customers segmented by usage quintiles, and Table 4-6 shows the same but segmented by usage deciles. Each customer was placed into 1 of 5 quintiles (or 1 of 10 deciles, in the case of Table 4-6), based on their average usage during the peak hours from 11 AM to 6 PM on all proxy event days in 2020. Impact estimates were calculated separately for each quintile and decile for the average event hour of the 2020 Average Event Day to determine reference loads and load impacts. Load impacts by quintile largely increase with electricity usage. In the case of the largest quintiles, per-premise load impacts top out at 0.29 kW for 50% cycling and 0.33 kW for 100% cycling – both approximately double the overall average impacts for these cycling options of 0.14 kW and 0.13 kW, respectively. For the largest decile, 50% cycling load impacts peak at 0.34 kW and 100% cycling load impacts peak at 0.43 kW.

Table 4-5: Residential Average (per Premise) Load Impacts by Usage Quintile and Cycling Option

Quintile	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	0.01	0.01	0.01	0.01
2	0.06	0.01	0.05	0.01
3	0.12	0.01	0.07	0.01
4	0.20	0.01	0.17	0.01
5	0.29	0.01	0.33	0.01

* Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day Of event

Table 4-6: Residential Average (per Premise) Load Impacts by Usage Decile and Cycling Option

Decile	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	0.01	0.01	0.01	0.01
2	0.01	0.01	0.01	0.01
3	0.05	0.01	0.05	0.01
4	0.06	0.01	0.04	0.01
5	0.11	0.01	0.06	0.01
6	0.14	0.01	0.08	0.01
7	0.18	0.01	0.17	0.01
8	0.22	0.01	0.16	0.02
9	0.25	0.02	0.24	0.02
10	0.34	0.02	0.43	0.02

* Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day Of event

4.2 Commercial Ex Post Load Impact Estimates

Table 4-7 presents the ex post load impact estimates for commercial customers for each 2020 event day and the Average Event Day. Here again, the Average Event Day load impacts are calculated using on June 2, 3, and 10, July 9, 10, 13, 27, and 29, August 19, 21, and 27. The rows highlighted in green represent weekday events from 6 PM to 8 PM that are used in the calculation of the Average Event Day. The rows highlighted in orange represent the two weekend events.

The commercial segment of AC Saver Day Of is smaller than the residential segment: commercial customers represent about 24% of the total AC Saver Day Of participants and about 41% of the enrolled CAC tonnage. In addition to the lower number of enrolled commercial customers and cooling tons, the per-premise load impacts for commercial customers are smaller than those for residential customers. This is due in part to the fact that enrolled commercial CAC units are cycled less than the residential CAC units – commercial units have options of 30% or 50%, versus residential unit options of 50% or 100%. Additionally, and importantly, commercial load impacts are currently lower than residential impacts due to the timing of the AC Saver Day Of events, which in 2020 were predominantly called when per-premise load is ramping down towards the commercial daily minimum that occurs in the evening and overnight hours, as opposed to during the residential daily maximum period that occurs at the same time.

Weekday commercial aggregate impacts vary from a low of -0.01 MW on September 5 to a high of 0.68 MW on August 18. The impacts on September 5 were likely low because this was an evening event during the weekend when many businesses are closed. On the other hand, the weekday event on August 18 started relatively early at 4 PM when business were still open. Additionally, the commercial customers have lower sensitivity to weather, evidenced by the fact that the September 5 event had a maximum event window temperature of 96 °F while the August 18 event had a maximum of 85 °F.

Table 4-7: Commercial Ex Post Load Impact Estimates

Date	Impact			Mean17 (°F)	Max. Event Window Temperature (°F)	Event Hours	Statistically Significant at 90% Level
	Per CAC Unit (kW)	Per Premise (kW)	Aggregate (MW)				
6/2/2020	0.02	0.05	0.17	68	73	6PM - 8PM	Yes
6/3/2020	0.01	0.03	0.10	73	75	6PM - 8PM	No
6/10/2020	0.03	0.07	0.24	76	85	6PM - 8PM	Yes
6/22/2020	0.01	0.02	0.06	68	70	7PM - 9PM	No
7/8/2020	0.05	0.12	0.34	70	78	12PM - 2PM	Yes
7/9/2020	0.02	0.04	0.13	68	76	6PM - 8PM	Yes
7/10/2020	0.03	0.07	0.20	73	82	6PM - 8PM	Yes
7/13/2020	0.02	0.05	0.15	74	78	6PM - 8PM	Yes
7/27/2020	0.01	0.03	0.09	70	74	6PM - 8PM	Yes
7/29/2020	0.02	0.05	0.16	68	73	6PM - 8PM	Yes
7/30/2020	0.02	0.05	0.15	70	78	6PM - 9PM	Yes
7/31/2020	0.03	0.06	0.19	74	82	5PM - 8PM	Yes
8/14/2020*	0.05	0.12	0.36	79	89	5PM - 9PM	Yes
8/17/2020	0.07	0.16	0.53	77	86	5PM - 8PM	Yes
8/18/2020	0.09	0.21	0.68	80	85	4PM - 8PM	Yes
8/19/2020	0.04	0.09	0.31	79	84	6PM - 8PM	Yes
8/21/2020	0.01	0.03	0.11	78	85	6PM - 8PM	No
8/27/2020	0.00	0.01	0.04	76	81	6PM - 8PM	No
9/5/2020	0.00	0.00	-0.01	82	96	5PM - 8PM	No
9/6/2020	0.03	0.08	0.24	87	96	5PM - 8PM	Yes
Average**	**0.02**	**0.05**	**0.15**	**73**	**79**	**6PM - 8PM**	**Yes**

* Reflects a date with rolling blackouts due to CAISO system emergency

** Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day Of event (green rows)

The 2020 Average Event Day commercial per-premise impacts are approximately 40% lower than those observed in 2019. The commercial Average Event Day load impacts per premise in 2019 and 2020 were 0.09 kW and 0.05 kW, respectively. These averages were calculated using events with similarly timed event windows (6 PM to 8 PM). Figure 4-2 shows the relationship between mean17 and impact for all events in 2019 and 2020. The dark circles show the average event mean17 versus impact between the two program years. The average event days have a similar mean17 temperature between 2019 and 2020, but the impacts are lower in 2020.

