

2018 IMPACT EVALUATION OF SAN DIEGO GAS & ELECTRIC'S PEAK TIME REBATE AND AC SAVER DAY AHEAD RESIDENTIAL PROGRAMS

Ex Post and Ex Ante Report CALMAC Study ID: SDG0313

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EXECUTIVE SUMMARY

This report presents the findings of the 2018 ex post and ex ante evaluation for San Diego Gas and Electric's (SDG&E) Peak Time Rebate (PTR) Program. The 2018 program year was the last year the PTR program was active in SDG&E. The PTR Program was marketed as the *Reduce Your Use*SM (RYU) Rewards. If customers saved electricity between 2 p.m. and 6 p.m. on RYU Reward days, they earned a credit on their SDG&E bill. To earn rewards, customers set up an alert (text, email, phone, or a combination) preference and SDG&E let them know when to expect an RYU day.

This report also includes the evaluation findings of the residential AC Saver DA program, formerly known as the Small Customer Technology Deployment (SCTD) program. The AC Saver DA program events last two to four hours and can be called between 12:00 p.m. and 9:00 p.m. The program provides two thermostat options for participation in the program, free and "Bring Your Own Thermostat" (BYOT). Free customers received a DR enabling smart thermostat from SDG&E at no cost. BYOT customers purchase their own thermostats and then register them with the program to participate. All the smart thermostats are demand response technology-enabled so that SDG&E can raise their thermostat setting for up to four continuous hours between the hours of 12 p.m. and 9 p.m. on event days.

E.S.1 EX POST EVALUATION SUMMARY

E.S.1.1 PTR Ex Post Evaluation

There were six PTR events during the summer of 2018, occurring on July 6th, July 24th, July 25th, August 6th, August 7th, and August 9th. The average temperature during event hours was 91.8°F. Table ES-1 shows the average and aggregate PTR ex post load impact estimates for the participant groups of interest in this evaluation. Across all of the 2018 PTR events, the overall PTR population had an average event hour load reduction of 0.11 kW per participant, representing an average reduction of 8.8% relative to the reference load. The average aggregate load reduction during event hours was 9.09 MW. Large participants delivered 61% of the aggregate load reduction (5.51 MW), while Medium and Small participants delivered the remaining 39% (2.68 MW and 0.85 MW, respectively). Inland customers experienced higher temperatures during events (97.6°F) than Coastal customers (86.0°F) and had a higher average load reduction during event hours (0.16 kW versus 0.07 kW). The participants who first enrolled in 2018 saved the most during the 2018 PTR events, with an average of 0.11 kW (8.4%) during event hours. Having both email and text event notification resulted a higher average event hour reduction of 0.11 kW (8.1%).



TABLE ES-1: PTR EX POST LOAD IMPACT ESTIMATES BY CUSTOMER CATEGORY - AVERAGE 2018 EVENT (2 P.M. TO 6 P.M.)

Customer Category	Active Participants	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Aggregate Load Reduction (MW)	Mean °F
All	80,798	1.37	1.26	0.11	8.8%	9.09	91.8
Large	38,430	1.70	1.56	0.14	9.4%	5.51	92.4
Medium	26,300	1.27	1.17	0.10	8.3%	2.68	91.7
Small	16,069	0.73	0.68	0.05	7.4%	0.85	90.4
Coastal	40,653	1.05	0.98	0.07	6.9%	2.69	86.0
Inland	40,145	1.69	1.54	0.16	9.8%	6.23	97.6
No TD	71,985	1.34	1.29	0.05	4.2%	3.80	91.7
No Load Control (TD or SS)	70,175	1.30	1.27	0.03	2.6%	2.20	91.6
Enroll. Year – 2014 or earlier *	35,212	1.34	1.32	0.02	1.4%	0.62	91.5
Enroll. Year – 2015*	7,616	1.36	1.36	0.00	0.0%	0.00	91.6
Enroll. Year – 2016*	8,009	1.33	1.30	0.03	2.4%	0.24	91.6
Enroll. Year – 2017*	13,079	1.14	1.09	0.05	5.6%	0.66	91.8
Enroll. Year – 2018*	6,260	1.32	1.21	0.11	8.4%	0.69	91.1
Notification – Email Only*	44,670	1.25	1.25	0.00	0.3%	0.09	91.5
Notification – Text Only*	12,689	1.39	1.33	0.07	4.8%	0.83	91.6
Notification – Both*	11,370	1.39	1.28	0.11	8.1%	1.25	92.0
Net Energy Metered*	17,806	0.73	0.72	0.01	1.8%	0.18	92.7

* Participants excluding load control (no TD or AC Saver DO).

E.S.1.2 AC Saver Day Ahead Ex Post Evaluation

In 2018, there were eighteen AC Saver Day Ahead events with varying event hours and durations, but generally ran for two hours between 6:00p.m. and 8:00p.m. AC Saver DA participants either received a free thermostat through the program or enrolled using their own thermostat. The latter group is known as “Bring Your Own Thermostat,” or BYOT. The average temperature for participants during the AC Saver DA events was 79.5°F. Table ES-2 shows the average and aggregate AC Saver DA ex post load impact estimates for the overall AC Saver DA group, by thermostat type, and by location. The average event hour aggregate load reduction for AC Saver DA group was 1.70 MW (0.17 kw per participant). Participants with BYOT thermostats had higher event hour load reductions, averaging 0.24 kW,



compared to those with free thermostats, who averaged 0.08 kW. Inland and costal participants had relatively equal reductions in load per participant with 0.18 kw and 0.16 kw in load respectively.

TABLE ES-2: AC SAVER DA EX POST LOAD IMPACT ESTIMATES BY CUSTOMER CATEGORY - AVERAGE 2018 EVENT

Customer Category	Active Participants	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Aggregate Load Reduction (MW)	Mean °F
All	10,007	1.45	1.28	0.17	12.1%	1.70	79.5
Free	4,217	1.52	1.44	0.08	6.4%	0.35	80.3
BYOT	5,536	1.38	1.14	0.24	17.1%	1.35	78.8
Inland	5,048	1.61	1.43	0.18	11.9%	0.92	83.5
Coastal	4,959	1.28	1.12	0.16	12.0%	0.78	75.4

E.S.2 EX ANTE EVALUATION SUMMARY

The ex ante evaluation is based on taking the results from the ex post analysis and using them to estimate per participant impacts for different weather scenarios and then multiplying these by forecasts of enrollment for different participant segments. Given that the PTR program was discontinued following the 2018 event season, only AC Saver DA ex ante results are presented in this report. SDG&E forecasts that the AC Saver DA program will grow from around 11,500 participants to approximately 20,000 by the end of 2019.

Table ES-3 shows the average hourly resource availability (RA) estimates for the AC Saver DA program and thermostat sub-groups, for the two types of weather conditions, 1-in-2 and 1-in-10. The overall AC Saver DA group is estimated to have average event hour load impacts of 0.19 kW in 1-in-10 conditions and 0.17 kW in 1-in-2 conditions. The BYOT AC Saver DA group participants are estimated to have average event hour load impacts of 0.27 kW in 1-in-10 scenarios and 0.23 kW in 1-in-2 scenarios. The free thermostats see smaller estimates for estimated average event hour load impacts with the 1-in-10 scenario seeing 0.11 kW and the 1-in-2 scenario seeing 0.12 kw in load reductions.



TABLE ES-3: EX ANTE AVERAGE HOURLY LOAD IMPACT ESTIMATES BY CUSTOMER CATEGORY – 2019 TYPICAL EVENT HOURS

Program Segment and Weather Scenario			Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Aggregate Load Reduction (MW)	Mean Temp. °F
AC Saver DA	BYOT	1-in-10	1.84	1.57	0.27	14.5%	2.91	86.38
		1-in-2	1.58	1.35	0.23	14.3%	2.69	81.33
	Free	1-in-10	2.01	1.90	0.11	5.6%	0.70	87.69
		1-in-2	1.72	1.60	0.12	6.8%	0.72	82.33
	Overall	1-in-10	1.91	1.73	0.19	9.7%	3.18	86.85
		1-in-2	1.64	1.46	0.17	10.5%	2.96	81.69

1 INTRODUCTION

This report provides estimates of the 2018 ex post and ex ante load impacts for San Diego Gas and Electric's (SDG&E) Peak Time Rebate (PTR) program. The program provides customers with notification on a day-ahead basis that a PTR event will occur on the following day. In emergency situations, a PTR event can be called on a day-of basis to help address an emergency, but day-of events are not the primary design or intended use of the program. The 2018 program year also represents the final year that the PTR was offered by SDG&E.

This report also provides estimates of the 2018 ex post and ex ante load impacts for the residential AC Saver Day Ahead (AC Saver DA) program. The 2018 season represents the first year the program was marketed as AC Saver DA. Formerly, participants in this program were a part of the as Small Customer Technology Deployment (SCTD) program and referred to as SCTD customers. In the past, SDG&E offered free programmable communicating thermostats (PCT) with demand response (DR) enabling technology to residential customers through the program, but now offers an additional "Bring Your Own Thermostat" (BYOT) option for program participation.

1.1 EVALUATION OBJECTIVES

This project has four principal objectives:

- Estimate *ex post* load impacts for the PTR opt-in and AC Saver DA programs,
- Make comparisons of the impacts of several program participant sub-groups,
- Estimate conservation effects resulting from the installation of PTR and AC Saver DA thermostats, and
- Estimate *ex ante* load impacts for the AC Saver DA programs for the future.

1.2 OPT-IN PEAK TIME REBATE PROGRAM OVERVIEW

The PTR program provides customers with notification on a day-ahead basis that a PTR event will occur on the following day. The PTR program is marketed as Reduce Your Use. In emergency situations, a PTR event can be called on a day-of basis to help address an emergency, but day-of events are not the primary design or intended use of the program. PTR is a two-level incentive program, providing a basic incentive level (\$0.75/kWh) to customers that reduce energy use through manual means and a premium incentive (\$1.25/kWh) to customers that reduce energy usage through automated DR enabling technologies. The PTR bill credit is calculated based on their event day reduction in electric usage below their established customer-specific reference level (CRL). The program is marketed under the name Reduce Your Use (RYU) and is an opt-in program for residential customers. CPUC Decision D-13-07-003



directed SDG&E to require residential customers to enroll in PTR to receive a bill credit beginning in 2014. Prior to 2014, the PTR program was a default program for all SDG&E residential customers with an opt-in component whereby customers could receive notification of events.

Table 1-1 summarizes the PTR program enrollment. Slightly more than 83,000 customers had enrolled in the PTR program between May 1st and August 9th, 2018 (the last 2018 PTR event day). Roughly two and half percent of these participants were dually enrolled in the AC Saver DO (formerly Summer Saver) program and roughly eleven percent of participants enrolled in PTR a DR enabling thermostat (TD on PTR). These TD on PTR participants were eligible for the premium incentive (\$1.25/kWh) for reducing energy use through automated DR enabling technologies.

Approximately 60% of PTR participants enrolled for email notification only, with another 14.6% enrolled jointly in email and text notifications. Text message-only notifications account for most of the remaining participants at 17.5%. Only 2.1% of participants received only telephone notifications.

TABLE 1-1: SUMMARY OF PTR ENROLLMENT BY CUSTOMER CATEGORY¹

Customer Category ²	Participants	
	N	%
PTR without Enabling Technology	72,507	87.0%
TD on PTR	8,976	10.8%
Dually enrolled in AC Saver DO	1,853	2.2%
Coastal Climate Zone	41,851	50.2%
Inland Climate Zone	41,485	49.8%
Notification Type – Email Only	49,049	58.9%
Notification Type – Text Only	14,563	17.5%
Notification Type – Phone Only	1,723	2.1%
Notification Type – Email & Text	12,202	14.6%
Notification Type – Email & Phone	2,816	3.4%
Notification Type – Text & Phone	715	0.9%
Notification Type – All Three	2,055	2.5%
All PTR Participants	83,336	100%

¹ Active at any point between May1, 2018 and August 9, 2018 (the PTR event season)

² Participants with unknown Notification Types are not included as a customer category, but are included in participant counts



1.3 OVERVIEW OF THE RESIDENTIAL AC SAVER DA PROGRAM

The residential AC Saver DA program provides demand response through a four-degree setback on a DR enabling thermostats during events. AC Saver DA events last two to four hours and can be called between 12:00 p.m. and 9:00 p.m. In 2018, there were eighteen AC Saver DA events with varying event hours and durations, but generally ran for two hours between 6:00 p.m. and 8:00 p.m. There are two thermostat options for participant in the program, free and BYOT. In past years, SDG&E offered a free Ecobee Smart Si thermostat to qualifying customers in the previously named SCTD program. Beginning in 2017, SDG&E added the BYOT option to the program. The eligible BYOT thermostats include the Nest Learning Thermostat, the Nest Thermostat E, the Ecobee 3 Thermostat, and the Ecobee 4 Thermostat.

Table 1-2 summarizes the AC Saver DA program enrollment. Slightly more than 11,800 customers were enrolled in the AC Saver Program between May 1st and September 30th, 2018. As seen, participation in the program was roughly equal between inland and costal climate zones. Approximately two thirds (61%) of program participant were equipped with BYOT thermostats whereas 36% of participants received a free thermostat.

TABLE 1-2: SUMMARY OF AC SAVER DA ENROLLMENT BY CUSTOMER CATEGORY¹

Customer Category ²	Participants	
	N	%
Coastal Climate Zone	5,942	50%
Inland Climate Zone	5,916	50%
BYOT Thermostat Source ²	7,291	61%
Free Thermostat Source ²	4,272	36%
All AC Saver DA Participants	11,858	100%

¹ Active at any point between May1,2018 and September 30, 2018 (AC Saver DA event season)

² Participants with unknown thermostat sources are not included as a customer category, but are included in participant counts

1.4 OVERVIEW OF METHODS

For both the opt-in PTR population and the AC Saver DA participants, Itron estimated *ex post* impacts using aggregate models for participants using a control group based on a set of accounts from the non-alert population that has been matched based on their similarity with the participant accounts. These aggregate models will mitigate the variability from the individual accounts while the control group will account for other factors that influence consumption for both the alert participant and non-participant populations. The models were estimated for a number of participant segments to ensure that the results have the granularity necessary to address all research questions.



The ex ante forecasts combined the models developed for the ex post analysis, an enrollment forecast provided by SDG&E, and normal weather forecasts for both 1-in-2 and 1-in-10 weather scenarios for SDG&E and Cal ISO system peaks.

1.5 REPORT ORGANIZATION

The remainder of this report contains the following sections:

- Ex Post Methodology,
- Ex Post Results,
- Ex Ante Methodology and Results,
- Appendix A – Ex Post Impact Tables, and
- Appendix B – Ex Ante Forecast Tables.

2 EX POST METHODS AND VALIDATION

To estimate ex post load impacts for the opt-in PTR and AC Saver DA programs, Itron developed regression-based models using a difference in differences (DiD) format, comparing participant and reference aggregate hourly residential loads. The reference loads for these models were calculated from matched control groups selected from SDG&E's population of non-program participants. The methods for matching and ex post estimations are described in detail below.

2.1 CONTROL GROUP SELECTION

Control groups were used to measure impacts from the PTR and AC Saver DA programs. The use of control groups help improve the estimation of reference loads and impacts when obfuscating conditions exist, such as: a) few events, with the potential of these events being the hottest days during the summer, b) some events occurring during non-cooling months and/or months where hot weather is not typical, c) small average impacts relative to the overall size of the average participant load during the events. To develop control groups for this evaluation, Itron used a Stratified Propensity Score Matching (SPSM) method.

2.1.1 Pre-Matching Stratification and Design

Prior to generating propensity scores, the participant sites were stratified to control for variables that may observationally influence participation. Strata were defined using a combination of three major participant characteristics¹: PTR participation, thermostat participation, and having Net Energy Metering (NEM). Each of the six possible participant combinations of these characteristics were also stratified by climate zone (coastal and inland). In total, this provided 12 different strata from which to develop control groups.

¹ Participant characteristics are based on the characteristics at the start of the event season. Some TD on PTR participants moved from a PTR rate to the AC Saver DA program on September 19, 2018. All TD on PTR participants are included in PTR participant and thermostat participant strata. As a result, AC Saver DA and TD on PTR participants are in mutually exclusive strata.



TABLE 2-1: PRE-MATCHING PARTICIPANT STRATIFICATION

Strata	PTR Participant/Rate	Net Energy Metered	Thermostat Participant (Including AC Saver DA and TD on PTR)	Climate Zones
1	✓	✓	✗	Inland, Coastal
2	✓	✗	✗	Inland, Coastal
3	✓	✓	✓	Inland, Coastal
4	✓	✗	✓	Inland, Coastal
5	✗	✓	✓	Inland, Coastal
6	✗	✗	✓	Inland, Coastal

Using these customer segments and strata, the SPSM methodology used a logistic regression (logit) model to estimate the probability of participation within each stratum. The matching routine paired each participant with a non-participant that had the most similar estimated probability of participation.

The control group selection used the hourly interval data for a random sample of 500,000 non-participant customers. The PSM selected the control group using variables developed from interval data. The matching was performed separately for PTR, TD on PTR, and AC Saver DA participants by the stratification detailed above, as well as for the other various participant subgroups, namely AC Saver DO (formerly Summer Saver) and Low Income.

After experimenting with various combinations, the final set of variables based on interval data for the months of June through October of 2018 were chosen. The logit model for strata 1,2,3, and 4 included hot day² morning kWh usage, hot day event hours kWh usage, hot day evening kWh usage, and annual usage size dummy variables (small and medium)³. Strata 5 and 6 are included also included average monthly weekday usage.

