Public Version. Redactions in “2022 Load Impact Evaluation for Pacific Gas & Electric Company’s SmartAC™ Program” and appendices.

2022 Load Impact Evaluation for Pacific Gas & Electric Company’s SmartAC™ Program

CALMAC Study ID – PGE0482

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April 3, 2023

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EXECUTIVE SUMMARY

This report documents ex-post and ex-ante load impact evaluations of Pacific Gas and Electric's (PG&E) SmartAC™ program for 2022. The evaluation produces estimates of the ex-post load impacts for each hour of each event dispatched in 2022, and it develops ex-ante load impact forecasts for the program through 2033.

ES.1 Resources Covered

SmartAC™ is a direct load control central air conditioner (AC) cycling program for residential customers that was integrated into the CAISO wholesale market in program year 2018. SmartAC™ program participants receive a one-time incentive for allowing PG&E to cycle their AC for up to 6 hours per day in response to CAISO market awards, during periods of system or local area emergencies for PG&E capacity, or for limited testing for a maximum of 100 hours per summer (May 1 through October 31). Upon enrollment in SmartAC™, PG&E installs a Zigbee AC load control switch on the participant's central AC unit that communicates bi-directionally over the AMI network. Legacy technology, installed prior to August 2017, is capable of one-way communication over commercial paging systems and includes programmable communicating thermostats (PCT) and switches. When events are dispatched, PG&E sends signals to the PCTs and switches.

PG&E employs a combination of events including system-wide serial events or at the Sub-Load Aggregation Point (sub-LAP) level. System-wide events include all participants and can be initiated based on CAISO or PG&E emergencies or for testing purposes. System-wide test events generally dispatch all SmartAC™ customers throughout the service territory except for a random sample of SmartAC™ customers that serve as the control group based on the last digit of the factory programmed serial number of their installed device (i.e., one or two serial groups are withheld from the event).[1] During sub-LAP level events, all SmartAC™ participants with devices that are associated with a given sub-LAP are dispatched for the event. Two of the events during PY2022 were serial test events with one serial group withheld from the event dispatch. Two of the events were system-wide emergency events with all SmartAC™ customers in all sub-LAPs dispatched for the events, while the remaining twelve events were CAISO market awards.

The primary goals of the evaluation include:

1. Estimate hourly ex-post load impacts for the 2022 program year, including:
    a. Hourly and average daily load impacts for each event;
    b. The distribution of hourly and average daily load impacts by customer segment, including: sub-LAP, Local Capacity Area (LCA), CARE/non-CARE customers, net-metering solar customers (NEM), housing type (i.e., detached vs. shared wall residences), AC usage intensity, and device type (i.e., two-way vs. one-way; by one-way device type: UtilityPro, Gen 1, and Gen 2);

[1] Currently, not all installed devices have a serial number that conforms to this serial group selection process. For these devices, customers are randomly assigned to a serial group at the time of device installation.

   c. Load Impact estimates for SmartAC™-only customers as compared to customers who are dually enrolled in SmartAC™ and SmartRate™;
   d. The opt-out/override rate by customer segment; and
   e. The persistence of load reductions across event-hours for multiple hour events.
2. Produce ex-ante load impact forecasts for 2023 to 2033 by local capacity area (LCA) on an aggregate and per-customer basis for a typical event day and the monthly system peak load day for May through October. Forecasts are based on the following four sets of weather conditions:
   a. PG&E's peaking conditions in a 1-in-2 weather year;
   b. PG&E's peaking conditions in a 1-in-10 weather year;
   c. CAISO peaking conditions in a 1-in-2 weather year; and
   d. CAISO peaking conditions in a 1-in-10 weather year.

ES.2 Evaluation Methodologies

In this evaluation, we estimate load impacts by comparing SmartAC™ customer loads to that of a control group on event days, net of the differences in loads on non-event days with comparable weather conditions. For system-wide serial test events where at least one serial group is withheld from the event, we use this random sample of SmartAC™ customers as an additional control group. For all events, we use a matched control group consisting of residential customers who are not enrolled in any demand response programs, including SmartAC™ or SmartRate™. Matched control group customers are selected based on the similarity of available customer characteristics (e.g., rate schedule, sub-LAP, AC usage level, CARE status, NEM status) as well as usage patterns on non-event days.

We then estimate event-day load impacts using a regression-based difference-in-differences method, which produces estimates of standard errors, and thus confidence intervals around the estimated event-hour or event-day usage reductions. This approach also adjusts for differences in usage between the treated SmartAC™ customers and the control group on event-like non-event days, thus representing a difference-in-differences evaluation approach.