As discussed in Section 3.3, reference loads for commercial customers were most likely lower in 2020 because of reduced occupancy or partial operating schedules as a result of COVID-19. Subsequently, per-premise impacts were also lower in 2020 compared to 2019. This can be seen in Figure 4-2 where the 2020 impacts (green diamonds) are slightly lower than 2019 impacts (blue diamonds) at comparable temperatures.

Figure 4-2: Commercial 2019 and 2020 Ex Post Load Impacts vs. Temperature

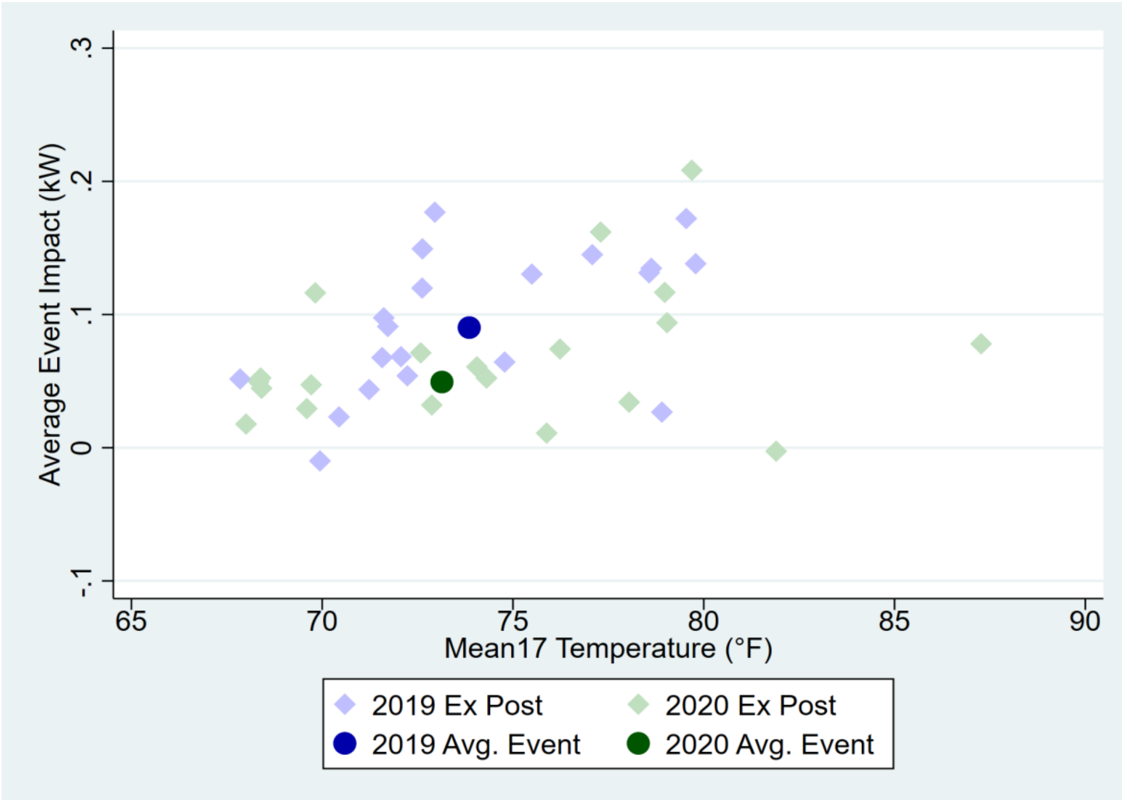


Table 4-8 presents a table comparing the Average Event Day for 2019 and 2020. The per-premise impacts are 0.04 kW lower in 2020, which leads to aggregate impacts that are 0.18 MW lower. Also, fewer customers were called in 2020 due to enrollment attrition (commercial customers were largely unaffected by the paging issues described earlier in this report). The 2020 reference loads are on average 1.11 kW lower, again, likely due to COVID-19 effects on commercial customers' business operations.

Table 4-8: Commercial 2019 vs. 2020 Ex Post Impacts

Year	Avg. Event Hours	Customers Called	Mean17 Avg. Temp. (°F)	Avg. Reference Load (kW)	Impact (kW)	Impact (%)	Snapback (kW)	Aggregate Impact (MW)
2019 Average Event Day	6 – 8 PM	3,707	74	6.09	0.09	1.5%	-0.01	0.33
2020 Average Event Day	6 – 8 PM	3,124	73	4.98	0.05	1.0%	0.01	0.15

A comparison of average impacts per CAC unit between Table 4-1 and Table 4-7 reveals that the 2020 Average Event Day impact per CAC unit for commercial customers is only 0.02 kW while it is 0.12 kW for residential customers. Some of this difference is due to the lower cycling options used by commercial customers, but load impacts per CAC unit can be directly compared across residential and commercial participants on the same cycling strategy to illuminate other factors that may be at play.

Table 4-9 shows a comparison of average load impact per CAC for 50% cycling residential and 50% cycling commercial customers. Looking at only the 50% cycling group for the commercial segment raises the Average Event Day load impact per CAC unit by a small amount, although with rounding it remains at 0.02 kW.

Table 4-9: Comparison Residential and Commercial AC Saver Day Of 50% Cycling Load Impacts

Event Date	Average Load Impact per CAC Unit (kW)	
	Residential 50%	Commercial 50%
6/2/2020	0.04	0.02
6/3/2020	0.10	0.03
6/10/2020	0.16	0.03
6/22/2020	0.01	0.01
7/8/2020	0.04	0.05
7/9/2020	0.03	0.02
7/10/2020	0.16	0.03
7/13/2020	0.17	0.03
7/27/2020	0.04	0.00
7/29/2020	0.05	0.03
7/30/2020	0.06	0.01
7/31/2020	0.16	0.03
8/14/2020	0.18	0.05
8/17/2020	0.22	0.08
8/18/2020	0.24	0.09
8/19/2020	0.22	0.04
8/21/2020	0.19	0.02
8/27/2020	0.19	0.01
9/5/2020	0.34	0.00
9/6/2020	0.32	0.05
Average*	**0.12**	**0.02**

* Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day Of event

Figure 4-3 shows the reference and observed loads for residential and commercial 50% cycling customers on the Average Event Day. The highlighted portions of the load represent the average event hours. Load impacts on the Average Event Day are nearly optimal for the residential customers due to the timing of the event, 6 PM to 8 PM, but the timing for the commercial customers is highly suboptimal, occurring when most occupancy and building processes have wound down. Another differentiating factor (which would need to be validated by a field study) may be that due to the advanced age of the AC Saver Day Of program, fewer commercial load control devices are still installed and functional. Many businesses have contracts with HVAC contractors for regular maintenance, and HVAC contractors may be inclined to remove or disconnect equipment such as load control devices that they may not recognize as legitimate equipment.