2.1.2 Propensity Score Matching Results

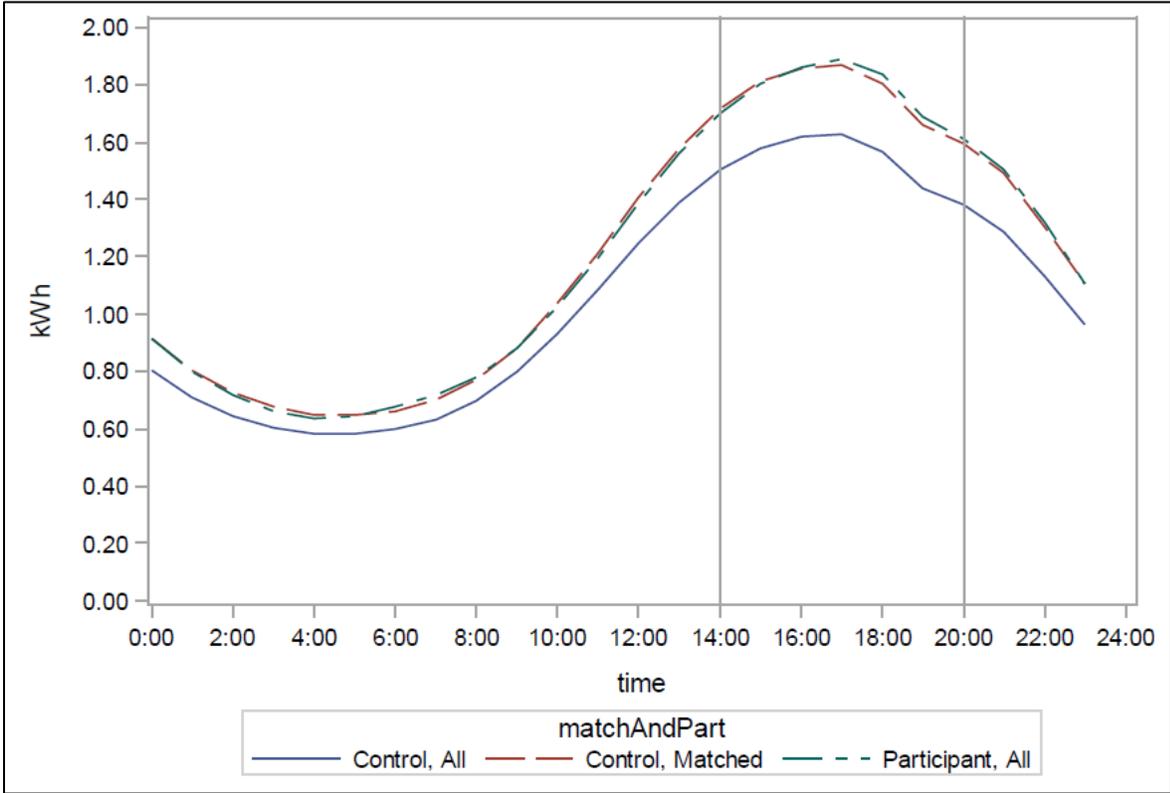
One of the key methods of assessing the effectiveness of the PSM is to conduct t-tests on the independent variables used in the logistic regression for the groups both before and after matching. If

² For hot days, Itron selected the five non-event, non-holiday weekdays in the summer of 2018 with the highest average peak temperatures across the different weather stations used for the analysis. The dates with these peak temperatures were the 23rd and 27th of July and the 1st, 8th, and 10th of August 2018. Load profiles by season were also compared to confirm that the groups were sufficiently similar.



the matching is successful, the participant and control groups should not be statistically significantly different for these variables. The results of the t-tests for both stages of the PTR and AC Saver DA participant PSM matching show that none of the PSM variables had a statistically significant difference after selecting the control premise candidates. A final assessment of the efficacy of the PSM is a graphical comparison of the annual load profiles of the participant premises with the control premises before and after matching. The candidate premises selected in the PSM have virtually the same profile as the participants, whereas the load profile for all non-participant premises before matching has substantially lower consumption. Figure 2-1 shows a comparison of the average hourly load profile on hot days for the participant and control groups for the Inland PTR group before and after the matching. The event window is marked by vertical lines and it is clear that the control and participants line up much more closely after the matching during these key hours. While the t-test results are strong evidence that the PSM method worked well, these visual representations provide further confirmation of its success.

FIGURE 2-1: COMPARISON OF HOURLY HOT DAY LOAD PROFILES FOR CONTROL GROUP WITH ALL AND ONLY MATCHED PTR PARTICIPANTS





2.2 ESTIMATING EX POST LOAD IMPACTS

Following validation of the control group matching processes, ex post load impact models were developed based on aggregate hourly residential loads for both the opt-in alert customers and the matched control groups for each of the identified segments. Load impacts were estimated using a regression, controlling for event hours and factors such as weather conditions, day of the week, and month.

2.2.1 PTR Ex Post Estimation

A number of different combinations of specifications were tested in developing the aggregate ex post model. The final model specifications used for the analysis included dummy variables for hour, day of the week, month, and event indicators, along with continuous variables for cooling degree hours (CDH65). Additionally, because enrollment increased during the summer, the model included a binary variable to indicate whether a participant was “active,” meaning that they had opted in to the program by the date in question. This means that for periods prior to enrollment, some participants were effectively part of the control group.

Expressed symbolically, the model is as follows:

$$\begin{aligned} kWh_{i,t} = & \beta_0 + \sum_d \beta_1^d \times DOW_t^d + \sum_m \beta_2^m \times Month_t^m + \sum_h \beta_3^h \times Hour_t^h \\ & + \sum_d \sum_h \beta_4^{h,d} \times Hour_t^h \times DOW_t^d + \sum_m \sum_h \beta_5^{h,m} \times Hour_t^h \times Month_t^m + \beta_6 \\ & \times CDH65_{i,t} + \sum_h \beta_7^h \times Hour_t^h \times CDH65_{i,t} + \sum_h \beta_8^h \times Hour_t^h \times Event_t \\ & + \sum_h \beta_9^h \times Hour_t^h \times Event_t \times CDH65_{i,t} + \sum_h \beta_{11}^h \times Hour_t^h \times Event_t \\ & \times InactivePart_{i,t} + \sum_h \beta_{12}^h \times Hour_t^h \times Event_t \times ActivePart_{i,t} \\ & + \sum_h \beta_{13}^h \times Hour_t^h \times Event_t \times InactivePart_{i,t} \times CDH65_{i,t} \\ & + \sum_h \beta_{14}^h \times Hour_t^h \times Event_t \times ActivePart_{i,t} \times CDH65_{i,t} + \varepsilon_{i,t} \end{aligned}$$



Where:

$kWh_{i,t}$	Is the kWh in time t for site i
DOW_t^d	Is the day of week dummy variable series, = 1 if time t is day d , and = 0 otherwise
$Month_t^m$	Is the month dummy variable series, = 1 if time t is month m , and = 0 otherwise
$Hour_t^h$	Is the hour dummy variable series, = 1 if time t is hour h , and = 0 otherwise
$CDH65_{i,t}$	Is the cooling degree hour for site i and hour t , calculated using 65 degree as base
$Event_t$	= 1 if time t is in an event day, and = 0 otherwise
$ActivePart_{i,t}$	= 1 if at time t , site i is an active participant, and = 0 otherwise
$InactivePart_{i,t}$	= 1 if site i participated after time t , and = 0 otherwise
β_0	Is the intercept
β_1^d	Is the set coefficients for day of week (DOW) d
β_2^m	Is the set of coefficients for month m
β_3^h	Is the set of coefficients for hour h
$\beta_4^{h,d}$	Is the set of coefficients for the interaction of hour h and DOW d
$\beta_5^{h,m}$	Is the set of coefficients for the interaction of hour h and month m
β_6	Is the coefficient for cooling degree hours (CDH), measuring how much more energy a site would consume, on average, if the cooling degree hours go up by one
β_7^h	Is the set of coefficients for CDH interacted with hour h , measuring how much more energy a site would consume, on average, if the cooling degree hours go up by one in hour h
β_8^h	Is the set of coefficients that measure how much energy the non-participants would consume more during the event days than non-event days, and in hour h , on average
β_9^h	Is the set of coefficients that measure how much more energy the non-participants would consume during the event days than non-event days, if cooling degree hour increases by one, and in hour h
β_{11}^h	Is the set of coefficients that measure how much energy the inactive participants would consume more during the event days than non-event days, and in hour h , on average
β_{12}^h	Is the set of coefficients that measure more how much energy the active participants would consume during the event days than non-event days, and in hour h , on average
β_{13}^h	Is the set of coefficients that measure how much more energy the inactive participants would consume during the event days than non-event days, if cooling degree hour increases by one, and in hour h
β_{14}^h	Is the set of coefficients that measure how much more energy the active participants would consume during the event days than non-event days, if cooling degree hour increases by one, and in hour h



$\varepsilon_{i,t}$	Is the error term for site i at time t
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The program impacts were modeled for each hour separately using two variables, 1) the dummy variable that indicates event days, and 2) the interaction of cooling degree hours with event dummy variables. The first one estimates, on average, how much energy a participant would use during an event hour, compared to non-participants. If on average, a participant saved energy during event days, we would then expect a negative coefficient for this variable, or $\beta_{12}^h < 0$.

The second part estimates how much more energy a participant would consume compared to a non-participant as temperature goes up by one degree. So, if the participants save more when temperature is higher, we would expect a negative coefficient for this term, or $\beta_{14}^h < 0$. However, if on the other hand, a participant would save less when temperature goes up, we would expect a positive coefficient, or $\beta_{14}^h > 0$, which would indicate marginally negative savings.

2.2.2 AC SAVER Day Ahead Ex Post Estimation

The model used to estimate savings for the AC Saver DA participants varied from the PTR program. Two key differences exist between the PTR and AC Saver DA models. The first difference is the inclusion of an event hour interaction between specified event hours and AC Saver DA participation to account for varying event hours on event days and the inclusion of band hours (the hour before and after each event) to account for variation between pre-cooling and snapback during event hours.

Using the population of AC Saver DA participants and its associated matched control group, ex post impacts were calculated using the equation below:



$$\begin{aligned}
kWh_{i,t} = & \beta_0 + \sum_d \beta_1^d \times DOW_t^d + \sum_m \beta_2^m \times Month_t^m + \sum_h \beta_3^h \times Hour_t^h \\
& + \sum_d \sum_h \beta_4^{h,d} \times Hour_t^h \times DOW_t^d + \sum_m \sum_h \beta_5^{h,m} \times Hour_t^h \times Month_t^m + \beta_6 \\
& \times CDH65_{i,t} + \sum_h \beta_7^h \times Hour_t^h \times CDH65_{i,t} + \sum_h \beta_8^h \times Hour_t^h \times Event_t \\
& + \sum_h \beta_9^h \times Hour_t^h \times Event_t \times CDH65_{i,t} \\
& + \sum_h \beta_{11}^h \times Hour_t^h \times Event_t \times InactivePart_{i,t} \\
& + \sum_h \beta_{12}^h \times Hour_t^h \times Event_t \times ActivePart_{i,t} \\
& + \sum_h \beta_{13}^h \times Hour_t^h \times Event_t \times InactivePart_{i,t} \times CDH65_{i,t} \\
& + \sum_h \beta_{14}^h \times Hour_t^h \times Event_t \times ActivePart_{i,t} \times CDH65_{i,t} \\
& + \sum_h \beta_{15}^h \times Hour_t^h \times BandHour_t + \sum_h \beta_{16}^h \times Hour_t^h \times BandHour_t \times CDH65_{i,t} \\
& + \sum_h \beta_{17}^h \times Hour_t^h \times BandHour_t \times InactivePart_{i,t} \\
& + \sum_h \beta_{18}^h \times Hour_t^h \times BandHour_t \times ActivePart_{i,t} \\
& + \sum_h \beta_{19}^h \times Hour_t^h \times BandHour_t \times InactivePart_{i,t} \times CDH65_{i,t} \\
& + \sum_h \beta_{20}^h \times Hour_t^h \times BandHour_t \times ActivePart_{i,t} \times CDH65_{i,t} \\
& + \sum_h \beta_{21}^h \times Hour_t^h \times EventHour_t + \sum_h \beta_{22}^h \times Hour_t^h \times EventHour_t \times CDH65_{i,t} \\
& + \sum_h \beta_{23}^h \times Hour_t^h \times EventHour_t \times InactivePart_{i,t} \\
& + \sum_h \beta_{24}^h \times Hour_t^h \times EventHour_t \times ActivePart_{i,t} \\
& + \sum_h \beta_{25}^h \times Hour_t^h \times EventHour_t \times InactivePart_{i,t} \times CDH65_{i,t} \\
& + \sum_h \beta_{26}^h \times Hour_t^h \times EventHour_t \times ActivePart_{i,t} \times CDH65_{i,t}
\end{aligned}$$

Where:

kWh_t	Is the kWh in hour t
DOW_t^d	Is the day of week dummy variable series, = 1 if time t is day d , and = 0 otherwise
$Month_t^m$	Is the month dummy variable series, = 1 if time t is month m , and = 0 otherwise
$Hour_t^h$	Is the hour dummy variable series, = 1 if time t is hour h , and = 0 otherwise
$CDH65_{i,t}$	Is the cooling degree hour for site i and hour t , calculated using 65 degree as base
$Event_t$	= 1 if time t is in an event day, and = 0 otherwise
$EventHour_t$	= 1 if time t is an event hour, and = 0 otherwise. This term is not included in PTR model, because PTR



	events were all called during the same time period. So, since the model is effectively estimated by hour, for PTR model, this term is the same as $Event_t$, during the event hours.
$BandHour_t$	= 1 if time t is one hour before or after event, and = 0 otherwise. This term is not included in PTR model, and the reason is same as for variable $EventHour_t$. This term is included to capture the possible pre-cooling and snapback effect of the program.
$ActivePart_{i,t}$	= 1 if at time t , site i is an active participant, and = 0 otherwise
$InactivePart_{i,t}$	= 1 if site i participated after time t , and = 0 otherwise
β_0	Is the intercept
β_1^d	Is the set coefficient for day of week (DOW) d
β_2^m	Is the set of coefficients for month m
β_3^h	Is the set of coefficients for hour h
$\beta_4^{h,d}$	Is the set of coefficients for the interaction of hour h and DOW d
$\beta_5^{h,m}$	Is the set of coefficients for the interaction of hour h and month m
β_6	Is the coefficient for cooling degree hours (CDH), measuring how much more energy a site would consume, on average, if the cooling degree hours go up by one
β_7^h	Is the set of coefficients for CDH interacted with hour h , measuring how much more energy a site would consume, on average, if the cooling degree hours go up by one in hour h
β_8^h	Is the set of coefficients that measure how much energy the non-participants would consume more during the event days than non-event days, and in hour h , on average
β_9^h	Is the set of coefficients that measure how much more energy the non-participants would consume during the event days than non-event days, if cooling degree hour increases by one, and in hour h
β_{11}^h	Is the set of coefficients that measure how much energy the inactive participants would consume more during the event days than non-event days, and in hour h , on average
β_{12}^h	Is the set of coefficients that measure how much energy the active participants would consume more during the event days than non-event days, and in hour h , on average
β_{13}^h	Is the set of coefficients that measure how much more energy the inactive participants would consume during the event days than non-event days, if cooling degree hour increases by one, and in hour h
β_{14}^h	Is the set of coefficients that measure how much more energy the active participants would consume during the event days than non-event days, if cooling degree hour increases by one, and in hour h
β_{15}^h	Is the set of coefficients that measure how much energy the non-participants would consume more during the band hours than otherwise, and in hour h , on average
β_{16}^h	Is the set of coefficients that measure how much more energy the non-participants would consume during the band hours than otherwise, if cooling degree hour increases by one, and in hour h
β_{17}^h	Is the set of coefficients that measure how much energy the inactive participants would consume more during the band hours than otherwise, and in hour h , on average
β_{18}^h	Is the set of coefficients that measure how much energy the active participants would consume more



	during the band hours than otherwise, and in hour h , on average
β_{19}^h	Is the set of coefficients that measure how much more energy the inactive participants would consume during the band hours than otherwise, if cooling degree hour increases by one, and in hour h
β_{20}^h	Is the set of coefficients that measure how much more energy the active participants would consume during the band hours than otherwise, if cooling degree hour increases by one, and in hour h
β_{21}^h	Is the set of coefficients that measure how much energy the non-participants would consume more during the event hours than otherwise, and in hour h , on average
β_{22}^h	Is the set of coefficients that measure how much more energy the non-participants would consume during the event hours than otherwise, if cooling degree hour increases by one, and in hour h
β_{23}^h	Is the set of coefficients that measure how much energy the inactive participants would consume more during the event hours than otherwise, and in hour h , on average
β_{24}^h	Is the set of coefficients that measure how much energy the active participants would consume more during the event hours than otherwise, and in hour h , on average
β_{25}^h	Is the set of coefficients that measure how much more energy the inactive participants would consume during the event hours than otherwise, if cooling degree hour increases by one, and in hour h
β_{26}^h	Is the set of coefficients that measure how much more energy the active participants would consume during the event hours than otherwise, if cooling degree hour increases by one, and in hour h
$\varepsilon_{i,t}$	Is the error term for site i at time t

The program impacts were modeled for each hour separately using six variables:

1. The dummy variable that indicates event days.
2. The dummy variable that indicates event hours.
3. The dummy variable that indicates band hours.
4. The interaction of cooling degree hours with event day dummy variables.
5. The interaction of cooling degree hours with event hour dummy variables.
6. The interaction of cooling degree hours with band hour dummy variables.

The AC Saver DA model essentially works the same as PTR program model, including one constant term and one interaction term to allow the savings to differ by temperature. However, the AC Saver DA model estimates event hours and band hours separately from all the other hours. This is necessary for the AC Saver DA program because events were called at varying start times, end times, and durations, unlike the PTR program.



For example, the majority of events ended at 8 p.m., however, on July 17th, the event lasted until 9 p.m. and was the only event end in that hour. If PTR model were applied to the AC Saver DA program, the savings during hour 8 p.m. – 9 p.m. on July 17th would be averaged across all 18 event days (a snapback hour for most other events). This would result in the July 17th, 8 p.m. – 9 p.m. savings being blended with the negative impacts from the snapback effects on other event days. In this case, both the program effects and the snapback effects would be underestimated.