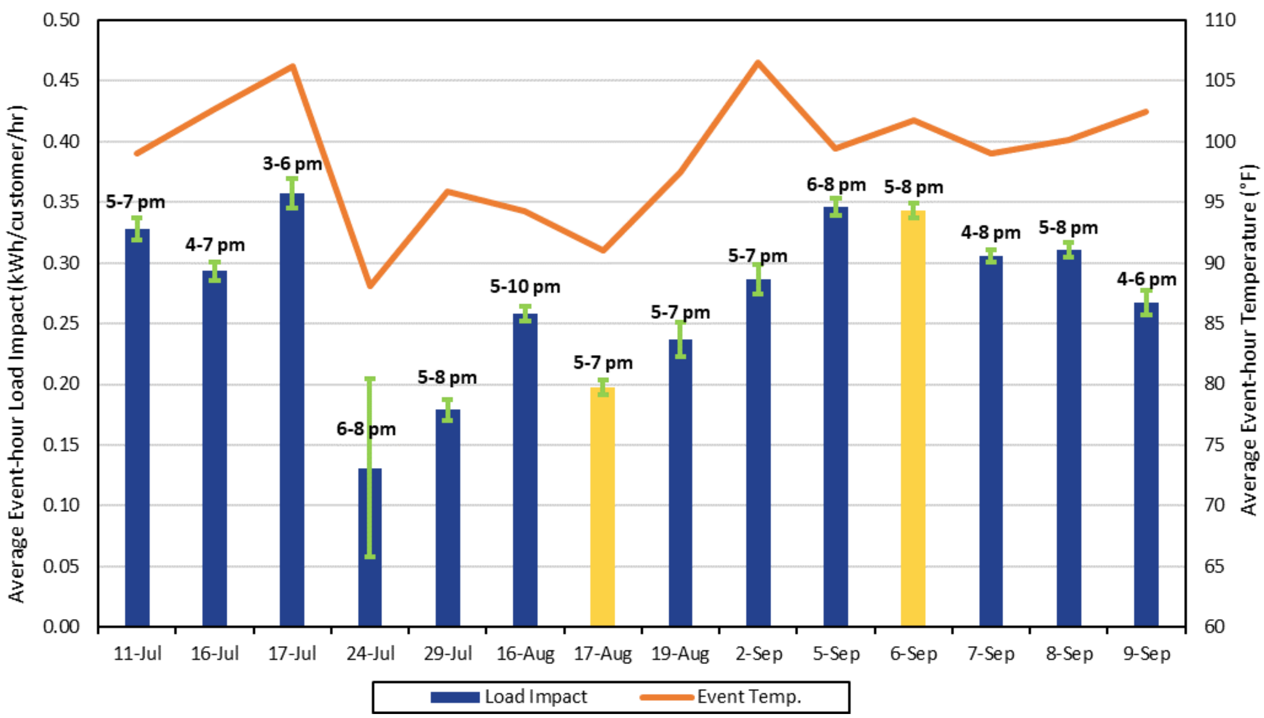
ES.3 Ex-Post Load Impacts

Figure ES.1 summarizes the ex-post load impact estimates (in kWh/customer/hour) for the average full event-hour for all SmartAC™ events in PY2022, along with an 80 percent confidence interval (corresponding to the 10th and 90th percentile uncertainty-adjusted load impacts).[2] There are sixteen events dispatched across fourteen event days. The yellow bars indicate the serial events on August 17th and September 6th. The blue bars correspond to the sub-LAP events. These results indicate that SmartAC™ customers had statistically significant load reductions on each of the fourteen event days, ranging from 0.13 to 0.36 kWh/customer/hour. Differences in event temperatures, the sub-LAPS dispatched for events, variation in sub-LAP performance, and

[2] Neither of the emergency events are included in this summary. The September 5th event was dispatched from 8:01 to 9:18 p.m. and did not include any full event hours. The September 6th event, dispatched from 8:01 to 8:42 p.m., lasted less than an hour.

dispatch issues for two-way devices drive the variation of average load impacts across events in 2022.

Figure ES.1: Average Event-Hour Load Impacts by Event



In addition to the overall load impacts, we examine patterns of load impacts at the sub-LAP level. We also examine how load impacts are distributed across customer subgroups. While two-way devices usually have higher load impacts than one-way devices, there were dispatch issues associated with two-way devices in 2022. When performance is isolated to devices that had no dispatch issues in 2022, the event load impacts increase by an average of 0.03 kWh/customer/hour. A more detailed discussion can be found in Section 3.7.