Figure 4-3: Reference and Observed Loads for the Average Event Day – Residential and Commercial 50% Cycling

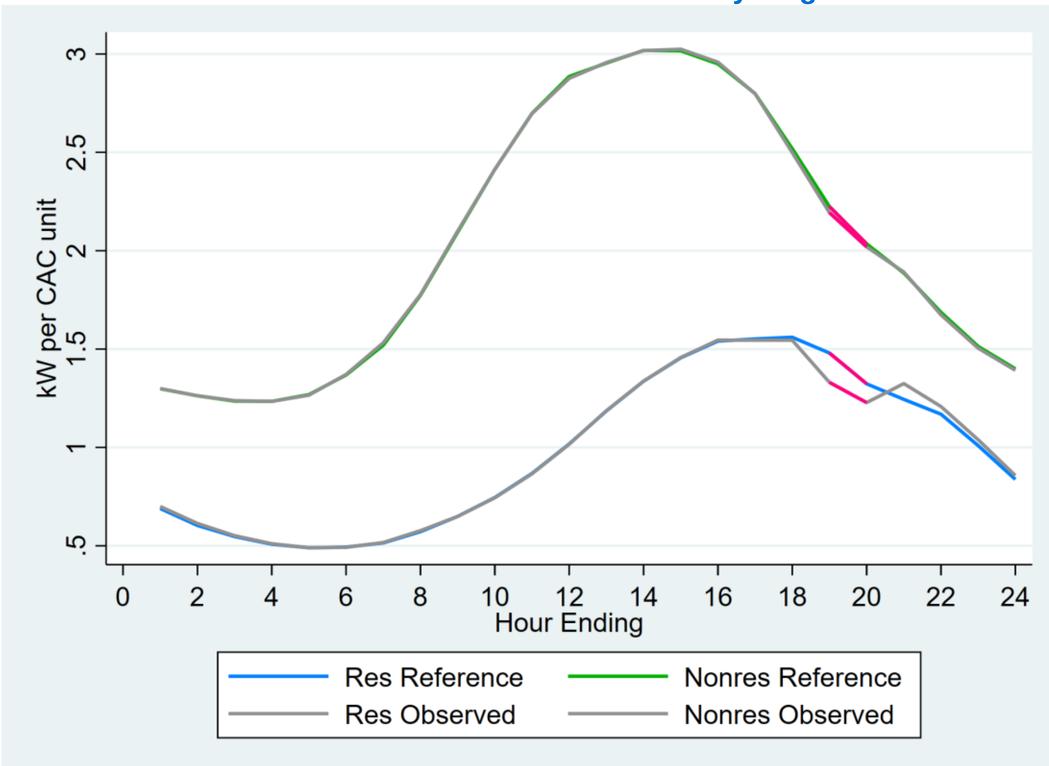


Table 4-10 presents the per-premise and aggregate load impacts for commercial participants on each event day, segmented by cycling strategy. On a per-premise basis, load impacts for the 50% cycling option range from 0.006 kW on September 5 (weekend event from 5 PM to 8 PM) to 0.20 kW on August 18 (weekday event from 4 PM to 8 PM). Per-premise load impacts for the 30% cycling option are more broadly distributed, ranging from -0.08 kW to 0.22 kW. Although the distributions of impacts vary between the groups, on the Average Event Day, load impacts for the 50% cycling group are approximately the same as those produced by the 30% cycling group.

Table 4-10: Commercial Average (per Premise) and Aggregate Load Impacts by Cycling Option

Event Date	Average Load Impact per Premise (kW)		Aggregate Load Impact (MW)	
	30%	50%	30%	50%
6/2/2020	0.11	0.04	0.08	0.09
6/3/2020	-0.08*	0.06	-0.06*	0.16
6/10/2020	0.10	0.07	0.07	0.17
6/22/2020	-0.02*	0.03*	-0.02*	0.07*
7/8/2020	0.11	0.12	0.07	0.27
7/9/2020	0.04*	0.04*	0.03*	0.10*
7/10/2020	0.07*	0.07	0.04*	0.16
7/13/2020	0.00*	0.07	0.00*	0.15
7/27/2020	0.10	0.01*	0.07	0.02*
7/29/2020	0.02*	0.06	0.01*	0.14
7/30/2020	0.10	0.03	0.07	0.08
7/31/2020	0.05*	0.06	0.03*	0.16
8/14/2020	0.15	0.11	0.10	0.27
8/17/2020	0.14	0.17	0.09	0.44
8/18/2020	0.22	0.20	0.15	0.53
8/19/2020	0.12	0.09	0.08	0.23
8/21/2020	0.02*	0.04*	0.01*	0.10*
8/27/2020	-0.01*	0.02*	-0.01*	0.04*
9/5/2020	-0.04*	0.01*	-0.02*	0.02*
9/6/2020	-0.04*	0.11	-0.03*	0.27
Average**	**0.04**	**0.05**	**0.03**	**0.12**

* Indicates impacts that are not statistically significant at the 90% confidence level
** Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day Of event

Table 4-11 shows estimated event impacts for commercial customers segmented by usage quintiles, and Table 4-12 shows the same but segmented by usage deciles. Each customer was placed into 1 of 5 quintiles (or 1 of 10 deciles, in the case of Table 4-12), based on their average usage during the peak hours from 11 AM to 6 PM on all proxy event days in 2020. Impact estimates were calculated separately for each quintile and decile for the average event hour of the Average Event Day to determine reference loads and load impacts.

Load impacts by quintile and decile largely increase with electricity usage for 50% cycling customers, however 30% cycling customers do not follow this pattern. There are approximately 700 commercial 30% cycling customers in total and dividing this group further produces a limited amount of data to evaluate. Given the smaller sample sizes associated with each individual decile for 30% cycling, there are relatively large standard errors associated with these estimates. For example, in the 10th decile for 30% cycling there is a per-premise load impact of -0.12 kW with standard error of 0.20. Additionally, Net Energy Metering (NEM) customers are included in the analysis and negative loads during this time can diminish impacts.

In the case of the largest quintile for 50% cycling, per-premise load impacts top out at 0.38 kW – substantially larger than the overall average impacts for this cycling option of 0.05 kW.