Another item worth noting is the definition of band hours. For purposes of this analysis, band hours are defined as the hour before and hour after the event. By design of the AC Saver DA model, band hours do not mix the pre-cooling effects and the snapback effects since the pre-cooling band hours include, depending on which event day, hour 15, 16 and 17 (3 – 4 p.m., 4 – 5 p.m. and 5 – 6 p.m.), and snapback band hours include hour 19, 20 and 21 (7 – 8 p.m., 8 – 9 p.m. and 9 – 10 p.m.). Secondly, the model assumes that both pre-cooling effects and snapback effects would take place for only one hour. This is because, from the past evaluations, it was shown that the pre-cooling, if any, took place only for one hour, and most of the snapback effects were during the first hour after the event.

2.2.3 Data Attrition

Underlying all of the analysis were the many steps that were necessary to integrate the many data sources into the structure required for analysis. These steps, in addition to diagnostics to identify outliers or other problematic data, mean that participants analyzed in the estimation of impacts was lower than the actual number of active participants. In the case of this analysis, the primary source of data attrition was a lack of information necessary to associate the appropriate weather station with a participant, followed by confusing or contradictory program participation information.

Prior to the PSM, participants were excluded from the analysis if they had an average monthly consumption or coefficient of variation greater than 5 standard deviations from the mean. Participants were also excluded if any of the inputs for the PSM logistic regression were missing (CDD, monthly consumption, etc.). After the PSM, additional criteria were implemented so the difference between matched propensity scores was less than 0.0005 and that participants with PV generation that were not identified as NEM were excluded. The remaining participants represent the final set of participants used to model the ex post impacts. The aggregate results incorporate the initial full counts of participants to determine the total impact of the programs for each of the sub-groups.

Unless the data attrition results in a shortage of the needed accounts to estimate the impacts, the main concern is whether it results in bias. That is, is there some systematic difference associated with the reason for dropping the accounts that would strongly influence the results in one direction or the other? While this is typically difficult to determine with certainty, in the case of this analysis there is no reason to assume that the removal of the participants had any influence on the results.

3 EX POST RESULTS

3.1 COMPARISON OF EX POST LOAD IMPACTS

In 2018, SDG&E called a total of six PTR events and eighteen AC Saver DA events. All PTR events hours occurred from 2 p.m. to 6 p.m., while AC Saver DA event hours varied across event days. AC Saver DA events generally started at 6 p.m. and went until 8 p.m., however specific event times varied across event days. Table 3-1 and Table 3-2 list the PTR and AC Saver DA event Days and hours below.

TABLE 3-1: LIST OF PTR EVENT DAYS AND EVENT HOURS

Event Day	Event Start	Event End
July 6 th , 2018	2:00 p.m.	6:00 p.m.
July 24 th , 2018	2:00 p.m.	6:00 p.m.
July 25 th , 2018	2:00 p.m.	6:00 p.m.
August 6 th , 2018	2:00 p.m.	6:00 p.m.
August 7 th , 2018	2:00 p.m.	6:00 p.m.
August 9 th , 2018	2:00 p.m.	6:00 p.m.



TABLE 3-2: LIST OF AC SAVER DA EVENT DAYS AND EVENT HOURS

Event Day	Event Start	Event End
June 11 th , 2018	6:00 p.m.	8:00 p.m.
June 12 th , 2018	5:00 p.m.	8:00 p.m.
July 6 th , 2018	4:00 p.m.	8:00 p.m.
July 12 th , 2018	6:00 p.m.	8:00 p.m.
July 16 th , 2018	6:00 p.m.	8:00 p.m.
July 17 th , 2018	5:00 p.m.	9:00 p.m.
July 19 th , 2018	6:00 p.m.	8:00 p.m.
July 20 th , 2018	6:00 p.m.	8:00 p.m.
July 25 th , 2018	6:00 p.m.	8:00 p.m.
July 30 th , 2018	6:00 p.m.	8:00 p.m.
July 31 st , 2018	6:00 p.m.	8:00 p.m.
August 6 th , 2018	6:00 p.m.	8:00 p.m.
August 7 th , 2018	6:00 p.m.	8:00 p.m.
August 9 th , 2018	6:00 p.m.	8:00 p.m.
September 18 th , 2018	6:00 p.m.	8:00 p.m.
September 20 th , 2018	6:00 p.m.	8:00 p.m.
September 26 th , 2018	6:00 p.m.	8:00 p.m.
September 27 th , 2018	5:00 p.m.	7:00 p.m.

This section presents the *ex post* load impact estimates for each of the analysis program participant sub-groups. These are:

- All PTR customers,
- Technology Deployment (TD thermostats) on PTR customers,
- PTR customers without Technology Deployment,
- PTR customers without Load Control (TD or AC Saver Day Of),
- PTR customers Dually Enrolled in AC Saver Day Of),
- AC Saver DA customers,
- AC Saver DA customers, by Thermostat Source, and
- AC Saver DA customers, by Climate Zone.



Table 3-3 through Table 3-7 present a high-level summary of these PTR, TD on PTR and AC Saver DA impact estimates. The individual event day and hour reductions for each event can be found in Appendix A.

TABLE 3-3: PTR EX POST LOAD IMPACT ESTIMATES – BY 2018 EVENT DATE (2 P.M. TO 6 P.M.)

Event Dates	Active Participants	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Aggregate Load Reduction (MW)	Mean °F
July 6 th , 2018	80,539	1.55	1.40	0.15	10.4%	12.31	98.9
July 24 th , 2018	80,511	1.35	1.25	0.11	8.5%	8.49	90.5
July 25 th , 2018	80,758	1.19	1.11	0.09	8.0%	7.04	87.4
August 6 th , 2018	80,764	1.24	1.13	0.11	9.9%	8.89	91.3
August 7 th , 2018	80,965	1.35	1.23	0.12	9.7%	9.65	92.9
August 9 th , 2018	81,253	1.54	1.44	0.10	6.7%	8.16	89.6
Average 2018 Event	80,798	1.37	1.26	0.11	8.8%	9.09	91.8

TABLE 3-4: PTR EX POST LOAD IMPACT ESTIMATES BY CUSTOMER CATEGORY – AVERAGE 2018 EVENT (2 P.M. TO 6 P.M.)

Customer Category	Active Participants	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Aggregate Load Reduction (MW)	Mean °F
All	80,798	1.37	1.26	0.11	8.8%	9.09	91.8
Large	38,430	1.70	1.56	0.14	9.4%	5.51	92.4
Medium	26,300	1.27	1.17	0.10	8.3%	2.68	91.7
Small	16,069	0.73	0.68	0.05	7.4%	0.85	90.4
Coastal	40,653	1.05	0.98	0.07	6.9%	2.69	86.0
Inland	40,145	1.69	1.54	0.16	9.8%	6.23	97.6
No TD	71,985	1.34	1.29	0.05	4.2%	3.80	91.7
No Load Control (TD or SS)	70,175	1.30	1.27	0.03	2.6%	2.20	91.6



TABLE 3-4 (CONT'D): PTR EX POST LOAD IMPACT ESTIMATES BY CUSTOMER CATEGORY – AVERAGE 2018 EVENT (2 P.M. TO 6 P.M.)

Customer Category	Active Participants	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Aggregate Load Reduction (MW)	Mean °F
Enroll. Year – 2014 or earlier *	35,212	1.34	1.32	0.02	1.4%	0.62	91.5
Enroll. Year – 2015*	7,616	1.36	1.36	0.00	0.0%	0.00	91.6
Enroll. Year – 2016*	8,009	1.33	1.30	0.03	2.4%	0.24	91.6
Enroll. Year – 2017*	13,079	1.14	1.09	0.05	5.6%	0.66	91.8
Enroll. Year – 2018*	6,260	1.32	1.21	0.11	8.4%	0.69	91.1
Notification – Email Only*	44,670	1.25	1.25	0.00	0.3%	0.09	91.5
Notification – Text Only*	12,689	1.39	1.33	0.07	4.8%	0.83	91.6
Notification – Both*	11,370	1.39	1.28	0.11	8.1%	1.25	92.0
Net Energy Metered*	17,806	0.73	0.72	0.01	1.8%	0.18	92.7

* Participants excluding load control (no TD or AC Saver Day Of).

TABLE 3-5: TD ON PTR EX POST LOAD IMPACT ESTIMATES – BY 2018 EVENT DATE (2 P.M. TO 6 P.M.)

Event Dates	Active Participants	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Aggregate Load Reduction (MW)	Mean °F
July 6 th , 2018	8,684	1.84	1.11	0.74	42.9%	6.38	100.0
July 24 th , 2018	8,667	1.62	1.06	0.56	38.8%	4.88	91.7
July 24 th , 2018	8,685	1.31	0.82	0.50	44.2%	4.33	88.7
August 6 th , 2018	8,649	1.46	0.88	0.58	46.2%	4.98	92.4
August 7 th , 2018	8,644	1.59	0.98	0.61	43.9%	5.24	93.8
August 9 th , 2018	8,654	1.81	1.28	0.53	30.5%	4.55	89.9
Average 2018 Event	8,664	1.61	1.02	0.58	40.3%	5.06	92.7



In 2018 AC Saver DA events occurred during varying hours. As a result, average 2018 AC Saver DA impacts are presented as an average of the reduction during the event hours of each of the individual events, weighted by the number of active participants during each event.

TABLE 3-6: AC SAVER DA EX POST LOAD IMPACT ESTIMATES BY 2018 EVENT DATE

Event Dates	Active Participants	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Aggregate Load Reduction (MW)	Mean °F
June 11, 2018	9,093	1.06	0.91	0.15	14.2%	1.38	75.7
June 12, 2018*	9,109	1.03	0.87	0.16	15.7%	1.47	75.7
July 6, 2018†	9,401	2.24	1.99	0.25	11.3%	2.36	94.8
July 12, 2018‡	9,500	1.45	1.32	0.13	9.2%	1.28	80.0
July 16, 2018	9,573	1.27	1.12	0.15	11.9%	1.45	75.7
July 17, 2018†	9,588	1.21	1.06	0.15	12.2%	1.42	73.7
July 19, 2018	9,612	1.26	1.10	0.16	12.4%	1.51	76.9
July 20, 2018	9,629	1.35	1.19	0.16	11.8%	1.53	77.2
July 25, 2018	9,734	1.65	1.47	0.18	10.9%	1.76	81.2
July 30, 2018	9,832	1.75	1.56	0.19	10.7%	1.84	82.6
July 31, 2018	9,852	1.63	1.45	0.18	10.9%	1.76	80.8
August 6, 2018	9,959	1.92	1.71	0.21	10.7%	2.05	86.0
August 7, 2018	9,973	1.95	1.74	0.21	10.8%	2.11	86.9
August 9, 2018	10,022	1.88	1.68	0.20	10.8%	2.04	85.8
September 18, 2018	10,174	1.06	0.92	0.14	13.0%	1.40	72.9
September 20, 2018	11,707	0.98	0.86	0.12	12.2%	1.40	69.6
September 26, 2018	11,682	0.99	0.87	0.12	12.6%	1.45	70.5
September 27, 2018	11,679	1.04	0.86	0.18	17.4%	2.12	77.1
2018 Average**	10,007	1.45	1.28	0.17	12.1%	1.70	79.5

* Three-hour event starting at 5:00pm and ending at 8:00pm

† Four-hour event: the July 6th event started at 4:00pm and ended at 8:00pm, the July 17th event started at 5:00pm and ended at 9:00pm

‡ One BYOT thermostat vendor signaled participants two hours before the reported event start, effectively making the July 12th event a four-hour event for a portion of the population

**2018 Averages represent the average of all event hours



TABLE 3-7: AC SAVER DA EX POST LOAD IMPACT ESTIMATES BY CUSTOMER CATEGORY – 2018 EVENT AVERAGE

Customer Category	Active Participants	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Aggregate Load Reduction (MW)	Mean °F
All	10,007	1.45	1.28	0.17	12.1%	1.70	79.5
Free	4,217	1.52	1.44	0.08	6.4%	0.35	80.3
BYOT	5,536	1.38	1.14	0.24	17.1%	1.35	78.8
Inland	5,048	1.61	1.43	0.18	11.9%	0.92	83.5
Coastal	4,959	1.28	1.12	0.16	12.0%	0.78	75.4

3.1.1 Peak Time Rebate (PTR) Total

Figure 3-1 and Table 3-8 show the hourly event load impacts for the overall PTR customer population compared with the reference loads. In the 2018 events, there was a definitive load reduction during event hours (2 p.m. to 6 p.m.), averaging 0.11 kW per participant, representing an average reduction of 8.8% relative to the reference load. The average hourly load reductions ranged between 0.09 kW and 0.13 kW during event hours. In the hours following events, there are noticeable snapback effects, with an average hourly increase in load of 0.04 kW per customer from 6 p.m. to midnight. The average hourly aggregate load reduction from the 80,798 participants during event hours was 9.09 MW. The average temperature across all the events and the associated event hours was 91.8°F.



FIGURE 3-1: HOURLY LOAD PROFILE FOR ALL PTR CUSTOMERS – 2018 EVENT AVERAGE

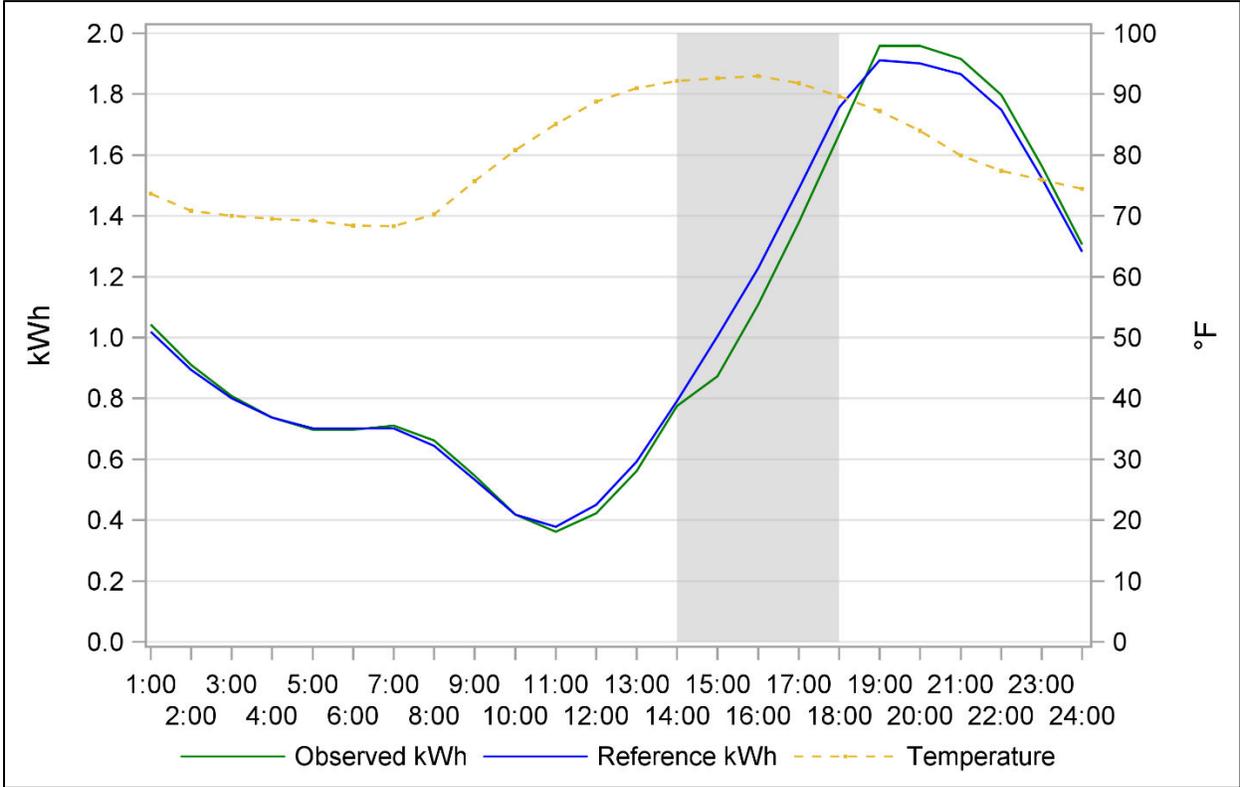




TABLE 3-8: SUMMARY OF EVENT IMPACTS FOR ALL PTR CUSTOMERS – 2018 AVERAGE

Hour Beg.	Hour End.	Event Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Aggregate Load Reduction (kW)
8:00	9:00	No	75.7	0.53	0.55	-0.012	-2.2%	80,798	-970
9:00	10:00	No	80.8	0.42	0.42	-0.000	-0.0%	80,798	-12
10:00	11:00	No	85.1	0.38	0.36	0.015	4.0%	80,798	1,210
11:00	12:00	No	88.8	0.45	0.42	0.029	6.4%	80,798	2,339
12:00	13:00	No	91.0	0.59	0.56	0.030	5.1%	80,798	2,454
13:00	14:00	No	92.2	0.79	0.78	0.017	2.1%	80,798	1,353
14:00	15:00	Yes	92.6	1.00	0.87	0.130	13.0%	80,798	10,543
15:00	16:00	Yes	93.0	1.23	1.11	0.121	9.8%	80,798	9,741
16:00	17:00	Yes	91.8	1.49	1.38	0.110	7.4%	80,798	8,913
17:00	18:00	Yes	89.6	1.76	1.67	0.089	5.0%	80,798	7,161
18:00	19:00	No	87.2	1.91	1.96	-0.048	-2.5%	80,798	-3,876
19:00	20:00	No	84.0	1.90	1.96	-0.058	-3.0%	80,798	-4,683
20:00	21:00	No	79.9	1.87	1.92	-0.051	-2.7%	80,798	-4,140

3.1.2 PTR without Technology Deployment

Figure 3-2 and Table 3-9 show the hourly event load impacts for PTR customers that are not equipped with a thermostat (TD) load control. These PTR participants do not have enabling DR technology. Therefore, the load reduction in the PTR without TD population is smaller. The average event hour load reduction for this group is lower than the overall group at 0.05 kW. Moreover, the PTR without TD group had a lower average aggregate event hour reduction with 3.80 MW (4.2%) than the overall PTR group, with 9.09 MW (8.8%).