ES.4 Ex-Ante Load Impacts

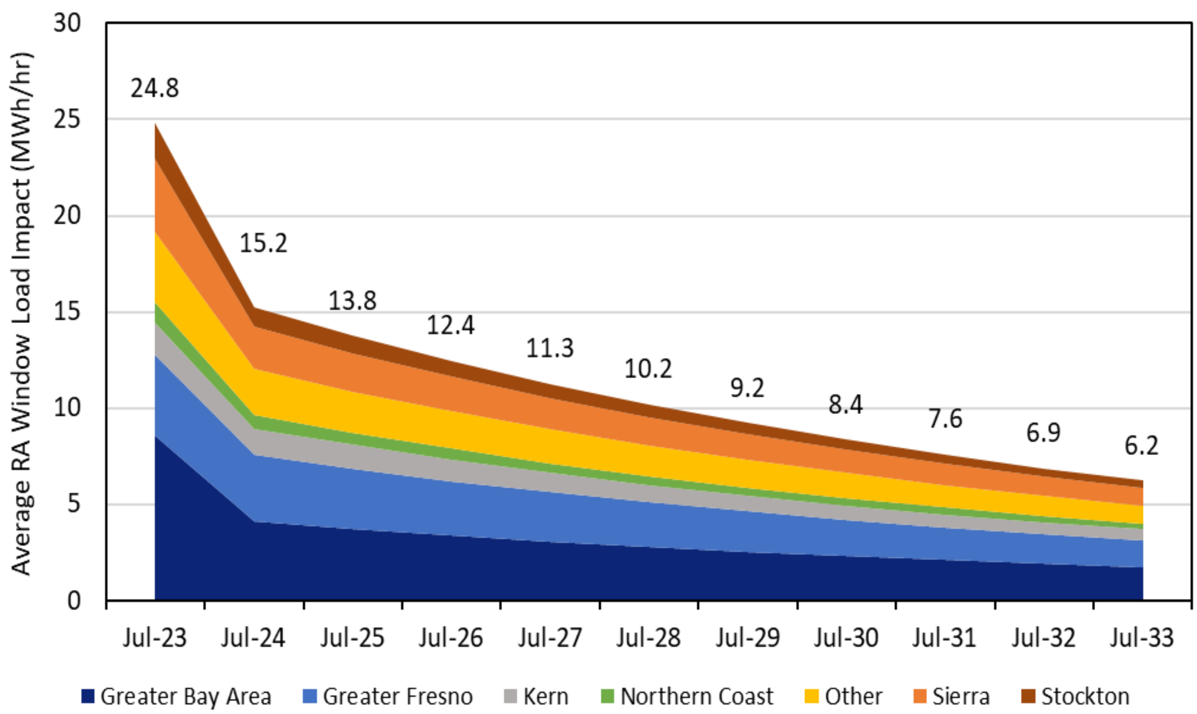
Ex-ante load impacts represent forecasts of load impacts that are expected to occur when program events are dispatched in future years under standardized weather conditions.

Estimating ex-ante load impacts requires three key pieces of information:

1. An *enrollment forecast* for relevant components of the program, which consists of forecasts of the number of customers by required type of customer;
2. *Reference loads* by customer type; and
3. A forecast of *load impacts per customer*, again by relevant customer type, where the load impact forecast also varies with weather conditions (if applicable), as determined in the ex-post evaluation.

Figure ES.2 summarizes the ex-ante program load impact forecast for 2023 to 2033 for SmartAC™ by plotting the average aggregate load impacts for the Resource Adequacy (RA) window over time by LCA. For this comparison we use the PG&E 1-in-2 scenario for July peak days. The trend of aggregate load impacts is driven by both enrollment change and replacement of all one-way devices with two-way devices. The aggregate load impact peaks at 24.8 MWh/hour in 2023, commensurate with peak of program enrollment. The sudden decline in aggregate load impacts for 2024 is due to the de-enrollment of approximately 29,500 customers that do not have their one-way devices swapped out for a two-way device before one-way devices are decommissioned in 2024. Program load impacts rapidly decline beginning in 2024 because there will be no new enrollments allowed in the SmartAC™ program after 2023.[3]

Figure ES.2: Aggregate Load Impacts over RA Window for PG&E 1-in-2 July Peak Scenario (2023-2033)



[3] PG&E proposed closing the SmartAC program to new enrollments in its "Application for Pacific Gas and Electric Company (U 39 E) for approval of its demand response programs, pilots, and budgets for programs years 2023-2027" and anticipates that this change will be approved by the CPUC. See https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M472/K478/472478718.PDF.