Table 4-11: Commercial Average (per Premise) Load Impacts by Usage Quintile and Cycling Option

Quintile	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	0.03	0.04	-0.10	0.02
2	0.01	0.02	-0.02	0.01
3	0.05	0.03	0.00	0.01
4	0.13	0.04	0.07	0.02
5	-0.01	0.11	0.38	0.05

* Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day Of event

Table 4-12: Commercial Average (per Premise) Load Impacts by Usage Decile and Cycling Option

Decile	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	0.07	-0.16	0.03
2	-0.05	0.02	-0.03	0.01
3	0.08	0.02	-0.02	0.01
4	-0.10	0.04	-0.02	0.01
5	-0.01	0.03	0.02	0.02
6	0.12	0.04	-0.01	0.02
7	0.21	0.05	0.10	0.03
8	0.08	0.07	0.05	0.03
9	0.13	0.08	0.17	0.04
10	-0.12	0.20	0.60	0.09

* Reflects the average 6 PM to 8 PM weekday 2020 AC Saver Day Of event

5 Ex Ante Load Impact Estimates

This section presents ex ante load impact estimates for SDG&E's AC Saver Day Of program. Residential ex ante estimates are provided first, followed by estimates for commercial customers. These estimates are then compared to the ex ante estimates produced in the 2019 load impact evaluation and the relationship between the 2020 ex post impacts and the ex ante estimates is explained.

5.1 Ex Ante Estimates

The models described in Section 3.3 were used to estimate load impacts based on ex ante event weather conditions and enrollment projections for the years 2021–2031. Recent AC Saver Day Of evaluations have shown dramatic changes in projected program enrollment due to dropping underperforming (i.e., low usage) participants in 2017 and residential NEM customers in 2018. In 2020, additional residential customers who lived in premises that had previously been deactivated were enrolled into the program. Forecasted enrollment currently only features modest enrollment attrition throughout the forecast window.

The Load Impact Protocols require that ex ante load impacts are 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 defined as those that would be expected to occur once every 10 years (1-in-10 conditions). From 2008 to 2014, the California IOUs based their ex ante weather conditions on system operating conditions specific to each individual utility for estimating demand response load impacts. However, an alternative is to use ex ante weather conditions that 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 do not address 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 requirement, California's IOUs contracted with Nexant in 2014 to develop ex ante weather conditions based on the peaking conditions for each utility and for the CAISO system. Nexant subsequently updated these weather conditions for SDG&E in 2017.[5] The new ex ante weather dataset utilizes a shorter historical window of weather conditions that better reflect recent warming trends.

Ex ante weather conditions for CAISO peaking conditions and SDG&E peaking conditions may differ, and the extent to which that can happen largely depends on the correlation between individual utility and CAISO peak loads. Based on CAISO and SDG&E system peak loads for

[5] The original ex ante weather conditions used in DR load impact evaluations were developed in 2009.

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, and vice-versa. This correlation for SDG&E tends to be weakest when CAISO loads are below 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. However, whenever CAISO loads have exceeded 45,000 MW, loads typically have been high across all three IOUs, leading to a stronger correlation for SDG&E in these cases.

Table 5-1 and Table 5-2 show the AC Saver Day Of residential and commercial enrollment-weighted average mean17 (temperature buildup from midnight to 5 PM) for the typical event day and the monthly system peak days 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 differences between normal and extreme weather conditions, can be significant. For example, the residential AC Saver Day Of enrollment-weighted temperature on a 1-in-10 SDG&E September peak day is 85ºF, while on a CAISO 1-in-10 peak September day it is 82ºF. There are also large differences across months. As seen in later tables in this section, even small differences in the value of mean17 can have large impacts on aggregate load impacts.

Table 5-1: Residential Enrollment-Weighted Ex Ante Weather Conditions

Customer Type	Cycle	Day Type	CAISO System Mean17 Temperature (°F)		SDG&E System Mean17 Temperature (°F)	
			1-in-2	1-in-10	1-in-2	1-in-10
Residential	50%	Typical Event Day	76	79	76	80
		April Peak Day	67	72	67	76
		May Peak Day	67	76	70	77
		June Peak Day	68	81	68	78
		July Peak Day	72	76	75	77
		August Peak Day	80	79	79	82
		September Peak Day	82	82	82	85
		October Peak Day	73	78	75	79
	100%	Typical Event Day	75	79	76	80
		April Peak Day	67	72	67	77
		May Peak Day	67	76	70	77
		June Peak Day	68	80	68	78
		July Peak Day	72	76	75	77
		August Peak Day	80	79	79	82
		September Peak Day	82	82	82	85
		October Peak Day	73	78	75	79

Table 5-2: Commercial Enrollment-Weighted Ex Ante Weather Conditions

Customer Type	Cycle	Day Type	CAISO System Mean17 Temperature (°F)		SDG&E System Mean17 Temperature (°F)	
			1-in-2	1-in-10	1-in-2	1-in-10
Commercial	30%	Typical Event Day	76	80	76	81
		April Peak Day	67	72	67	76
		May Peak Day	67	76	70	77
		June Peak Day	68	82	68	79
		July Peak Day	73	77	76	78
		August Peak Day	81	80	80	82
		September Peak Day	83	82	82	85
		October Peak Day	73	78	76	79
	50%	Typical Event Day	76	80	76	81
		April Peak Day	67	72	67	76
		May Peak Day	67	76	70	77
		June Peak Day	68	82	68	79
		July Peak Day	73	77	76	78
		August Peak Day	81	80	79	82
		September Peak Day	83	82	82	85
		October Peak Day	73	78	76	79

As described in Section 3.2.1.1, the AC Saver Day Of enrollment forecast assumes that the research group assignment issues that occurred in 2020 will not recur in future program years. Therefore, the customer counts used in the ex ante estimates have a higher starting point than the final ex post customer counts. Over the forecast horizon, enrollment is expected to decrease for commercial customers and is expected to increase for residential customers. Table 5-3 shows the enrollment forecast for the two customer groups for the summer months of each year from 2021 to 2031. The forecast reflects an annual enrollment change from 2021-2025 of an approximately 1% increase for residential customers and 2.5% decrease for commercial customers.