FIGURE 3-2: HOURLY LOAD PROFILE FOR PTR CUSTOMERS WITHOUT TD – 2018 EVENT AVERAGE

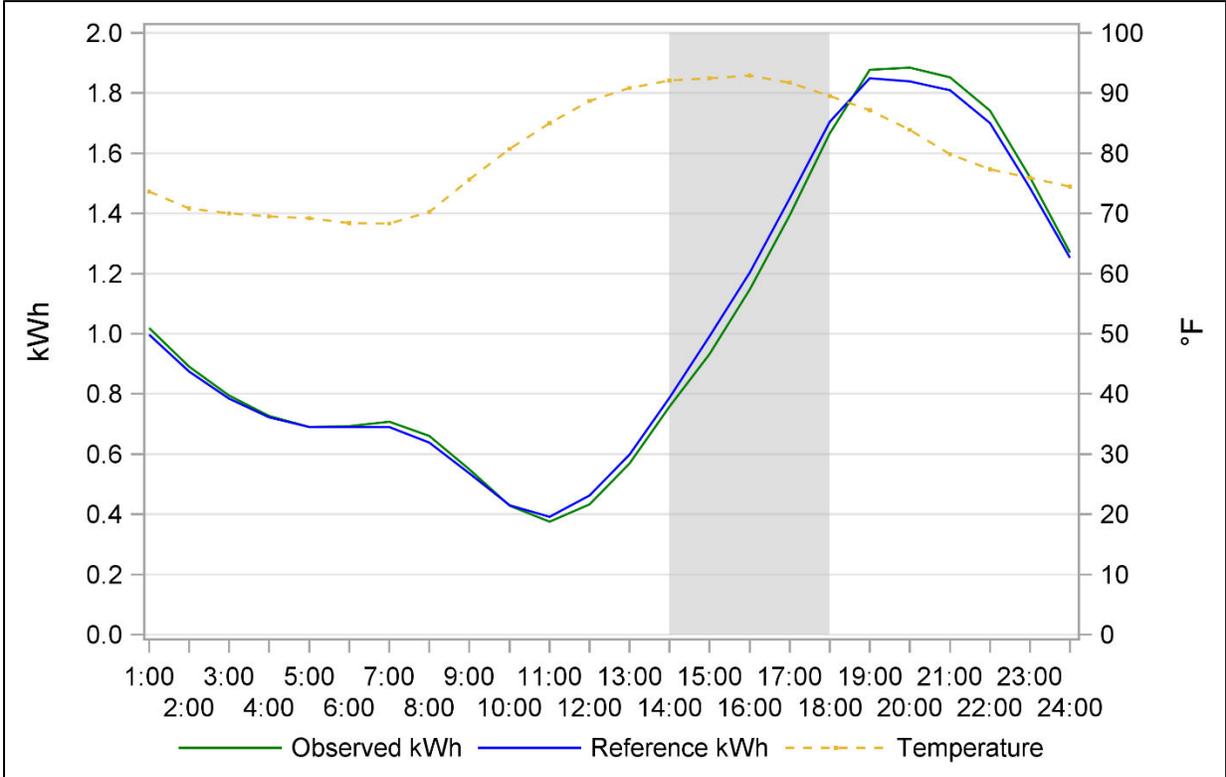




TABLE 3-9: SUMMARY OF EVENT IMPACTS FOR PTR CUSTOMERS WITHOUT TD – 2018 AVERAGE

Hour Beg.	Hour End.	Event Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Aggregate Load Reduction (kW)
8:00	9:00	No	75.6	0.54	0.55	-0.014	-2.6%	71,985	-991
9:00	10:00	No	80.7	0.43	0.43	0.002	0.4%	71,985	124
10:00	11:00	No	85.0	0.39	0.38	0.017	4.2%	71,985	1,195
11:00	12:00	No	88.7	0.46	0.43	0.029	6.4%	71,985	2,116
12:00	13:00	No	90.9	0.60	0.57	0.030	5.0%	71,985	2,156
13:00	14:00	No	92.1	0.79	0.76	0.030	3.8%	71,985	2,144
14:00	15:00	Yes	92.5	0.99	0.93	0.059	6.0%	71,985	4,251
15:00	16:00	Yes	92.9	1.20	1.15	0.057	4.7%	71,985	4,083
16:00	17:00	Yes	91.7	1.45	1.39	0.056	3.9%	71,985	4,030
17:00	18:00	Yes	89.5	1.71	1.67	0.039	2.3%	71,985	2,837
18:00	19:00	No	87.1	1.85	1.88	-0.028	-1.5%	71,985	-2,038
19:00	20:00	No	83.9	1.84	1.88	-0.046	-2.5%	71,985	-3,334
20:00	21:00	No	79.9	1.81	1.85	-0.043	-2.4%	71,985	-3,071

3.1.3 PTR without Any Load Control (TD or AC Saver Day Of)

Another participant subgrouping saw the additional exclusion of AC Saver Day Of participants from the overall PTR group. This leaves a PTR participant group without the effects of any load control devices during events. Figure 3-3 and Table 3-10 show the hourly event load impacts for this group. The average event hour load reduction for this group was 0.03 kW, which achieved roughly a quarter the 0.11 kW average load reduction for the overall PTR group, and slightly lower as the PTR group without TD. The average aggregate load reduction during event hours was 2.20 MW (2.6%), which was also lower than the overall group. This suggests that the load control programs did have an effect on increasing the overall program impact, which will be explored in the subsequent sections.



FIGURE 3-3: HOURLY LOAD PROFILE FOR PTR CUSTOMERS WITHOUT ANY LOAD CONTROL – 2018 EVENT AVERAGE

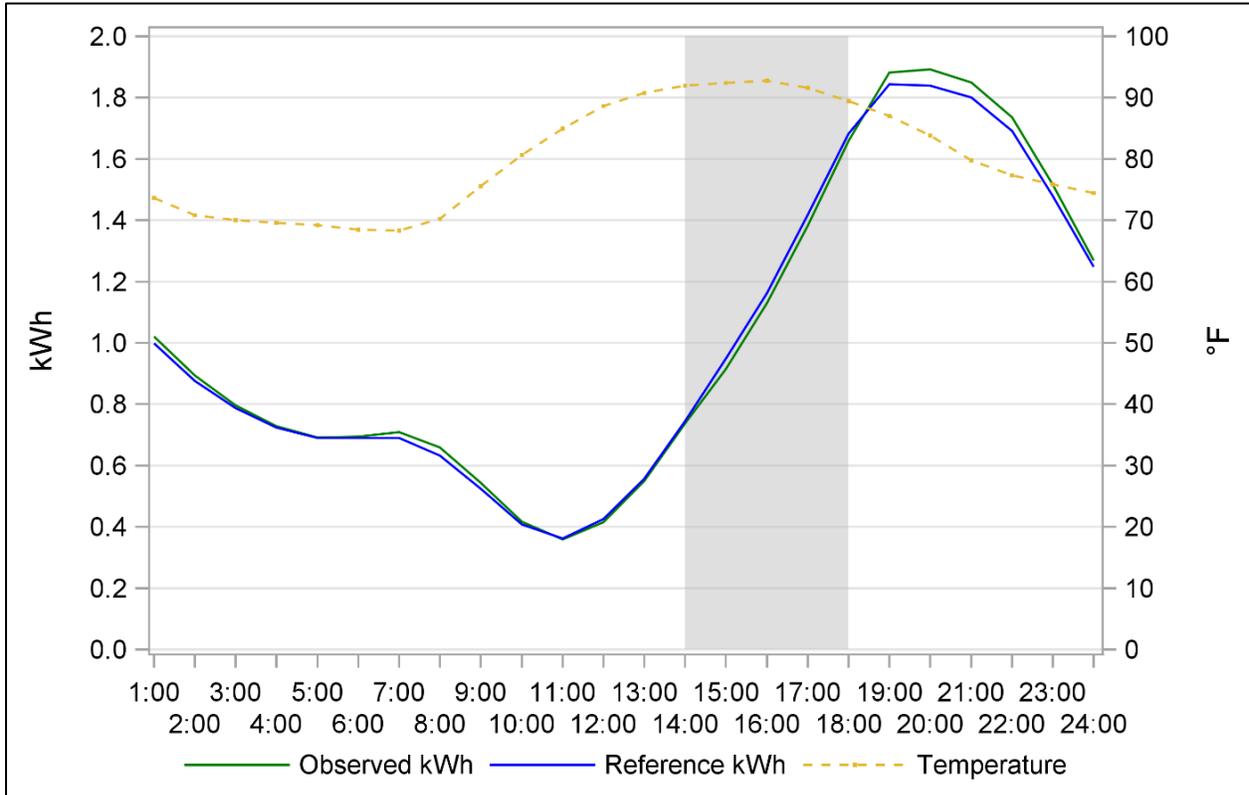




TABLE 3-10: SUMMARY OF EVENT IMPACTS FOR PTR CUSTOMERS WITHOUT ANY LOAD CONTROL – 2018 AVERAGE

Hour Beg.	Hour End.	Event Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Aggregate Load Reduction (kW)
8:00	9:00	No	75.6	0.52	0.54	-0.021	-3.9%	70,175	-1,446
9:00	10:00	No	80.7	0.41	0.42	-0.009	-2.3%	70,175	-651
10:00	11:00	No	84.9	0.36	0.36	0.002	0.6%	70,175	142
11:00	12:00	No	88.6	0.43	0.41	0.011	2.5%	70,175	760
12:00	13:00	No	90.8	0.56	0.55	0.009	1.6%	70,175	607
13:00	14:00	No	92.0	0.75	0.74	0.009	1.1%	70,175	598
14:00	15:00	Yes	92.4	0.95	0.91	0.035	3.7%	70,175	2,430
15:00	16:00	Yes	92.8	1.16	1.13	0.033	2.8%	70,175	2,310
16:00	17:00	Yes	91.6	1.42	1.38	0.035	2.5%	70,175	2,439
17:00	18:00	Yes	89.4	1.68	1.66	0.023	1.4%	70,175	1,620
18:00	19:00	No	87.0	1.84	1.88	-0.039	-2.1%	70,175	-2,726
19:00	20:00	No	83.8	1.84	1.89	-0.053	-2.9%	70,175	-3,713
20:00	21:00	No	79.8	1.80	1.85	-0.048	-2.7%	70,175	-3,366
Total kWh- Entire Day			79.9	24.23	24.44	-0.218	-0.9%	70,175	-15,270
Total kWh - Event Hours			91.6	5.21	5.09	0.125	2.4%	70,175	8,800

3.1.4 PTR Dually Enrolled in AC Saver Day Of

As referenced above, there are subsets of customers that are enrolled in several energy-saving programs through SDG&E. This section examines the group of participants that are dually enrolled in the PTR and AC Saver Day Of programs. These participants, in addition to receiving notifications on RYU event days, have a device installed on their central AC units that are activated on AC Saver DO event days, cycling their AC on and off for several hours. In 2018, all PTR events were also AC Saver DO events. The AC Saver DO events on PTR event days ran from 6 p.m. to 8 p.m., with the exception of the July 6th event, which ran from 5 p.m. to 8 p.m. Because this analysis focuses on the impact of the PTR program, the impacts described are incremental savings over and above those realized from the AC Saver DO program. As a reminder, the control group for these dually enrolled participants are AC Saver DO participants that are not dually enrolled in PTR. The AC Saver DO-only impacts are evaluated under a different project. Figure 3-4 and Table 3-11 show the hourly PTR event load impacts for these dually



enrolled customers. Their average event hour load reduction (during PTR event hours) was 0.33 kW, which is higher than the overall PTR group. In general, AC Saver DO participants have much higher peak consumption, and thus have a higher potential to save. Being dually-enrolled in PTR suggests that they are also well in-tune with demand response programs and may be more likely to lower their peak consumption. These larger savings resulted in an average aggregate load reduction during event hours of 0.33 MW, representing a 9.1% reduction compared to the reference load.

FIGURE 3-4: HOURLY LOAD PROFILE FOR PTR CUSTOMERS DUALY ENROLLED IN AC SAVER DAY OF – 2018 EVENT AVERAGE

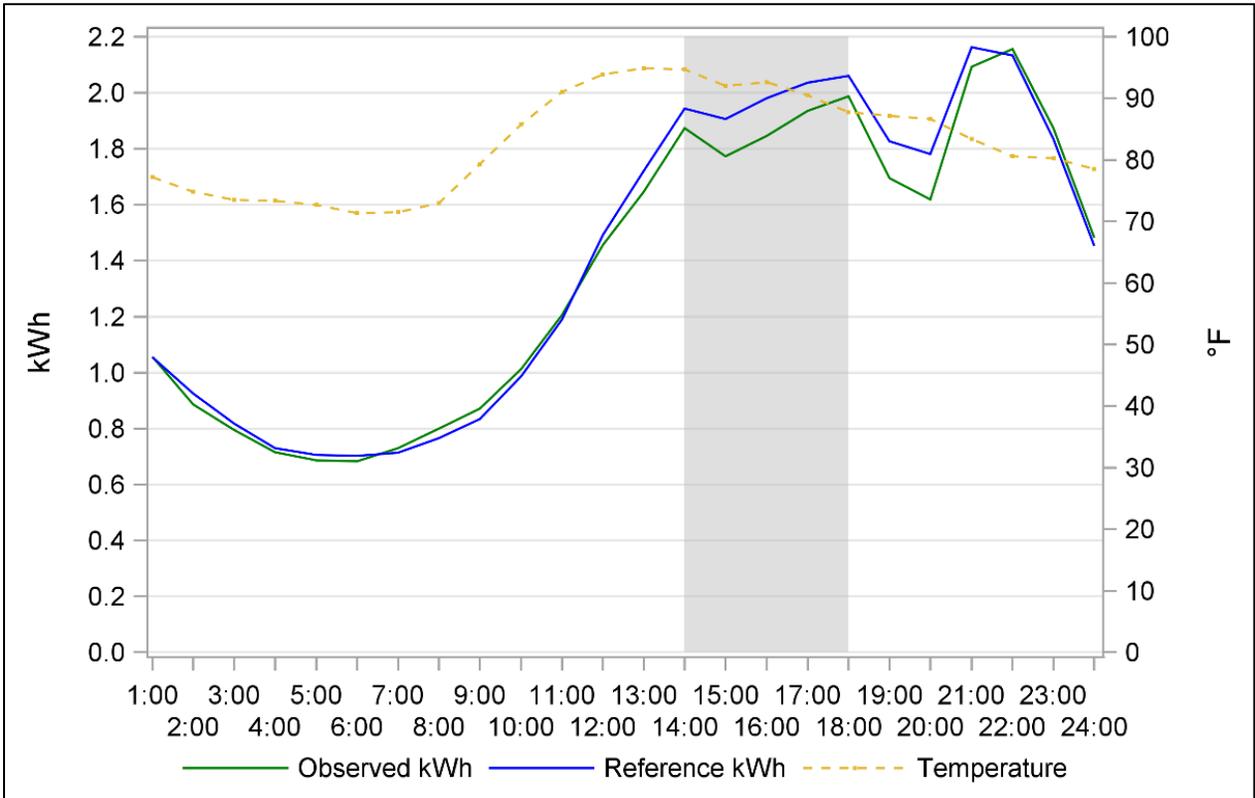




TABLE 3-11: SUMMARY OF PTR EVENT IMPACTS FOR CUSTOMERS DUALY ENROLLED IN AC SAVER DAY OF – 2018 AVERAGE

Hour Beg.	Hour End.	Event Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Aggregate Load Reduction (kW)
8:00	9:00	No	77.1	0.77	0.79	-0.021	-2.8%	1,810	-38
9:00	10:00	No	83.2	0.88	0.90	-0.020	-2.2%	1,810	-36
10:00	11:00	No	87.8	1.05	1.05	-0.003	-0.3%	1,810	-5
11:00	12:00	No	91.8	1.27	1.24	0.037	2.9%	1,810	67
12:00	13:00	No	94.4	1.51	1.43	0.075	5.0%	1,810	136
13:00	14:00	No	95.8	1.71	1.64	0.067	3.9%	1,810	122
14:00	15:00	Yes	95.9	1.89	1.71	0.182	9.6%	1,810	330
15:00	16:00	Yes	96.4	2.04	1.86	0.181	8.9%	1,810	328
16:00	17:00	Yes	95.5	2.07	1.89	0.175	8.5%	1,810	318
17:00	18:00	Yes	93.2	2.11	1.91	0.195	9.3%	1,810	353
18:00	19:00	No	90.7	1.84	1.66	0.183	9.9%	1,810	331
19:00	20:00	No	87.0	1.71	1.55	0.165	9.6%	1,810	298
20:00	21:00	No	81.9	2.01	1.93	0.077	3.8%	1,810	139

3.1.5 TD on PTR

SDG&E PTR customers are also eligible to participate in load control during PTR events if the customer’s thermostat is enabled with demand response enabling technology. In 2018, all TD on PTR participants were subjected to a four-degree thermostat setback on PTR event days and hours. Figure 3-5 and Table 3-12 show the hourly event load impacts for entire group of TD on PTR participants. The participant load shows a sharp drop as the demand response the four-degree setback starts, and subsequently rising through the duration of the event and in the hour following. The average event hour load reduction (during PTR event hours) was 0.58 kW, which is more than 5 times higher than the overall PTR group. The average aggregate load reduction was 5.06 MW during PTR event hours, representing 40.3% of the reference load.



FIGURE 3-5: HOURLY LOAD PROFILE FOR TD ON PTR CUSTOMERS – 2018 EVENT AVERAGE

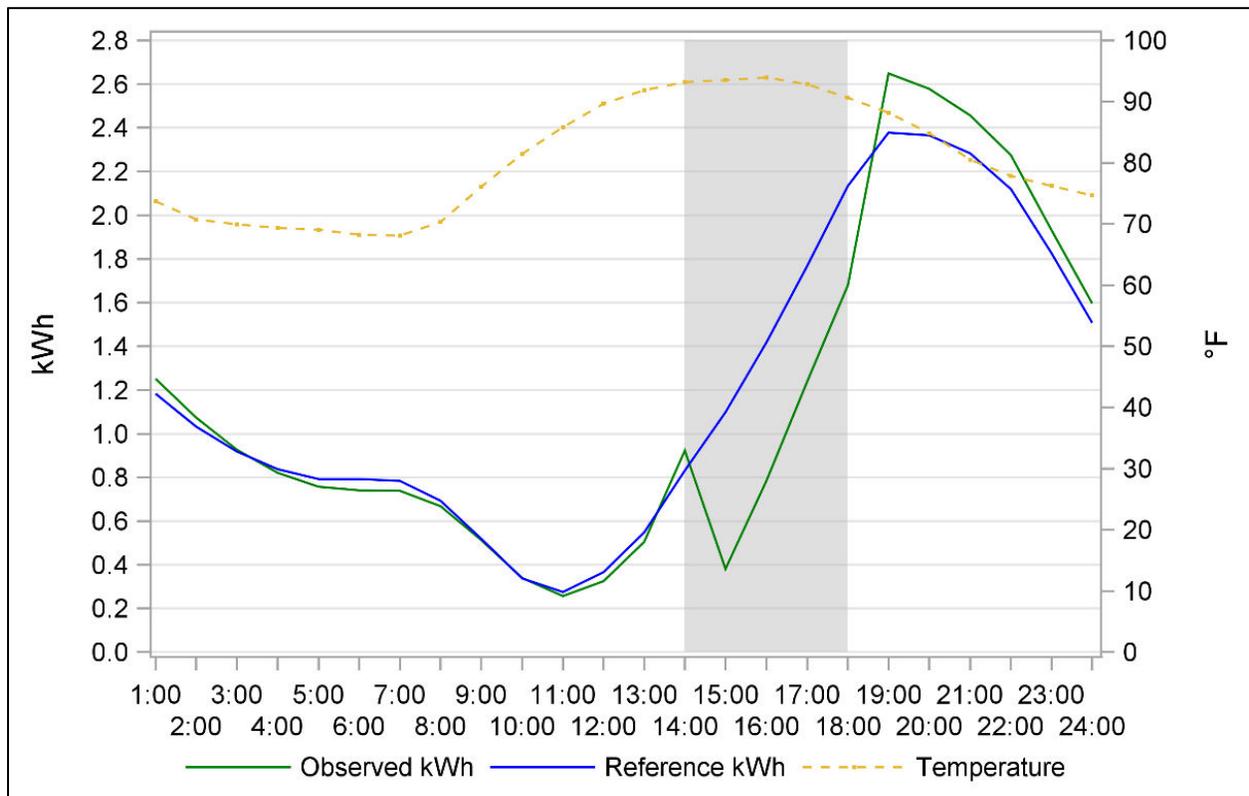


TABLE 3-12: SUMMARY OF TD ON PTR EVENT IMPACTS FOR TD ON PTR CUSTOMERS— 2018 AVERAGE

Hour Beg.	Hour End.	Event Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Aggregate Load Reduction (kW)
8:00	9:00	No	76.1	0.52	0.51	0.006	1.2%	8,664	52
9:00	10:00	No	81.5	0.34	0.34	-0.003	-1.0%	8,664	-29
10:00	11:00	No	85.8	0.28	0.26	0.018	6.6%	8,664	157
11:00	12:00	No	89.6	0.37	0.33	0.040	11.1%	8,664	351
12:00	13:00	No	91.9	0.55	0.50	0.045	8.1%	8,664	387
13:00	14:00	No	93.2	0.83	0.92	-0.091	-10.9%	8,664	-786



TABLE 3-12 (CONT'D): SUMMARY OF TD ON PTR EVENT IMPACTS FOR TD ON PTR CUSTOMERS— 2018 AVERAGE

Hour Beg.	Hour End.	Event Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Aggregate Load Reduction (kW)
14:00	15:00	Yes	93.5	1.10	0.38	0.718	65.4%	8,664	6,224
15:00	16:00	Yes	94.0	1.42	0.79	0.633	44.6%	8,664	5,483
16:00	17:00	Yes	92.9	1.77	1.24	0.531	30.0%	8,664	4,601
17:00	18:00	Yes	90.6	2.13	1.68	0.454	21.3%	8,664	3,935
18:00	19:00	No	88.2	2.38	2.65	-0.270	-11.4%	8,664	-2,340
19:00	20:00	No	84.8	2.37	2.58	-0.213	-9.0%	8,664	-1,845
20:00	21:00	No	80.5	2.28	2.46	-0.172	-7.5%	8,664	-1,492

3.1.6 PTR without Load Control by Notification Type

There are three methods of notification for PTR events – email, text message, and phone call. Only about 7% of the final participant group had opted for phone notification (only 2% opted for phone-only notification), so this sub-group analysis focused on the email and text message notifications. About 65% of the analysis group opted for email-only notification, about 18% opted for text-only notification, and about 17% opted for both email and text notifications. Figure 3-6 through Figure 3-8 show the hourly event load impacts for each of these groups, respectively. The email-only notification group had an average event hour load reduction of 0.002 kW (0.3%), which is much lower than the general PTR Without Load Control population average. The text message-only group had an average event hour load reduction of 0.07 kW (4.8%), which was approximately in line with the general average. The group with both types of notifications had the greatest average event hour reduction of 0.11 kW (8.1%), which was well above the overall population average.



FIGURE 3-6: HOURLY LOAD PROFILE FOR PTR CUSTOMERS WITHOUT ANY LOAD CONTROL – EMAIL-ONLY NOTIFICATION – 2018 EVENT AVERAGE

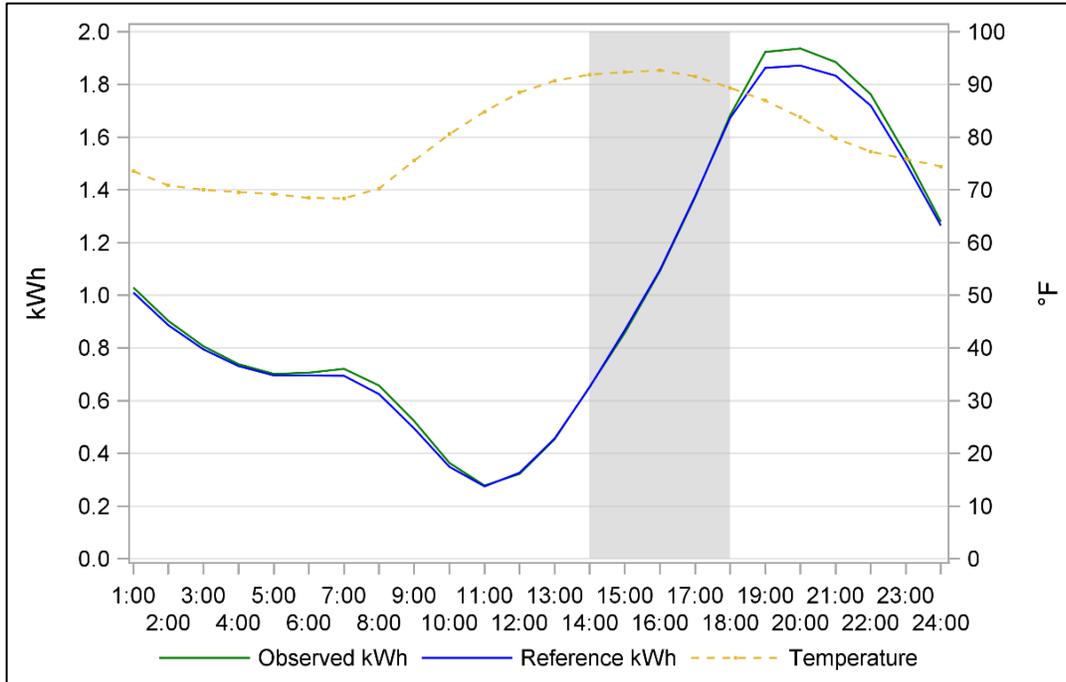


FIGURE 3-7: HOURLY LOAD PROFILE FOR PTR CUSTOMERS WITHOUT ANY LOAD CONTROL – TEXT-ONLY NOTIFICATION – 2018 EVENT AVERAGE

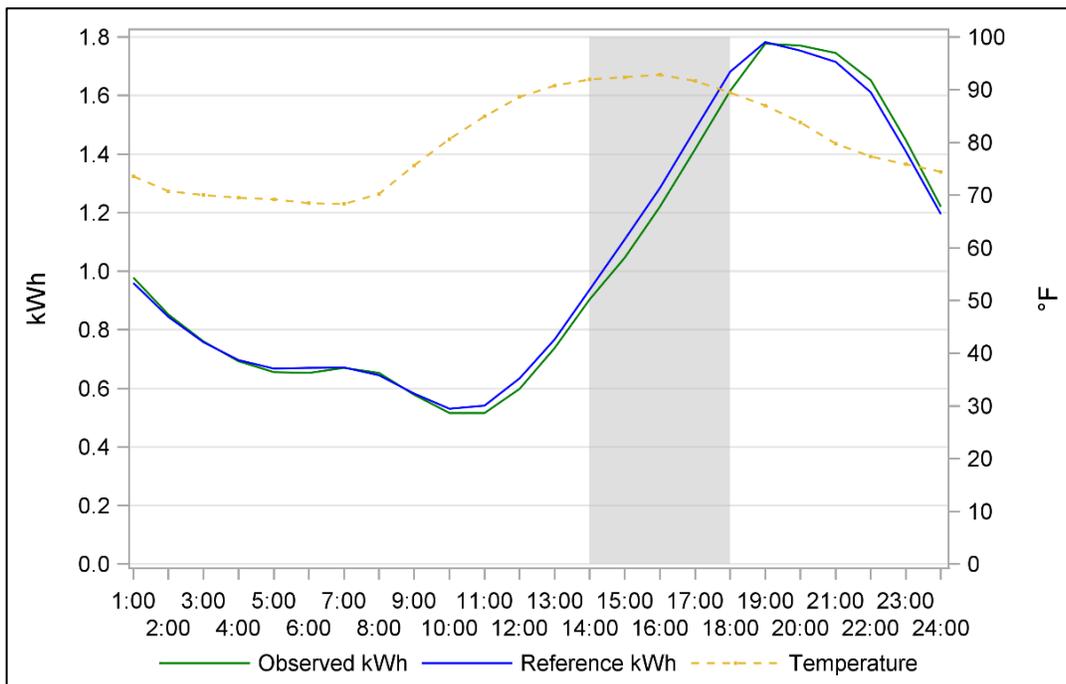
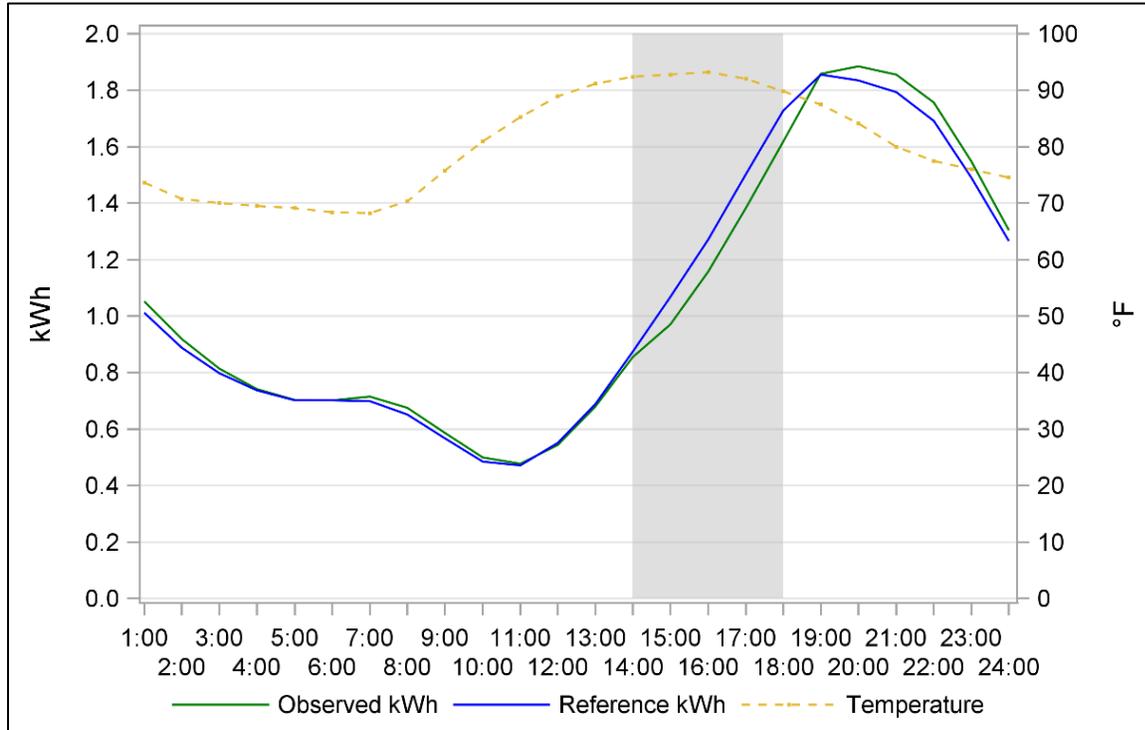




FIGURE 3-8: HOURLY LOAD PROFILE FOR PTR CUSTOMERS WITHOUT ANY LOAD CONTROL – BOTH EMAIL AND TEXT NOTIFICATIONS – 2018 EVENT AVERAGE



3.1.7 AC Saver Day Ahead

During the 2018 event season, there were eighteen events called with event hours ranging from 4 p.m. to 9 p.m. As stated earlier, the event start and end times varied by event. Therefore, average 2018 event impacts are presented in two ways. The first method for presentation of impacts are averages by time (as done with PTR and the SCTD program in previous years). Results tables of average impacts by time present loads and impacts for each individual hour during event days (for example average load at 5:00 p.m.). The second method is to show impacts by relative event hours. The relative hours presents 2018 average load impacts by event hour relative to when the event started. For example, relative “Hour 1” represents the first hour of the event. Generally, the relative hour impacts present a more accurate view of how the 2018 AC Saver DA participants behaved on average and show larger impacts than the “by time” averages.

Figure 3-9 and Figure 3-10 show the average hourly event load impacts for AC Saver Day Ahead customers by time. During the 2018 event season there were eighteen events called with event hours ranging from 4 p.m. to 9 p.m. As seen in Figure 3-9 below, the grayed bands represent all event hour times called during 2018 with the dark grey band representing hours that were a part of 17 or more of



events. The average load reduction from 6 p.m. to 8 p.m. on event days (the dark gray band) was 0.16 kW (11.2%). The weighted average aggregate impact across all event days is impact of 1.68 MW.

While event days were generally called on the hottest week days during the event season, it is important to note that the temperature, on average, decreased during the event hours. This contributes to a decreasing average reference load in the majority of event hours. Moving event start times back one hour on average may allow the AC Saver DA program to achieve greater savings on aggregate during the event season.

FIGURE 3-9: HOURLY LOAD PROFILE FOR AC SAVER DA – 2018 EVENT AVERAGE

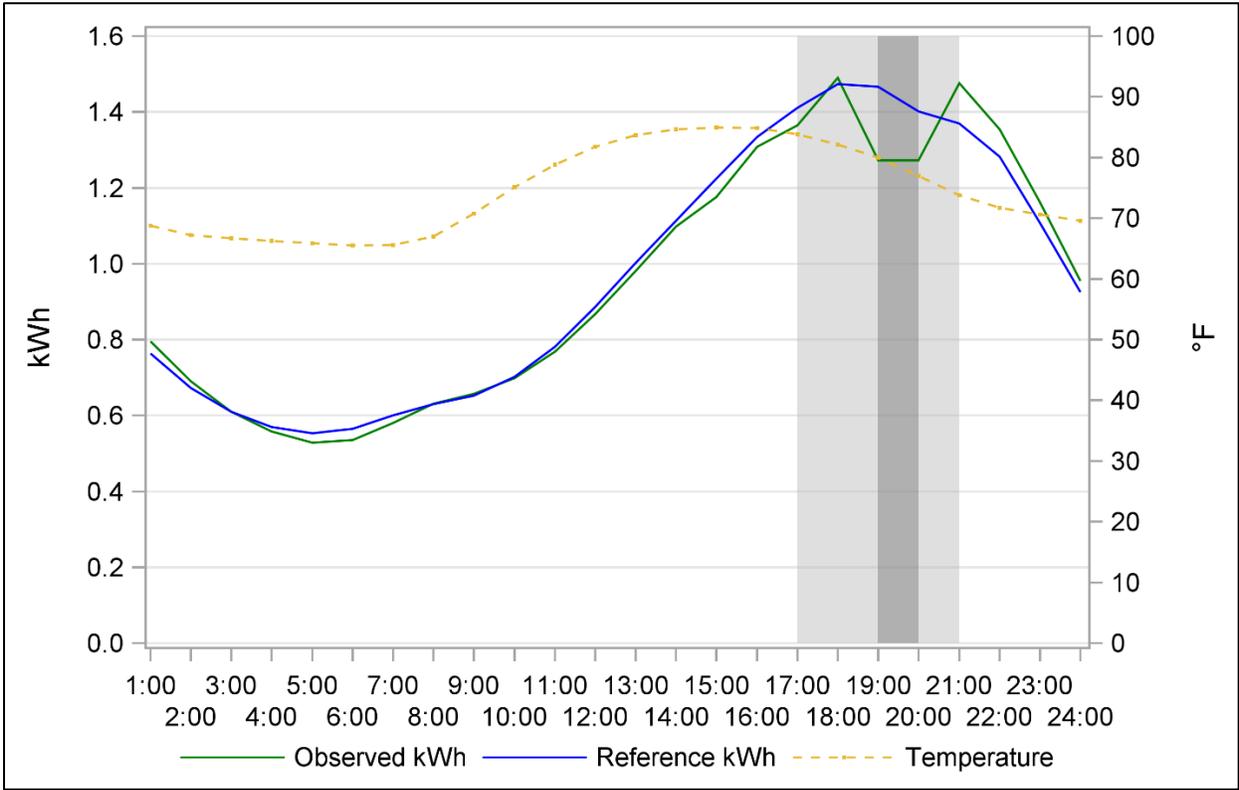




TABLE 3-13: SUMMARY OF EVENT IMPACTS FOR AC SAVER DAY AHEAD CUSTOMERS – 2018 AVERAGE

Hour Beg.	Hour End.	Event Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Aggregate Load Reduction (kW)
10:00	11:00	No	78.8	0.78	0.77	0.013	1.7%	10,007	131
11:00	12:00	No	81.7	0.89	0.87	0.019	2.1%	10,007	190
12:00	13:00	No	83.7	1.00	0.98	0.022	2.2%	10,007	220
13:00	14:00	No	84.7	1.11	1.10	0.016	1.4%	10,007	156
14:00	15:00	No	85.0	1.22	1.18	0.048	4.0%	10,007	484
15:00	16:00	No	84.9	1.33	1.31	0.026	1.9%	10,007	258
16:00	17:00	Yes*	83.8	1.41	1.37	0.045	3.2%	10,007	451
17:00	18:00	Yes*	82.1	1.47	1.49	-0.017	-1.1%	10,007	-165
18:00	19:00	Yes	80.0	1.47	1.27	0.194	13.3%	10,007	1,945
19:00	20:00	Yes*	76.9	1.40	1.27	0.129	9.2%	10,007	1,288
20:00	21:00	Yes*	73.8	1.37	1.48	-0.107	-7.8%	10,007	-1,072
21:00	22:00	No	71.7	1.28	1.35	-0.072	-5.6%	10,007	-723
22:00	23:00	No	70.6	1.11	1.16	-0.054	-4.9%	10,007	-538
Total kWh- Entire Day			74.4	23.10	22.83	0.265	1.1%	10,007	2,656
Total kWh - Event Hours			77.8	3.43	3.12	0.310	9.0%	10,007	3,107