Table 5-3: Program Enrollment Forecast

Customer Type	Forecast Year	Forecast Month						
		April	May	June	July	August	Sept.	October
Residential	2021	8,320	8,320	8,320	8,320	8,320	8,320	8,320
	2022	8,412	8,412	8,412	8,412	8,412	8,412	8,412
	2023	8,507	8,507	8,507	8,507	8,507	8,507	8,507
	2024	8,605	8,605	8,605	8,605	8,605	8,605	8,605
	2025-2031	8,706	8,706	8,706	8,706	8,706	8,706	8,706
Commercial	2021	3,065	3,065	3,065	3,065	3,065	3,065	3,065
	2022	2,987	2,987	2,987	2,987	2,987	2,987	2,987
	2023	2,912	2,912	2,912	2,912	2,912	2,912	2,912
	2024	2,838	2,838	2,838	2,838	2,838	2,838	2,838
	2025-2031	2,766	2,766	2,766	2,766	2,766	2,766	2,766

While AC Saver Day Of events can be called any time between 12 PM and 9 PM, ex ante load impacts reported here represent the average load impact across the hours from 4 PM to 9 PM, reflecting the peak period as defined by the CPUC for determining resource adequacy requirements.

Table 5-4 and Table 5-5 summarize the average and aggregate load impact estimates per premise under SDG&E-specific peaking conditions and CAISO peaking conditions for 2021. The per-premise load impacts are highest for the September monthly peak for both CAISO and SDG&E system conditions, for both residential and commercial, and for both 1-in-2 and 1-in-10 weather conditions, with the exception of residential CAISO 1-in-10 weather conditions which show the highest impacts for the June monthly peak. Similarly, the per-premise impacts are lowest for the April monthly peak for all scenarios and customer types.

In 2021, the COVID “timing” factor described in Section 3.3, which is estimated by SDG&E, begins to decrease. This factor dictates the degree to which COVID is expected to influence residential and commercial load throughout the ex ante forecast horizon. From a full 1.0 in December 2020, the effects of COVID are projected to linearly decrease by 0.0727 each month in 2021. In April 2021, the factor is estimated to be 0.71. By the end of the summer season in October 2021, the factor is estimated to decrease to 0.27. These estimated factors are shown in Table 5-4 and Table 5-5. In the remainder of the forecast horizon from 2022 to 2031, the effects of COVID are assumed to be zero.

For a typical event day under SDG&E-specific weather conditions, the impact per premise in a 1-in-2 year is 0.14 kW for residential customers and 0.23 kW in a 1-in-10 year. The hottest weather conditions are expected in the month of September, where per-premise load impacts peak at 0.24 kW under the SDG&E-specific 1-in-2 conditions and at 0.31 kW under 1-in-10 conditions. Differences between 1-in-2 and 1-in-10 load impacts are driven by differences in mean17, which vary by as much as 7 degrees for some months; a 7 degree temperature difference on average over 17 hours represents a very large difference in temperature conditions and air conditioning requirements. While the forecasted per-premise impacts increase when the weather scenarios are warmer, the COVID timing effect decreases throughout the 2021 season. This causes slightly diminished reference loads and kW impacts in the residential sector as households in SDG&E territory are expected to return to more normal usage patterns throughout the summer. For example, under the same SDG&E 1-in-2 weather conditions, the typical event day per-premise impact is estimated to decrease from 0.14 kW in 2021 to 0.13 kW in 2022, when the COVID timing effect has completely rolled off.

Load impacts for commercial customers follow similar patterns. Under the SDG&E peaking scenarios, typical event day per-premise load impacts are 0.08 kW under the 1-in-2 assumption and 0.10 kW under the 1-in-10 assumption. In September, commercial per-premise load impacts peak at 0.10 kW under 1-in-2 conditions and 0.11 kW under 1-in-10 conditions. Commercial load impacts are lower than residential impacts because they reflect lower cycling strategies (30% and 50% compared to 50% and 100%). The milder cycling strategies also yield less weather-sensitive load impacts for commercial participants as compared to residential participants. As the COVID timing effect diminishes throughout the 2021 control season, commercial reference loads and impacts slightly increase as businesses are projected to return to standard operations. For example, under the same SDG&E 1-in-2 weather conditions, the typical event day per-premise impact is estimated to increase from 0.08 kW in 2021 to 0.09 kW in 2022.

The aggregate program load reduction potential for residential customers is 1.2 MW for a typical event day under SDG&E-specific 1-in-2 year weather conditions in 2020 and 0.3 MW for commercial customers. Under SDG&E-specific 1-in-10 year weather conditions, the aggregate impacts for residential and commercial customers are 1.9 MW and 0.3 MW, respectively. The aggregate impacts under CAISO weather conditions are slightly lower for both weather year types.

Table 5-4: 2021 Residential Ex Ante Load Impact Estimates by CAISO and SDG&E-specific Weather and Day Type

Customer Type	Day Type	Per-Premise Impact (kW)				Aggregate Impact (MW)				COVID-19 Timing Factor
		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	0.14	0.14	0.21	0.23	1.1	1.2	1.7	1.9	0.42
	April Monthly Peak	0.03	0.03	0.09	0.15	0.3	0.2	0.7	1.2	0.71
	May Monthly Peak	0.04	0.06	0.15	0.17	0.3	0.5	1.2	1.4	0.64
	June Monthly Peak	0.04	0.04	0.25	0.19	0.3	0.3	2.1	1.6	0.56
	July Monthly Peak	0.09	0.13	0.16	0.18	0.7	1.1	1.3	1.5	0.49
	August Monthly Peak	0.22	0.20	0.20	0.25	1.8	1.6	1.6	2.0	0.42
	September Monthly Peak	0.25	0.24	0.23	0.31	2.1	2.0	1.9	2.6	0.35
	October Monthly Peak	0.09	0.13	0.17	0.18	0.8	1.1	1.4	1.5	0.27

Table 5-5: 2021 Commercial Ex Ante Load Impact Estimates by CAISO and SDG&E-specific Weather and Day Type

Customer Type	Day Type	Per-Premise Impact (kW)				Aggregate Impact (MW)				COVID-19 Timing Factor
		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	
Commercial	Typical Event Day	0.08	0.08	0.09	0.10	0.3	0.3	0.3	0.3	0.42
	April Monthly Peak	0.06	0.06	0.07	0.08	0.2	0.2	0.2	0.3	0.71
	May Monthly Peak	0.06	0.06	0.08	0.09	0.2	0.2	0.2	0.3	0.64
	June Monthly Peak	0.06	0.06	0.10	0.09	0.2	0.2	0.3	0.3	0.56
	July Monthly Peak	0.07	0.08	0.08	0.09	0.2	0.2	0.3	0.3	0.49
	August Monthly Peak	0.10	0.09	0.09	0.10	0.3	0.3	0.3	0.3	0.42
	September Monthly Peak	0.10	0.10	0.10	0.11	0.3	0.3	0.3	0.3	0.35
	October Monthly Peak	0.08	0.08	0.09	0.09	0.2	0.3	0.3	0.3	0.27

5.1.1 Comparison of Ex Ante Load Impacts by Month

Table 5-5 and Table 5-6 provide ex ante impact estimates on an hourly basis for residential and commercial customers, respectively. The hours presented reflect the peak period as defined by the CPUC resource adequacy requirements of 4 PM to 9 PM. Residential impacts peak in the hour from 5 PM to 6 PM, and commercial impacts peak in the hour from 4 PM to 5 PM.