*Signifies an event hour that is not an event hour for all events. Hour 16:00, 17:00, 19:00, 20:00 are events hours for 11%, 28%, 94% and 6% of events respectively

Additionally, impacts for relative event hours are presented in Table 3-14 for two-hour events and Table 3-15 for events with more than two hours. For two-hour events¹, the average event hour load reduction was 0.17 kW (12.1%) with the first hour achieving 0.19 kW (13.9%) across the 15 events. Additionally, there are increases in load associated with AC Saver DA events participation in the hours before the event (as a result of pre-cooling) and the in the hours after the event as a result of snapback. Average load increases as a result of precooling in the hour before are 0.07 kW (5.3%) and snapback load increases in the first hour following events are 0.12 kW (7.7%).

¹ AC Saver DA events are all two-hour events, with the exception of events on June 12th (three-hour event), July 6th (four hour event), and July 17th (four hour event)



Events with two or more event hours² occurred on hotter days on average than two-hour event days, with average departures during event hours of 81.9 °F and 78.5 °F, respectively). Additionally, these longer events achieved larger average hourly load reductions. The average load reduction during event hours was 0.19 kW (12.8%) with the largest load reductions occurring in the first hour of the event (0.25 kW, 17.5%). As the events progressed, load reductions decrease in each preceding event hour on average. This is consistent with drops in the reference load as temperature decreases and participant attrition occurs in later event hours. These event days also saw similar load impacts as a result of pre-cooling to two-hour events but had slightly higher load impacts in the first post-event hour.

TABLE 3-14: SUMMARY OF EVENT HOUR IMPACTS FOR AC SAVER DA CUSTOMERS – 2018 AVERAGE OF TWO-HOUR EVENTS

Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Mean Aggregate Load Reduction (kW)	Number of Events*
Pre-Hour	81.9	1.47	1.54	-0.07	-5.3%	10,135	-737	15
Hour 1	79.9	1.44	1.25	0.19	13.9%	10,135	1,973	15
Hour 2	77.0	1.39	1.25	0.14	10.3%	10,135	1,424	15
Post Hour 1	73.8	1.37	1.49	-0.12	-7.7%	10,135	-1,178	15
Post Hour 2	71.8	1.28	1.35	-0.07	-4.7%	10,135	-701	15
Event Average	78.5	1.42	1.25	0.17	12.1%	10,135	1,699	15

* Events included in this analysis exclude June 12th, July 6th, and July 17th events and exclude the first two hours of some BYOT thermostats that started participating two hours before the event on July 12th.

TABLE 3-15: SUMMARY OF EVENT HOUR IMPACTS FOR AC SAVER DA CUSTOMERS – 2018 AVERAGE OF EVENTS LONGER THAN TWO HOURS

Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Mean Aggregate Load Reduction (kW)	Number of Events*
Pre-Hour	86.1	1.39	1.47	-0.08	-5.3%	9,366	-739	3
Hour 1	85.0	1.45	1.20	0.25	17.5%	9,366	2,375	3

² AC Saver DA events with two or more hours include June 12th, July 6th, and July 17th.



Hour 2	82.7	1.50	1.33	0.17	12.3%	9,366	1,573	3
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TABLE 3-15 (CONT'D): SUMMARY OF EVENT HOUR IMPACTS FOR AC SAVER DA CUSTOMERS – 2018 AVERAGE OF EVENTS LONGER THAN TWO HOURS

Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Mean Aggregate Load Reduction (kW)	Number of Events*
Hour 3	79.3	1.54	1.37	0.17	11.1%	9,366	1,604	3
Hour 4	80.2	1.71	1.56	0.15	9.0%	9,495	1,440	2
Post Hour 1	74.5	1.35	1.49	-0.14	-9.1%	9,366	-1,295	3
Post Hour 2	72.0	1.26	1.33	-0.07	-4.5%	9,366	-666	3
Event Average†	81.9	1.53	1.34	0.19	12.8%	9,389	1,776	3

* Events included in this analysis are June 12th, July 6th, and July 17th events

† Event averages are “number of events” weighted average

AC Saver Day Ahead, by Thermostat Source

AC Saver Day Ahead participants either receive a free thermostat through the program or can bring their own thermostat into the program (BYOT). Figure 3-10, Figure 3-11, and Table 3-16 through Table 3-19 show the hourly event load impacts for AC Saver DA participants by thermostat source. Free thermostat participants had smaller relative event hour impacts than the BYOT thermostat participants for both two-hour events and events with more than two hours. Free thermostats had 0.08 kW (6.4%) and 0.10 kW (7.2%) in event hour average reductions for two-hour and two or more hour events respectively, whereas the BYOT group achieved 0.24 kW (17.5% and 16.5%) in event hour average reductions for two-hour and two or more hour events respectively. Interestingly, participants with free thermostats showed larger observed loads on average than BYOT participants. This suggests that free thermostat participants have the potential for larger savings but did not achieve the full potential of savings in 2018.



FIGURE 3-10: HOURLY LOAD PROFILE FOR AC SAVER DA CUSTOMERS – FREE THERMOSTAT SOURCE – 2018 EVENT AVERAGE

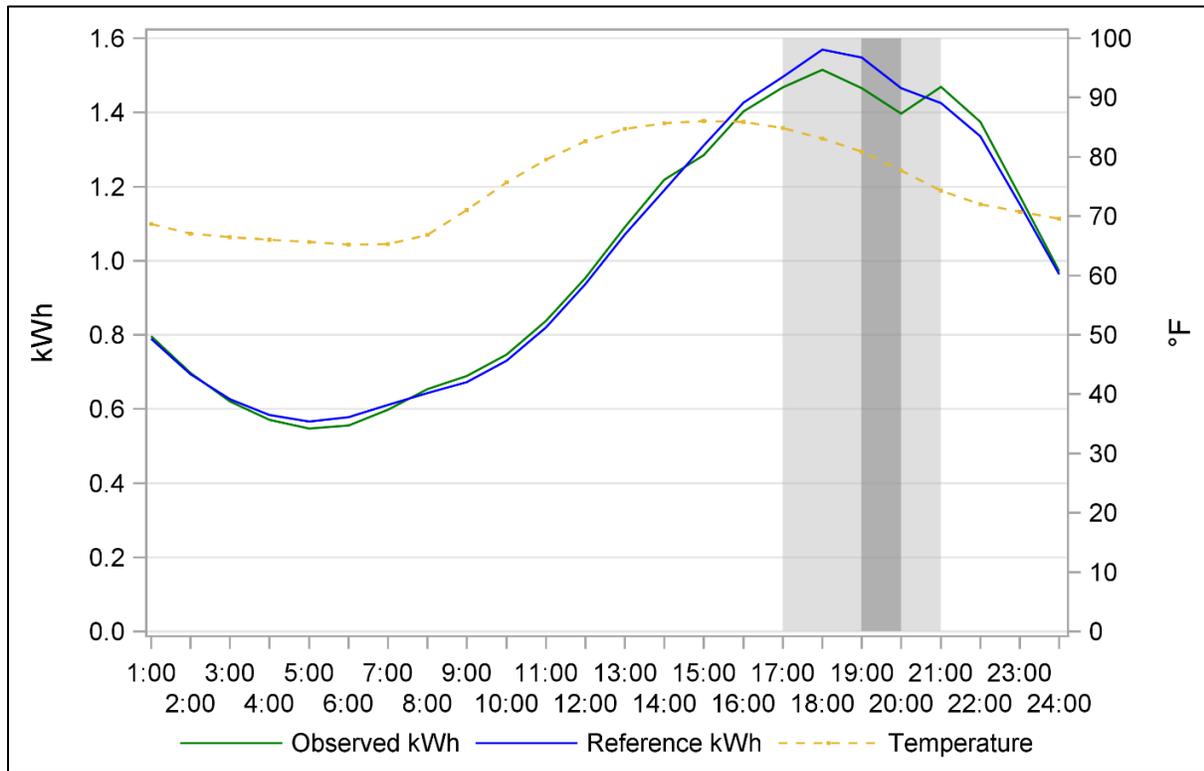


TABLE 3-16: SUMMARY OF EVENT HOUR IMPACTS FOR AC SAVER DA CUSTOMERS – FREE THERMOSTAT SOURCE – 2018 AVERAGE OF TWO-HOUR EVENTS

Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Mean Aggregate Load Reduction (kW)	Number of Events*
Pre-Hour	82.8	1.56	1.54	0.03	2.2%	4,216	108	15
Hour 1	80.7	1.54	1.46	0.09	6.8%	4,216	366	15
Hour 2	77.7	1.46	1.39	0.07	5.9%	4,216	316	15
Post Hour 1	74.2	1.42	1.47	-0.05	-2.3%	4,216	-201	15
Post Hour 2	72.0	1.34	1.37	-0.04	-1.6%	4,216	-152	15
Event Average	79.2	1.50	1.42	0.08	6.4%	4,216	341	15

* Events included in this analysis exclude June 12th, July 6th, and July 17th, events and exclude the first two hours of some BYOT thermostats that started participating two hours before the event on July 12th.



TABLE 3-17: SUMMARY OF EVENT HOUR IMPACTS FOR AC SAVER DA CUSTOMERS – FREE THERMOSTAT SOURCE – 2018 AVERAGE OF EVENTS LONGER THAN TWO HOURS

Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Mean Aggregate Load Reduction (kW)	Number of Events*
Pre-Hour	87.1	1.49	1.44	0.04	3.1%	4,224	178.4	3
Hour 1	86.1	1.44	1.35	0.09	8.0%	4,224	397.9	3
Hour 2	83.9	1.56	1.40	0.16	9.8%	4,224	661.9	3
Hour 3	80.4	1.52	1.46	0.06	5.7%	4,224	265.7	3
Hour 4	81.2	1.73	1.67	0.06	4.5%	4,225	246.8	2
Post Hour 1	75.2	1.42	1.49	-0.07	-3.3%	4,224	-296.3	3
Post Hour 2	72.6	1.32	1.37	-0.05	-1.8%	4,224	-193.9	3
Event Average†	83.0	1.55	1.45	0.10	7.2%	4,224	406.4	3

* Events included in this analysis are June 12th, July 6th, and July 17th, events

† Event averages are “number of events” weighted average

FIGURE 3-11: HOURLY LOAD PROFILE FOR AC SAVER DA CUSTOMERS – BYOT THERMOSTAT SOURCE – 2018 EVENT AVERAGE

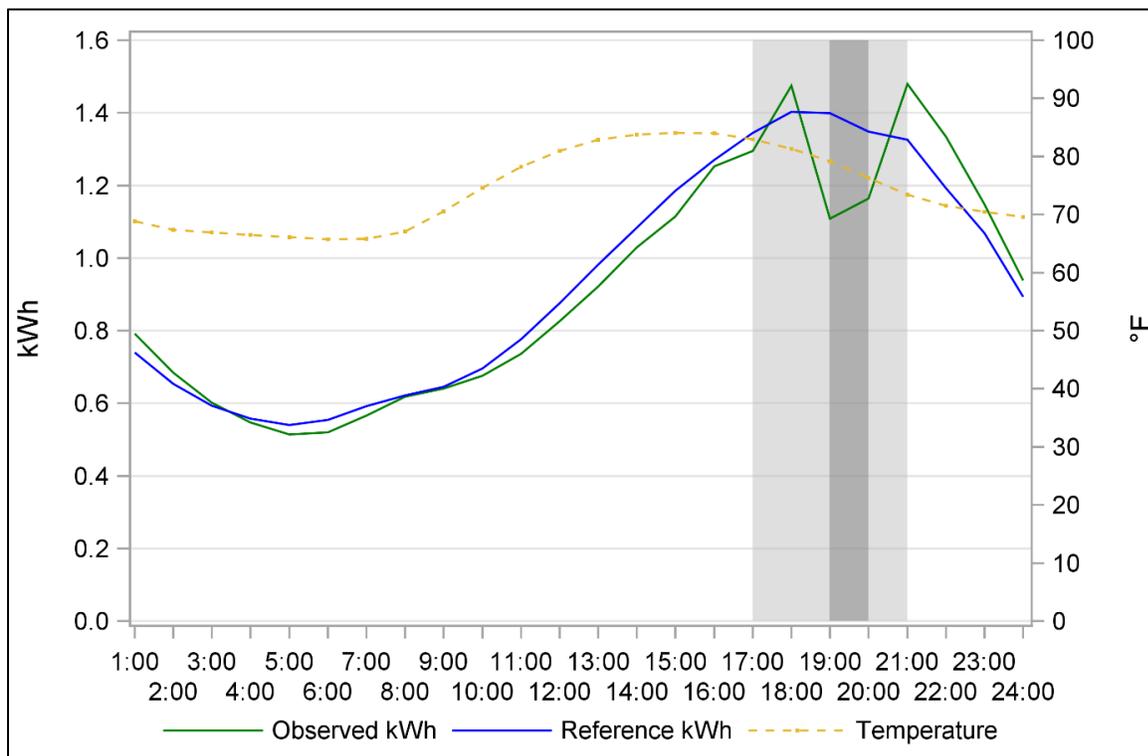




TABLE 3-18: SUMMARY OF EVENT HOUR IMPACTS FOR AC SAVER DA CUSTOMERS – BYOT THERMOSTAT SOURCE – 2018 AVERAGE OF TWO-HOUR EVENTS

Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Mean Aggregate Load Reduction (kW)	Number of Events*
Pre-Hour	81.2	1.40	1.57	-0.17	-12.3%	5,707	-950	14
Hour 1	79.2	1.35	1.06	0.29	20.7%	5,707	1,657	14
Hour 2	76.4	1.33	1.13	0.20	14.3%	5,707	1,128	14
Post Hour 1	73.5	1.33	1.50	-0.17	-12.1%	5,707	-968	14
Post Hour 2	71.6	1.24	1.33	-0.09	-6.8%	5,707	-518	14
Event Average	77.8	1.34	1.10	0.24	17.5%	5,707	1,393	14

* Events in this table exclude June 12th, July 6th, July 12th, and July 17th events. July 12th was excluded as a result BYOT thermostat participation starting two hours before the actual event start.

TABLE 3-19: SUMMARY OF EVENT HOUR IMPACTS FOR AC SAVER DA CUSTOMERS – BYOT THERMOSTAT SOURCE – 2018 AVERAGE OF EVENTS LONGER THAN TWO HOURS

Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Mean Aggregate Load Reduction (kW)	Number of Events*
Pre-Hour	84.3	1.28	1.51	-0.23	-18.0%	4,937	-1159.1	4
Hour 1	83.3	1.34	1.05	0.29	22.1%	4,937	1,437.1	4
Hour 2	81.3	1.41	1.25	0.16	12.7%	4,937	789.2	4
Hour 3	78.5	1.55	1.27	0.28	16.3%	4,937	1,364.1	4
Hour 4	78.4	1.61	1.37	0.24	14.5%	5,027	1,217.3	3
Post Hour 1	73.7	1.11	1.50	-0.39	-89.5%	4,937	-1928.9	4
Post Hour 2	71.5	1.23	1.32	-0.09	-7.0%	4,937	-454.2	4
Event Average†	80.5	1.47	1.23	0.24	16.5%	4,955	1200.9	4

* Event days included in this table are June 12th, July 6th, July 12th, and July 17th

† Event averages are “number of events” weighted average



AC Saver Day Ahead, by Climate Zone

Figure 3-12 and Figure 3-13 present the average load during 2018 events for coastal and inland participants by average 2018 hours. As seen in the figures, the average temperature for inland participants was higher than coastal participants and experienced larger temperature decreases during event hours on average. Table 3-20 through Table 3-23 present the relative average event hour impacts for two-hour events and events with more than two hours for AC Saver DA participants by coastal and inland regions. As seen in the tables, the inland AC Saver DA participants achieved slightly larger savings in relative event hours. The average relative event hour impact for coastal participants was 0.16 kW (12.2%) for both two-hour and two or more-hour events, whereas the BYOT group achieved 0.18 kW (11.9%) and 0.21 kW (12.8%) in average relative event hour reductions for two-hour and two or more hour events respectively.

FIGURE 3-12 HOURLY LOAD PROFILE FOR AC SAVER DA CUSTOMERS – COASTAL – 2018 EVENT AVERAGE

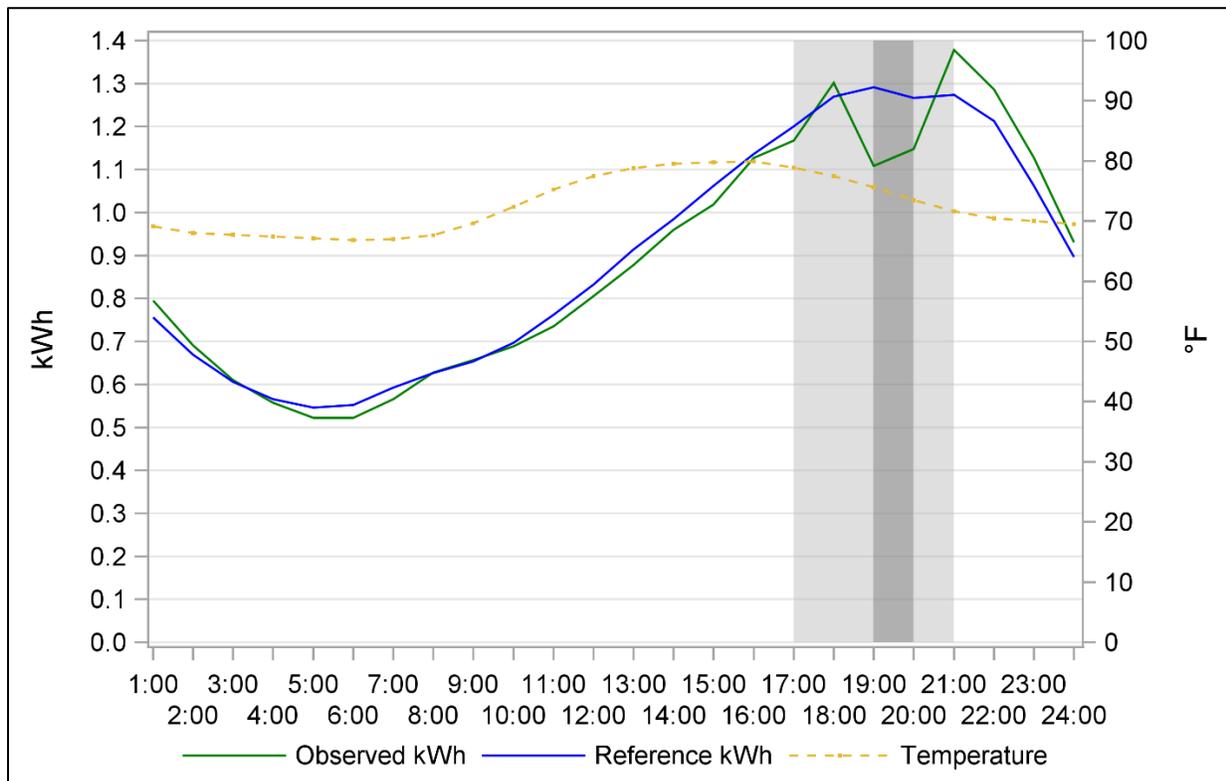




TABLE 3-20: SUMMARY OF EVENT HOUR IMPACTS FOR AC SAVER DA CUSTOMERS – COASTAL – 2018 AVERAGE OF TWO-HOUR EVENTS

Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Mean Aggregate Load Reduction (kW)	Number of Events*
Pre-Hour	77.5	1.27	1.35	-0.08	-6.4%	5,027	-412.0	15
Hour 1	75.9	1.27	1.08	0.19	14.3%	5,027	944.0	15
Hour 2	73.7	1.26	1.13	0.13	10.1%	5,027	657.7	15
Post Hour 1	71.9	1.27	1.39	-0.12	-8.7%	5,027	-594.3	15
Post Hour 2	70.7	1.21	1.29	-0.08	-6.0%	5,027	-380.9	15
Event Average	74.8	1.27	1.11	0.16	12.2%	5,027	800.8	15

* Events in this table exclude June 12th, July 6th, and July 17th events.

TABLE 3-21: SUMMARY OF EVENT HOUR IMPACTS FOR AC SAVER DA CUSTOMERS – COASTAL – 2018 AVERAGE OF EVENTS LONGER THAN TWO HOURS

Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Mean Aggregate Load Reduction (kW)	Number of Events*
Pre-Hour	81.1	1.13	1.26	-0.13	-10.7%	4,618	-595	3
Hour 1	79.3	1.21	1.00	0.21	16.7%	4,618	947	3
Hour 2	76.7	1.27	1.14	0.13	10.8%	4,618	609	3
Hour 3	74.1	1.37	1.20	0.16	10.8%	4,618	747	3
Hour 4	75.1	1.54	1.38	0.15	10.0%	4,682	725	2
Post Hour 1	70.8	1.26	1.37	-0.11	-7.6%	4,618	-492	3
Post Hour 2	69.1	1.18	1.24	-0.06	-4.9%	4,618	-286	3
Event Average†	76.4	1.33	1.17	0.16	12.2%	4,629	760	3

* Event days included in this table are June 12th, July 6th, and July 17th

† Event averages are “number of events” weighted average



FIGURE 3-13: HOURLY LOAD PROFILE FOR AC SAVER DA CUSTOMERS – INLAND – 2018 EVENT AVERAGE

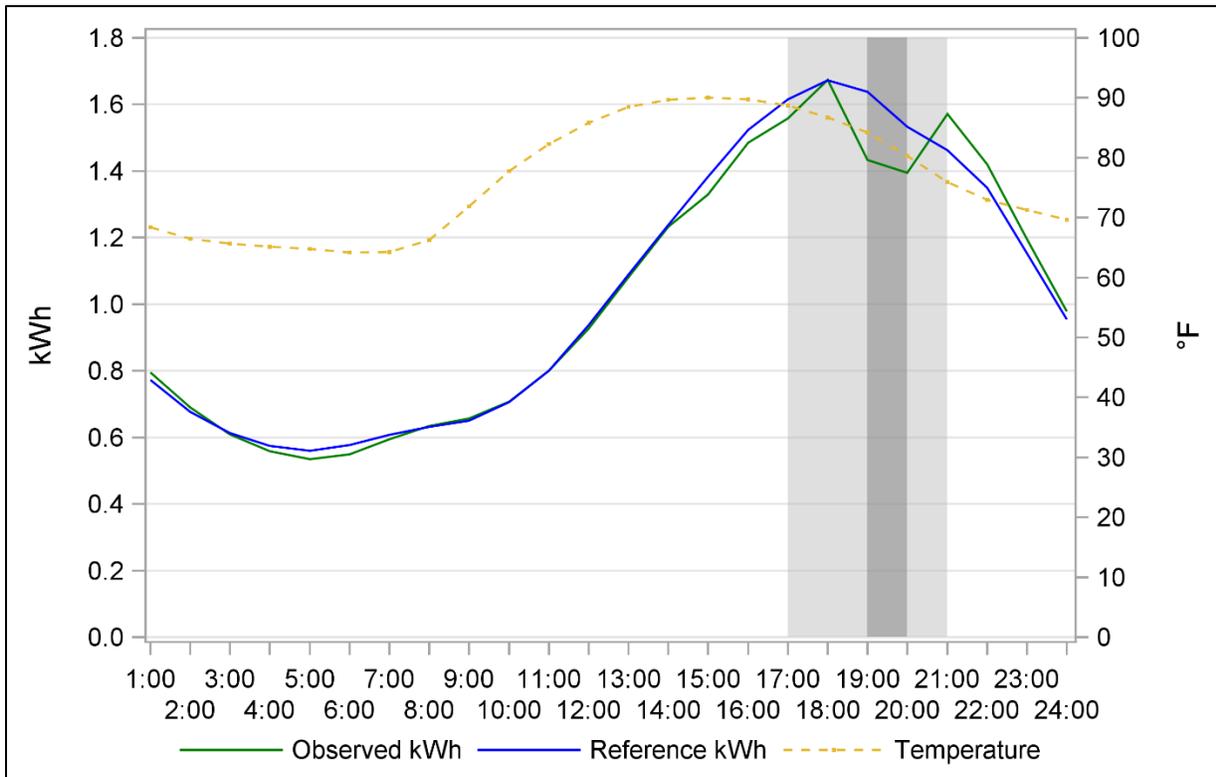


TABLE 3-22: SUMMARY OF EVENT HOUR IMPACTS FOR AC SAVER DA CUSTOMERS – INLAND – 2018 AVERAGE OF TWO-HOUR EVENTS

Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Mean Aggregate Load Reduction (kW)	Number of Events*
Pre-Hour	86.3	1.66	1.72	-0.06	-3.7%	5,107	-323.1	15
Hour 1	83.9	1.61	1.41	0.21	13.5%	5,107	1,048.9	15
Hour 2	80.2	1.52	1.37	0.15	10.2%	5,107	757.4	15
Post Hour 1	75.6	1.47	1.58	-0.11	-6.8%	5,107	-583.3	15
Post Hour 2	72.8	1.35	1.41	-0.06	-3.4%	5,107	-311.8	15
Event Average	82.0	1.56	1.39	0.18	11.9%	5,107	903.1	15

* Events in this table exclude June 12th, July 6th, and July 17th events.



TABLE 3-23: SUMMARY OF EVENT HOUR IMPACTS FOR AC SAVER DA CUSTOMERS – INLAND – 2018 AVERAGE OF EVENTS LONGER THAN TWO HOURS

Hour	Mean °F	Mean Reference Load (kW)	Mean Observed Load (kW)	Mean Impact (kW)	% Load Reduction	Mean Active Participants	Mean Aggregate Load Reduction (kW)	Number of Events*
Pre-Hour	91.0	1.64	1.68	-0.04	-2.3%	4,748	-195	3
Hour 1	90.4	1.69	1.39	0.30	18.1%	4,748	1,438	3
Hour 2	88.5	1.70	1.51	0.19	12.3%	4,748	904	3
Hour 3	84.4	1.70	1.52	0.18	10.9%	4,748	858	3
Hour 4	85.1	1.88	1.72	0.15	8.4%	4,813	741	2
Post Hour 1	78.0	1.43	1.60	-0.17	-10.4%	4,748	-798	3
Post Hour 2	74.8	1.33	1.42	-0.09	-4.8%	4,748	-422	3
Event Average†	87.3	1.73	1.52	0.21	12.8%	4,760	1,008	3

* Event days included in this table are June 12th, July 6th, and July 17th

† Event averages are “number of events” weighted average



4 EX-ANTE METHODOLOGY AND RESULTS

4.1 ESTIMATING EX-ANTE LOAD IMPACTS FOR THE AC SAVER DAY AHEAD PROGRAM

Ex-ante impacts for the residential AC Saver Day Ahead program were estimated by combining the regression model results from the ex post impacts with two other sources of data. The first data source was a 10-year forecast of enrollment for the program, as well as by thermostat source (free vs. Bring Your Own Thermostat). The second data source was two separate versions of weather scenarios containing hourly weather for different types of weather years and day types for each month of the year, one from SDG&E and the second from CAISO. The results presented in this section use the weather conditions based on SDG&E estimates.

The *ex-ante* estimation process involved two main steps.

The first step combined the parameters from ex-post regression model with the weather scenarios from the various year and day types, to calculate per participant average reference loads, observed loads, and load impacts. The standard errors from the impact variable parameters were used to calculate the uncertainty estimates. It worth pointing out that the 2018 AC Saver program has different event hours for different days, ranging from 4 pm to 9 pm, same as the RA hours for ex-ante estimation. However, for 8 pm to 9 pm, there was only one event, and from 4 pm to 5 pm, there were two events for half of the participants, and one for the other half (due to vendor-specific signaling). In all scenarios, the sample is too small to make valid reference. Therefore, in the ex-ante estimation, the following adjustments were made:

1. Event hour 16 (4 p.m. to 5 p.m.) uses estimation results from hour 17 (5 p.m. to 6 p.m.)
2. Event hour 20 (8 p.m. to 9 p.m.) uses estimation results from hour 19 (7 p.m. to 8 p.m.)

Similarly, for the first hour after event (hour 21), to capture the snapback effect that can be observed from 2018 AC Saver participants' load, ex post estimation results from hour 20 were applied, since 16 out of 18 AC Saver events ended at 8 p.m. In addition, to capture the observed pre-cooling effect during AC Saver events, the ex-ante estimation applied weighted average of parameters for all the pre-event hours, including hour 15, 16 and 18, using the number of active participants as weights.

The second step was to combine estimated per-participant impacts for the different weather scenarios and multiply them by the forecast of enrolled participants to generate the total program impacts. SDG&E forecasts that the AC Saver Day Ahead residential program is expected to grow to over 20,000 participants by the end of 2019. By the end of 2022, the program is forecasted to grow to over 40,000



participants. These projections are then expected to remain relatively constant throughout the remainder of the *ex-ante* forecast period.

The enrollment forecasts were based on total participants by participant segment, whereas the weather scenarios and estimated impacts have more detailed information. Consequently, the alignment of these data sources called for making certain assumptions about the allocation of program participants. Total participants from the forecast were allocated to climate zones and thermostat sources based on the relative shares as of the event days from 2018. Additionally, since the weather scenarios were provided by climate zone, an average weather scenario was created using an average where the same participant shares were used as weights. Note that this weighting was program segment specific. The shares used for the allocation of the enrollment forecast are presented in Table 4-1.

TABLE 4-1: SHARES FOR ALLOCATION OF ENROLLMENT FORECAST

Participant Segment		Coastal	Inland	All	Number of Participants
AC Saver Day Ahead	BYOT	37%	27%	64%	5,536
	Free	14%	22%	36%	4,217
	All	51%	49%	100%	10,007*

* AC Saver DA Participants with Unknown thermostat source were excluded from the enrollment shares for *ex ante*.

4.2 EX-ANTE LOAD IMPACT RESULTS

4.2.1 AC Saver Day Ahead

Figure 4-1 and Table 4-2 show the *ex-ante* load impact estimates for the average customer only enrolled in the AC Saver Day Ahead program for the various combinations of day types and weather scenarios for 2019. The average weekday and monthly system peak days are presented for June, July, and August, while the typical event day is presented for the month of August. For a 1-in-2 typical event day, the estimated load reduction for the average participant is 0.172 kW during the resource availability hours. For a 1-in-10 typical event day, the estimated load reduction is slightly higher, at 0.185 kW. The estimated aggregate load reductions are 2.96 MW (10.5%) and 3.18 MW (9.7%), respectively. As the enrollment in the AC Saver Day Ahead program continues to grow, these aggregate estimates will increase.

For the AC Saver Day Ahead program customers, those who received free thermostats are forecasted to reduce usage by 0.116 kW for the 1-in-2 weather condition, and by 0.112 kW for the 1-in-10 weather condition, which are about 5.6% and 6.8% of the corresponding reference usages, respectively. On the



other hand, the BYOT customers are forecasted to reduce usage by 0.226 kW (14.3%), and 0.267 kW (14.5%), respectively. The forecasted program impact for the BYOT group is higher than that for group who received free thermostats.