September ex ante conditions are much hotter than typical event day conditions and therefore have the highest impacts. In 2020, the residential program is estimated to provide an average impact of 2.6 MW over the 5-hour event window from 4 PM to 9 PM on a 1-in-10 September monthly system peak day and 2.0 MW on the September monthly system peak day under 1-in-2 year weather conditions for SDG&E-specific peaking conditions.

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 April, May, and June typically experienced in San Diego result in the smallest average and aggregate load impacts. The April, May, and June 1-in-2 year impacts for residential customers are each less than 0.6 MW while the remaining month estimates are each above 1.0 MW. The 1-in-10 year estimate for residential customers are greatest in August and September. For commercial customers, the estimates are much more stable given the lack of weather sensitivity for these customers. The average aggregate impacts are either 0.2 MW or 0.3 MW regardless of month of weather.

Table 5-5: 2021 AC Saver Day Of Ex Ante Load Impact Estimates by Weather Year, Day Type and Hour Residential Customers – SDG&E Peaking Conditions

Weather Year	Day Type	Hour of Day					Average (MW)
		4 to 5 PM (MW)	5 to 6 PM (MW)	6 to 7 PM (MW)	7 to 8 PM (MW)	8 to 9 PM (MW)	
1-in-2	Typical Event Day	1.2	1.5	1.3	1.1	0.7	1.2
	April Monthly Peak	0.2	0.3	0.3	0.2	0.1	0.2
	May Monthly Peak	0.5	0.6	0.5	0.5	0.3	0.5
	June Monthly Peak	0.3	0.4	0.3	0.3	0.2	0.3
	July Monthly Peak	1.2	1.4	1.2	1.1	0.7	1.1
	August Monthly Peak	1.7	2.0	1.8	1.6	1.0	1.6
	September Monthly Peak	2.2	2.5	2.2	1.9	1.3	2.0
	October Monthly Peak	1.1	1.3	1.2	1.0	0.7	1.1
1-in-10	Typical Event Day	2.0	2.3	2.1	1.8	1.2	1.9
	April Monthly Peak	1.3	1.5	1.3	1.2	0.8	1.2
	May Monthly Peak	1.5	1.7	1.5	1.3	0.9	1.4
	June Monthly Peak	1.7	2.0	1.8	1.5	1.0	1.6
	July Monthly Peak	1.6	1.8	1.6	1.4	0.9	1.5
	August Monthly Peak	2.2	2.5	2.3	2.0	1.3	2.0
	September Monthly Peak	2.7	3.2	2.8	2.4	1.6	2.6
	October Monthly Peak	1.6	1.9	1.7	1.4	1.0	1.5

Table 5-6: 2021 AC Saver Day Of Ex Ante Load Impact Estimates by Weather Year, Day Type and Hour Commercial Customers – SDG&E Peaking Conditions

Weather Year	Day Type	Hour of Day					Average (MW)
		4 to 5 PM (MW)	5 to 6 PM (MW)	6 to 7 PM (MW)	7 to 8 PM (MW)	8 to 9 PM (MW)	
1-in-2	Typical Event Day	0.5	0.3	0.2	0.2	0.1	0.3
	April Monthly Peak	0.3	0.2	0.2	0.1	0.1	0.2
	May Monthly Peak	0.4	0.2	0.2	0.1	0.1	0.2
	June Monthly Peak	0.3	0.2	0.2	0.1	0.1	0.2
	July Monthly Peak	0.4	0.3	0.2	0.2	0.1	0.2
	August Monthly Peak	0.5	0.3	0.3	0.2	0.1	0.3
	September Monthly Peak	0.5	0.3	0.3	0.2	0.2	0.3
	October Monthly Peak	0.5	0.3	0.2	0.2	0.1	0.3
1-in-10	Typical Event Day	0.5	0.3	0.3	0.2	0.2	0.3
	April Monthly Peak	0.4	0.3	0.2	0.2	0.1	0.3
	May Monthly Peak	0.5	0.3	0.2	0.2	0.1	0.3
	June Monthly Peak	0.5	0.3	0.2	0.2	0.1	0.3
	July Monthly Peak	0.5	0.3	0.2	0.2	0.1	0.3
	August Monthly Peak	0.5	0.3	0.3	0.2	0.2	0.3
	September Monthly Peak	0.6	0.4	0.3	0.3	0.2	0.3
	October Monthly Peak	0.5	0.3	0.3	0.2	0.2	0.3

Table 5-7 provides program-level ex ante aggregate estimates for each hour. In 2021, the program is expected to provide its highest impact under 1-in-10 year conditions in September. Under those conditions, the average impact over the event window is expected to be 2.9 MW, with an hourly peak of 3.5 MW between the hours of 5 PM and 6 PM.

Table 5-7: 2021 AC Saver Day Of Ex Ante Load Impact Estimates by Weather Year, Day Type and Hour – All Customers – SDG&E Peaking Conditions

Weather Year	Day Type	Hour of Day					Average (MW)
		4 to 5 PM (MW)	5 to 6 PM (MW)	6 to 7 PM (MW)	7 to 8 PM (MW)	8 to 9 PM (MW)	
1-in-2	Typical Event Day	1.7	1.7	1.5	1.3	0.9	1.4
	April Monthly Peak	0.6	0.5	0.4	0.3	0.2	0.4
	May Monthly Peak	0.9	0.8	0.7	0.6	0.4	0.7
	June Monthly Peak	0.7	0.6	0.5	0.4	0.3	0.5
	July Monthly Peak	1.6	1.6	1.4	1.2	0.8	1.4
	August Monthly Peak	2.2	2.3	2.0	1.8	1.2	1.9
	September Monthly Peak	2.7	2.9	2.5	2.2	1.5	2.3
	October Monthly Peak	1.6	1.6	1.4	1.2	0.8	1.3
1-in-10	Typical Event Day	2.5	2.7	2.3	2.0	1.4	2.2
	April Monthly Peak	1.7	1.8	1.6	1.4	0.9	1.5
	May Monthly Peak	1.9	2.0	1.8	1.5	1.0	1.6
	June Monthly Peak	2.2	2.3	2.0	1.7	1.2	1.9
	July Monthly Peak	2.0	2.1	1.9	1.6	1.1	1.7
	August Monthly Peak	2.7	2.9	2.5	2.2	1.5	2.4
	September Monthly Peak	3.3	3.5	3.1	2.7	1.8	2.9
	October Monthly Peak	2.1	2.2	1.9	1.7	1.1	1.8

5.2 Comparison of 2019 Ex Ante Load Impacts to 2020 Ex Ante Load Impacts

The following section compares ex ante impacts for a common year, 2021, between the last two evaluations. The 2019 AC Saver Day Of load impact evaluation estimated that the program's 2021 capacity load reduction is reached under September SDG&E-specific 1-in-10 weather conditions with a combined load impact peak of 3.1 MW.

This current year's evaluation yields slightly lower estimates of program capacity for the residential segment under these conditions – 2.9 MW. A full comparison of the 2019 estimates and 2020 estimates of the 2021 program year under different weather years and day types can be found in Table 5-8.

Table 5-8: 2021 AC Saver Day Of Estimates by Weather Year and Day Type – 2019 to 2020 Comparison – All Customers – SDG&E Peaking Conditions

Weather Year	Day Type	2019 Average Estimate for 2021 (MW)	2020 Average Estimate for 2021 (MW)
1-in-2	Typical Event Day	1.6	1.4
	April Monthly Peak	0.2	0.4
	May Monthly Peak	0.5	0.7
	June Monthly Peak	0.2	0.5
	July Monthly Peak	1.5	1.4
	August Monthly Peak	2.1	1.9
	September Monthly Peak	2.6	2.3
	October Monthly Peak	1.5	1.3
1-in-10	Typical Event Day	2.4	2.2
	April Monthly Peak	1.6	1.5
	May Monthly Peak	1.8	1.6
	June Monthly Peak	2.0	1.9
	July Monthly Peak	1.9	1.7
	August Monthly Peak	2.6	2.4
	September Monthly Peak	3.1	2.9
	October Monthly Peak	2.1	1.8

The differences between the 2021 ex ante load impact estimates are small and are a composite net change that are largely attributable to decreases in commercial customers and their usage. The forecasted enrollment for commercial customers in 2021 changed from 3,452 to 3,065 between the previous and current evaluations. Additionally, the predicted per-premise commercial impacts in the current evaluation are significantly smaller than the previous evaluation because of COVID-19. On average, the reference loads are about 7% lower in 2021 than previously estimated because of COVID-19 effects for commercial customers. These lower reference loads in turn result in lower estimated ex ante impacts in 2021. For SDG&E peaking conditions on a 1-in-10 year for a September monthly peak, the previous prediction was 0.7 MW while the current prediction is 0.3 MW.

5.3 Relationship between Ex Post and Ex Ante Load Impact Estimates

Table 5-9 facilitates a comparison of the ex post load impact estimates between each event and the ex ante estimates for 1-in-2 and 1-in-10 SDG&E weather conditions. Although ex ante estimates were created using only weekday 6 PM to 8 PM events, all events are included in this table for completeness.

The purpose of this table is to demonstrate the four important changes that are made to go from ex post results to ex ante predictions: enrollment, predictions using a weather-dependent model, the event window, and weather. We step through the table to explain each of these changes, using the first event as an example:

1. First, 0.41 MW (Column D) was delivered by AC Saver Day Of on June 2, 2020, when the heat build-up (as measured by mean17) was 68 °F (Column B). This load impact was generated by 10,089 total AC Saver Day Of participants (Column C).

2. Given the mean17 observed on this date (Column B), the observed enrollment numbers (Column C), and the hours of the event (Column A), our ex ante model predicts that we would expect AC Saver Day Of to deliver 0.46 MW of load reduction (Column E). The impact scaling in this model is based on the impacts from 6 PM to 8 PM weekday events from 2019 and 2020, and because our model is linear, this difference between ex post (Column D) and ex ante (Column E) implies that the load impact observed on June 2, 2020 was lower than average.

3. The next step is to perform the same ex ante model calculation as in Step 2, but to use the total predicted enrollment between residential and commercial (Column F) in place of the observed enrollment numbers (Column C). Note that as the total enrollment number changes, there may also be changes in the proportions of residential and commercial customers, and in the enrollments in different cycling options within each customer type, all of which is captured by the model. Using these new enrollment figures, our ex ante model predicts that we would expect AC Saver Day Of to deliver 0.52 MW of load reduction (Column G) on a day with a similar temperature profile (Column B) as June 2, 2020.

4. Another key difference in going from ex post to ex ante results is that ex ante results are designed to cover the RA window of 4 PM to 9 PM, which is longer than any AC Saver Day Of events. This is resolved by creating an approximate load shape that covers the RA window, which is used to convert the ex ante model output to an ex ante impact. Here, we take the observed ex post load impact (Column D), apply the predicted enrollment numbers from ex ante (Column F), and stretch the hourly impacts to fit the approximate RA window load shape. This gives an adjusted ex post load impact of 0.47 MW (Column H). Depending on the proportions of different groups of customers and the

hours of the event, this new estimate may increase, decrease, or stay the same, as it did for this event.

5. We may now compare this adjusted ex post impact "apples-to-apples" with ex ante load impacts, since they now use the same enrollment (Column F) and RA window load shape. Our adjusted ex post load impact of 0.47 MW (Column H) occurs at a mean17 value of 68 °F (Column B). That temperature is closer to the 1-in-2 mean17 value for June monthly system peak day of 68 °F (Column I) than the 1-in-10 value of 79 °F (Column K); therefore, we expect the adjusted ex post load impact to lie closer to the 1-in-2 ex ante load impact estimates. Indeed, this is the case – the 1-in-2 ex ante load impact estimate is 0.49 MW (Column J), and the 1-in-10 ex ante load impact estimate is 1.86 MW (Column L).