FIGURE 4-1: 2019 EX-ANTE HOURLY LOAD PROFILE – AC SAVER DAY AHEAD AVERAGE CUSTOMER

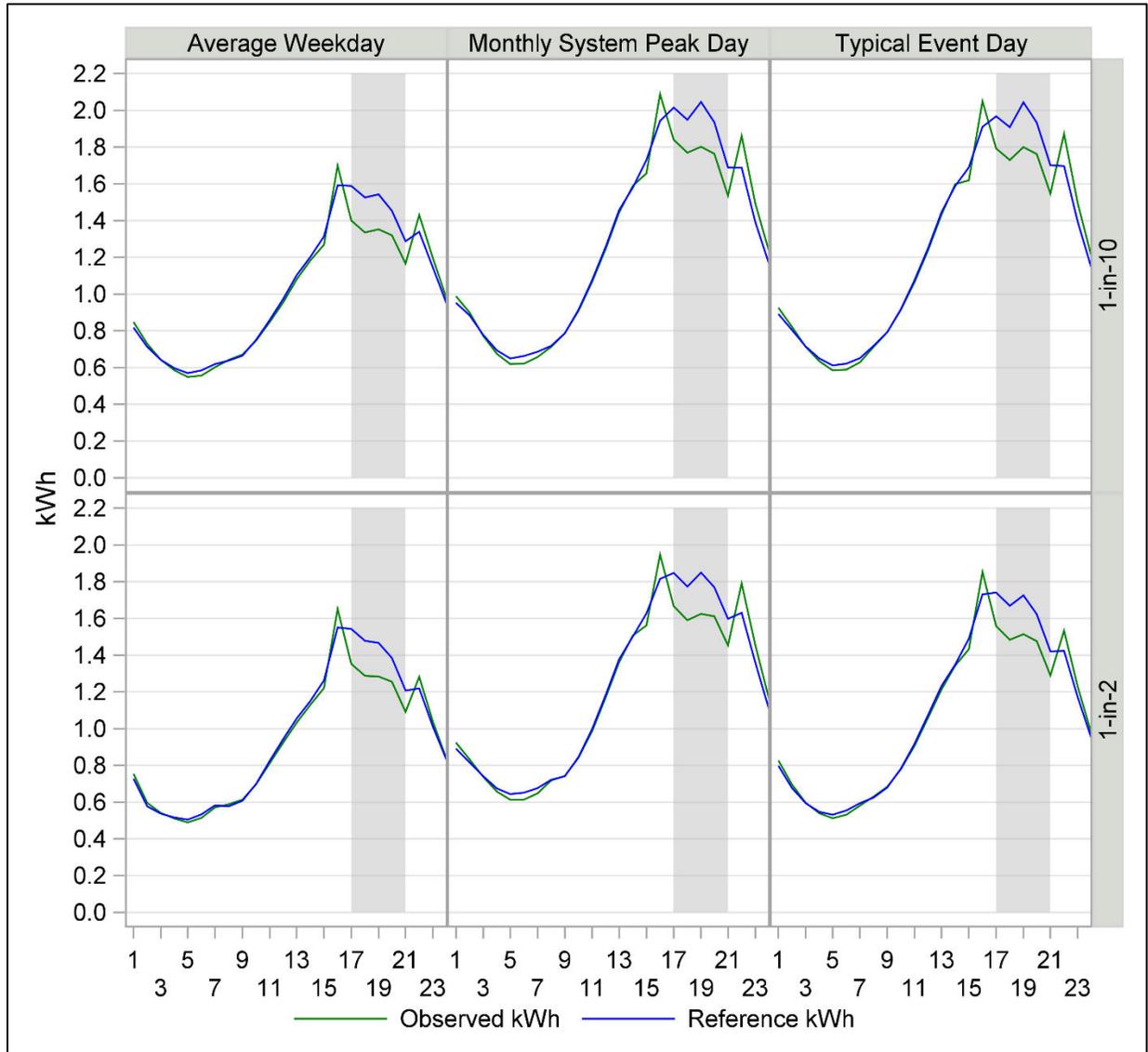




TABLE 4-2: 2019 EX-ANTE HOURLY LOAD IMPACT RESULTS – AC SAVER DAY AHEAD

Control Strategy	Day / Type	Month	1-in-10					1-in-2				
			Average Hourly Reference Load (kWh)	Average Hourly Observed Load (kWh)	Average Hourly Impact (kWh)	Percent Load Reduction	Average Total Hourly Impact (MWh)	Average Hourly Reference Load (kWh)	Average Hourly Observed Load (kWh)	Average Hourly Impact (kWh)	Percent Load Reduction	Average Total Hourly Impact (MWh)
BYOT	Average Weekday	Jun	0.86	0.70	0.167	19.4%	1.68	0.63	0.49	0.133	21.2%	1.33
		Jul	1.32	1.12	0.201	15.1%	2.11	1.13	0.96	0.172	15.2%	1.80
		Aug	1.42	1.21	0.203	14.3%	2.23	1.36	1.17	0.194	14.2%	2.12
	Monthly System Peak Day	Jun	1.48	1.22	0.260	17.6%	2.61	0.90	0.73	0.167	18.6%	1.68
		Jul	1.68	1.43	0.251	14.9%	2.64	1.41	1.20	0.214	15.1%	2.25
		Aug	1.86	1.60	0.266	14.3%	2.91	1.69	1.45	0.245	14.5%	2.69
	Typical Event Day	Aug	1.84	1.57	0.267	14.5%	2.93	1.58	1.35	0.226	14.3%	2.48
Free	Average Weekday	Jun	0.92	0.81	0.116	12.6%	0.67	0.62	0.50	0.118	19.1%	0.68
		Jul	1.46	1.35	0.116	7.9%	0.69	1.24	1.12	0.118	9.5%	0.70
		Aug	1.57	1.46	0.117	7.4%	0.73	1.49	1.37	0.119	8.0%	0.74
	Monthly System Peak Day	Jun	1.58	1.47	0.109	6.9%	0.62	0.95	0.83	0.119	12.6%	0.68
		Jul	1.87	1.76	0.114	6.1%	0.68	1.54	1.43	0.116	7.5%	0.69
		Aug	2.01	1.90	0.115	5.7%	0.72	1.87	1.76	0.114	6.1%	0.71
	Typical Event Day	Aug	2.01	1.90	0.112	5.6%	0.70	1.72	1.60	0.116	6.8%	0.72



TABLE 4-2 (CONT'D): 2019 EX-ANTE HOURLY LOAD IMPACT RESULTS – AC SAVER DAY AHEAD

Control Strategy	Day / Type	Month	1-in-10					1-in-2				
			Average Hourly Reference Load (kWh)	Average Hourly Observed Load (kWh)	Average Hourly Impact (kWh)	Percent Load Reduction	Average Total Hourly Impact (MWh)	Average Hourly Reference Load (kWh)	Average Hourly Observed Load (kWh)	Average Hourly Impact (kWh)	Percent Load Reduction	Average Total Hourly Impact (MWh)
ALL	Average Weekday	Jun	0.88	0.73	0.154	17.4%	2.43	0.62	0.48	0.143	23.0%	2.25
		Jul	1.38	1.21	0.165	12.0%	2.71	1.17	1.01	0.155	13.3%	2.56
		Aug	1.48	1.31	0.165	11.2%	2.85	1.42	1.25	0.162	11.4%	2.79
	Monthly System Peak Day	Jun	1.52	1.34	0.183	12.0%	2.89	0.92	0.76	0.154	16.8%	2.43
		Jul	1.76	1.58	0.181	10.3%	2.98	1.46	1.30	0.168	11.5%	2.78
		Aug	1.93	1.74	0.184	9.6%	3.17	1.77	1.59	0.178	10.1%	3.07
	Typical Event Day	Aug	1.91	1.73	0.185	9.7%	3.18	1.64	1.46	0.172	10.5%	2.96



4.2.2 Comparison of 2018 and 2017 Ex-Ante Estimates

Table 4-3, Figure 4-2 and Figure 4-3 show the comparisons between the *ex-ante* estimates in the current evaluation and those reported in the previous evaluation for the forecast year 2019. The estimated impacts for the AC Saver participants in the current analysis decreased from previous evaluation forecast. For the participants, the previous analysis found estimates of 0.45 kW on 1-in-2 event days and 0.47 kW on 1-in-10 event days. The current analysis projects 0.17 kW on 1-in-2 event days and 0.19 kW on 1-in-10 event days. The percentage load reduction estimates under the current analysis are also much lower. For example, in the 1-in-2 year, the previous results had load reductions of 24.4%, while the current estimates are 10.5%.

Shown in Figure 4-2 and Figure 4-3, the hourly load shapes for each of the groups are noticeably different between evaluation years. On average, the participants' observed loads are at similar level, but reference loads are higher in the previous evaluation. Last year, three events were called on three consecutive days, and all of which were of high temperature. This year, on the other hand, many more events were called, eighteen to be exact, the days were spread out, the temperatures varied significantly, and the event hours were during a later part of the day. All of these contributed to the difference in model estimations, which, in turn, led to different forecasting.

TABLE 4-3: COMPARISON OF 2018 AND 2017 EX-ANTE ESTIMATES PER CUSTOMER – FORECAST YEAR 2019 SYSTEM PEAK DAYS AND TYPICAL EVENT DAY – AC SAVER

		Current				Previous			
		Average Hourly Reference Load	Average Hourly Observed Load	Average Hourly Impact	Percent Load Reduction	Average Hourly Reference Load	Average Hourly Observed Load	Average Hourly Impact	Percent Load Reduction
1-in-10	August System Peak Day	1.93	1.74	0.18	9.6%	2.19	1.72	0.47	21.5%
	Typical Event Day	1.91	1.73	0.19	9.7%	2.15	1.67	0.47	22.0%
1-in-2	August System Peak Day	1.77	1.59	0.18	10.1%	2.01	1.54	0.47	23.2%
	Typical Event Day	1.64	1.46	0.17	10.5%	1.85	1.40	0.45	24.4%



FIGURE 4-2: COMPARISON OF 2018 AND 2017 EX-ANTE HOURLY LOAD PROFILES – AC SAVER PROGRAM AVERAGE CUSTOMER— AUGUST SYSTEM PEAK DAY

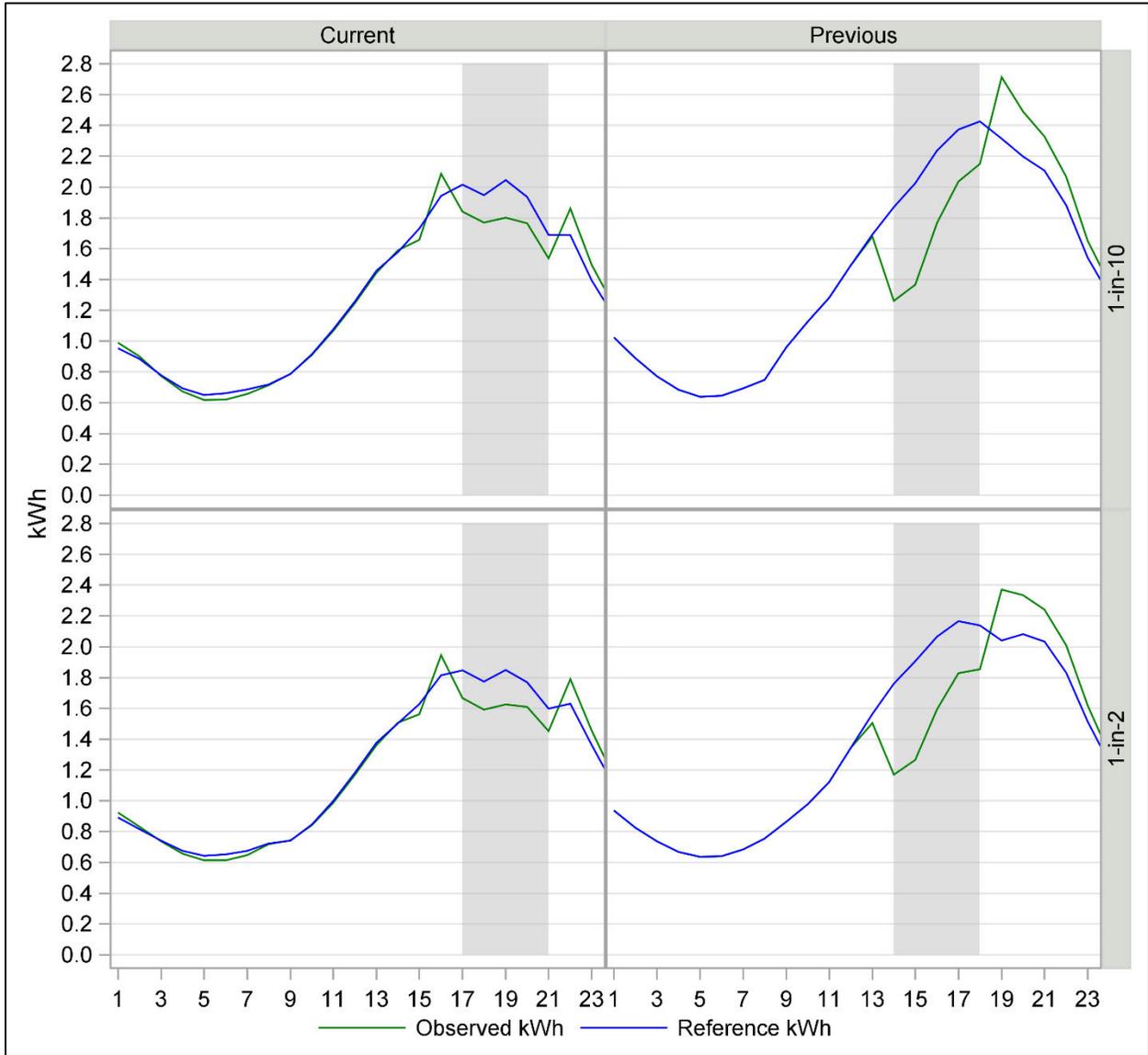
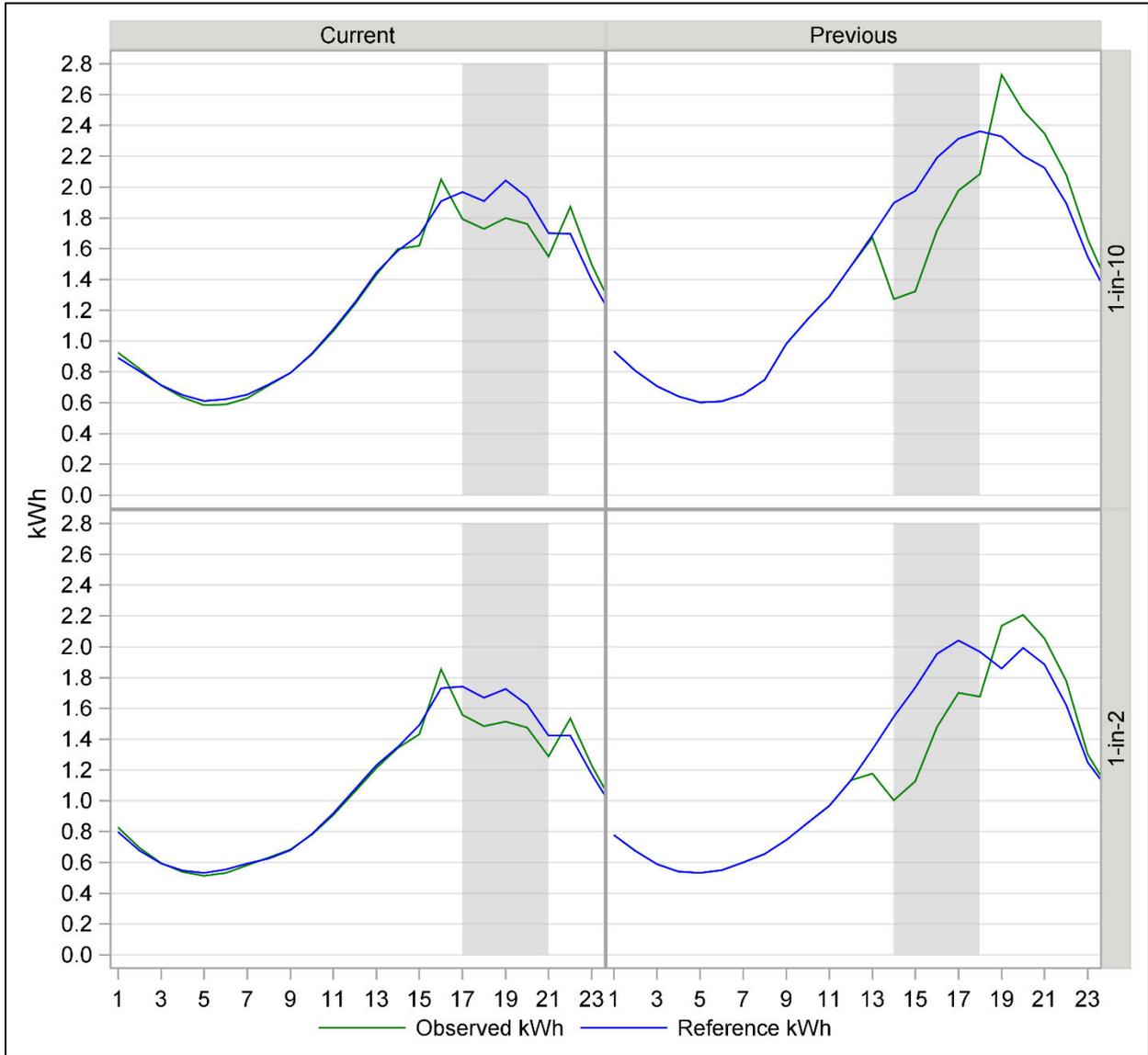




FIGURE 4-3: COMPARISON OF 2018 AND 2017 EX-ANTE HOURLY LOAD PROFILES – AC SAVER PROGRAM AVERAGE CUSTOMER – TYPICAL EVENT DAY





4.2.3 Relationship between Ex Post and Ex-Ante Estimates

Table 4-4 shows comparisons between the *ex-ante* and *ex post* estimates from the PY2018 evaluation. For the AC Saver program, the impacts were modeled as a function of cooling degree days, and hence the predicted impacts are vary given different temperatures. The *ex post* estimates are a little bit lower for the Free sub-group, and higher for the BYOT sub-group. Overall, the average ex post estimates for the whole program is 0.17 kW, same as predicted using 1-in-2 typical day weather data, and slightly lower than predicted using 1-in-10 typical event day weather data, which is about 0.19 kW. Yet, percentage wise, the ex post impact is the highest, 11.6%, comparing to 9.7% for 1-in-10 typical event days and 10.5% for 1-in-2 typical event days.



TABLE 4-4: COMPARISON OF EX-ANTE AND EX POST ESTIMATES PER CUSTOMER

Participant Segment	Control Strategy	Weather Year	Day / Type	Average Hourly Reference Load (kW)	Average Hourly Observed Load (kW)	Average Hourly Impact (kW)	Percent Load Reduction	Average °F
AC Saver	BYOT	1-In-10	August System Peak Day	1.86	1.60	0.27	14.3%	86.86
			Typical Event Day	1.84	1.57	0.27	14.5%	86.38
		1-In-2	August System Peak Day	1.69	1.45	0.24	14.5%	83.58
			Typical Event Day	1.58	1.35	0.23	14.3%	81.33
		Ex Post	Ex Post	1.36	1.12	0.25	18.1%	77.98
		Free	1-In-10	August System Peak Day	2.01	1.90	0.11	5.7%
	Typical Event Day			2.01	1.90	0.11	5.6%	87.69
	1-In-2		August System Peak Day	1.87	1.76	0.11	6.1%	85.18
			Typical Event Day	1.72	1.60	0.12	6.8%	82.33
	Ex Post		Ex Post	1.54	1.46	0.08	5.0%	79.31
	ALL		1-In-10	August System Peak Day	1.93	1.74	0.18	9.6%
		Typical Event Day		1.91	1.73	0.19	9.7%	86.85
		1-In-2	August System Peak Day	1.77	1.59	0.18	10.1%	84.16
			Typical Event Day	1.64	1.46	0.17	10.5%	81.69
		Ex Post	Ex Post	1.44	1.28	0.17	11.6%	78.59

Note: The Ex Post results for comparison to ex ante are from 34 out of 43 event hours. These 34 hours represent events that ran from hour 18 and 19 only between June 11th and Sep 26th, 2018. The other event hours only represented a couple of events, and hence the estimations were not robust.