Table 5-9: Ex Post to Ex Ante Impacts by Analysis Step

Ex Post									SDG&E 1-in-2		SDG&E 1-in-10	
Date and Event Time		Mean 17 (°F)	Ex Post Enrollment	Ex Post Estimate (MW)	Ex Ante Estimate Using 2019 Enrollment (MW)	Ex Ante Enrollment	Ex Ante Estimate Using 2020 Enrollment (MW)	Ex Post Estimate Using 2020 Enrollment and Adjusted to RA Window (MW)	Mean17 (°F)	Ex Ante Estimate Using 2020 Enrollment and Adjusted to RA Window (MW)	Mean17 (°F)	Ex Ante Estimate Using 2020 Enrollment and Adjusted to RA Window (MW)
A		B	C	D	E	F	G	H	I	J	K	L
6/2/2020	6-8 PM	68	10,089	0.41	0.46	11,385	0.52	0.47	68	0.49	79	1.86
6/3/2020	6-8 PM	73	10,018	0.92	0.89		1.03	1.07				
6/10/2020	6-8 PM	76	10,017	1.60	1.22		1.43	1.75				
6/22/2020	6-8 PM	68	10,057	0.15	0.35		0.39	0.18				
7/8/2020	12-2 PM	70	10,436	0.72	0.77	11,385	0.84	0.78	76	1.36	78	1.73
7/9/2020	6-8 PM	68	10,435	0.51	0.48		0.52	0.50				
7/10/2020	6-8 PM	73	10,298	1.48	0.89		0.98	1.55				
7/13/2020	6-8 PM	75	10,299	1.44	1.12		1.23	1.52				
7/27/2020	6-8 PM	70	10,572	0.47	0.59		0.63	0.49				
7/29/2020	6-8 PM	68	10,610	0.51	0.49		0.53	0.53				
7/30/2020	6-9 PM	70	10,636	0.75	0.57		0.61	0.74				
7/31/2020	5-8 PM	75	10,649	1.66	1.23		1.34	1.66				
8/14/2020	5-9 PM	80	9,069	1.62	1.41	11,385	1.86	2.00	79	1.91	82	2.36
8/17/2020	5-8 PM	78	9,591	2.01	1.44		1.79	2.33				
8/18/2020	4-8 PM	80	9,585	2.52	1.85		2.30	2.91				
8/19/2020	6-8 PM	80	9,581	1.92	1.55		1.95	2.26				
8/21/2020	6-8 PM	78	9,587	1.42	1.39		1.74	1.68				
8/27/2020	6-8 PM	76	9,585	1.31	1.12		1.39	1.57				
9/5/2020	5-8 PM	83	9,928	3.01	2.22	11,385	2.64	3.25	82	2.34	85	2.89
9/6/2020	5-8 PM	88	9,916	3.13	3.21	11,385	3.83	3.37	82	2.34	85	2.89

6 Findings and Recommendations

This section summarizes Nexant's findings and recommendations from the 2020 AC Saver Day Of load impact evaluation.

Finding 1

As discussed in Section 3.2.1.1, paging issues prevented the program from delivering load reductions to full program capacity; customer cycling strategies and control groups were not properly readdressed due to incomplete paging messaging to the load control devices. Also, the RCT design of withholding control groups from cycling was not correctly implemented, resulting in more groups being held back than was necessary for each event. Overall, on the average event day, the program delivered approximately 0.16 MW less (13%) than expected under full program capacity.

Recommendation 1

Prior to the first event being called, there should be agreement between SDG&E, the party responsible for the sample design, and the party responsible for implementing the control strategies on the approach to be used for the upcoming season. This can be accomplished via a regularly-scheduled meeting in which customers are confirmed to have been correctly assigned to their control groups and that each month of the season has a designated control group to be withheld. This could be followed up by a basic interval data analysis immediately after the first event to confirm that the RCT is performing as intended.

Finding 2

Another cause of sub-optimal performance may be the age and responsiveness of the device fleet. As of the previous evaluation in 2019, 44.5% of customers (4,192) had a device with an enrollment date before 2010. Seventy-five percent of customers (7,021) had a device with an enrollment date before 2015. The average age of customers' oldest devices was 8 years and 8 months (July 2011). Devices that have been installed for a long period of time could be nonfunctional or have been inadvertently disconnected during CAC upgrades or maintenance.

Recommendation 2

In order to ensure that the program's direct load control devices are dispatching during events and producing load reductions, a field study should be conducted that examines the fleet of devices for functionality, prioritizing those that have been installed for the longest period of time. This is particularly important if new residential customers continue to be re-added to the program using legacy AC Saver switches. Alternatively, a data-based analysis could be designed that uses clustering or similar techniques to identify specific devices that do not exhibit evidence of cycling during program events.

Finding 3

Commercial customers produced relatively small impacts when compared to residential customers, but the days when events were called earlier in the day during standard business hours produced larger impacts. There were five weekday events that were called before 6 PM in 2020 and commercial customers had average aggregate impacts of 0.42 MW on these days. This is much larger than the average event day impacts (6 PM to 8 PM) of 0.15 MW.

Recommendation 3

Consider calling events for commercial participants that include hours before 6 PM in order to achieve larger commercial impacts.

Finding 4

Eleven out of 20 events in 2020 were two-hour events that occurred between 6 PM and 8 PM. In the ex ante analysis, to ensure that similar events were used from both 2019 and 2020, the average load impacts are defined as the average load impact across the window of 6 PM to 8 PM, for all weekday events with the event window spanning this two-hour range. The benefit of this is that it resulted in the greatest amount of data points available for estimating the model – 11 of the 20 events in 2020 fit these criteria, as well as 12 of the 20events in 2019. However, the CPUC Load Impact Protocols require that ex ante load impacts be reported for the Resource Adequacy window of 4 to 9 PM. Only using two-hour events to estimate impacts for a five-hour window requires developing techniques such as the shaping ratios described in Section 3.3.

Recommendation 4

In order to facilitate a less tenuous connection between ex post and ex ante, SDG&E should call three to four events that are four hours in duration each season, between the hours of 4 PM to 9 PM. The results from these events will help the load impact evaluator produce robust the ex ante impacts for the Resource Adequacy window.

Headquarters
49 Stevenson Street, Suite 700
San Francisco CA 94105-3651
Tel: (415) 369-1000
Fax: (415) 369-9700
www.nexant.com