1. INTRODUCTION AND PURPOSE OF THE STUDY

This report documents ex-post and ex-ante load impact evaluations of Pacific Gas and Electric's (PG&E) SmartAC™ program for 2022. The evaluation produces estimates of the ex-post load impacts for each hour of each event dispatched in 2022, and it develops ex-ante load impact forecasts for the program through 2033.

SmartAC™ is a direct load control central air conditioner (AC) cycling program for residential customers that was integrated into the CAISO wholesale market in program year 2018. SmartAC™ program participants receive a one-time incentive for allowing PG&E to cycle their AC for up to 6 hours per day in response to CAISO market awards, during periods of system or local area emergencies for PG&E capacity, or for limited testing for a maximum of 100 hours per summer (May 1 through October 31).

Upon enrollment in SmartAC™, PG&E installs a Zigbee AC load control switch on the participant's central AC unit that communicates bi-directionally over the AMI network. Legacy technology, installed prior to August 2017, is capable of one-way communication over commercial paging systems and includes programmable communicating thermostats (PCT) and switches. As part of the second phase of the Reliability Order Instituting Rulemaking decision (D.21-12-015), PG&E is authorized to offer SmartAC™ customers with one-way devices a $25 incentive for PG&E to upgrade their switch to a two-way Zigbee device during 2022 and 2023. After 2023, enrollment in the SmartAC™ program will be closed.[4] When events are dispatched, PG&E sends signals to the PCTs and switches. As dictated by the tariff, PG&E cycles the AC unit for residential customers for approximately 50 percent of the compressor run-time during each half-hour. Switches and some PCTs are cycled using adaptive algorithms.

PG&E employs a combination of events including system-wide serial events or at the Sub-Load Aggregation Point (sub-LAP) level. System-wide events include all participants and can be initiated based on CAISO or PG&E emergencies or for testing purposes. System-wide test events generally dispatch all SmartAC™ customers throughout the service territory except for a random sample of SmartAC™ customers that serve as the control group based on the last digit of the factory programmed serial number of their installed device (i.e., one or two serial groups are withheld from the event).[5] During sub-LAP level events, all SmartAC™ participants with devices that are associated with a given sub-LAP are dispatched for the event. Historically, sub-LAP "addressing" was done by sending a signal to new SmartAC™ devices after installation to associate these devices with the appropriate sub-LAP. Since the CAISO wholesale market integration of the SmartAC™ program in 2018, a majority of SmartAC™ events are sub-LAP-level events, while a select number of serial events are dispatched for testing purposes.

Table 1-1 shows the details for each event in program year 2022 (PY2022). There were sixteen SmartAC™ events dispatched across fourteen event days in 2022. Twelve events were CAISO market awards. There were two serial test events on August 17th and September 6th. On

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[4] PG&E proposed closing the SmartAC program to new enrollments in its "Application for Pacific Gas and Electric Company (U 39 E) for approval of its demand response programs, pilots, and budgets for programs years 2023-2027" and anticipates that this change will be approved by the CPUC. See https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M472/K478/472478718.PDF.

[5] Currently, not all installed devices have a serial number that conforms to this serial group selection process. For these devices, customers are randomly assigned to a serial group at the time of device installation.

September 5th, an emergency event was dispatched from 8:01 to 9:18 p.m., immediately after a system-wide market event that ended at 8 p.m. On September 6th, an emergency event was dispatched from 8:01 to 8:42 p.m., immediately after a serial test event that ended at 8 p.m.

On July 16th, 17th, 29th, August 16th and September 8th, customers in different sub-LAPs were dispatched for different event hours. On August 17th, September 5th, 6th and 8th, all sub-LAPs were dispatched for the events.

Table 1-1: PY2022 SmartAC™ Events

Date	Smart-Rate™ Event?	Reason	Event Hours (p.m.)	Sub-LAPs/Serial Groups Dispatched	# Customers Dispatched
7/11	Yes	Market	5:00-7:00	PGNP, PGSI, PGKN, PGZP, PGNC	24,871
7/16	No	Market	4:00-6:00	PGSI, PGST, PGKN, PGF1, PGZP	34,570
			5:00-7:00	PGNP	10,636
7/17	No	Market	3:00-5:00	PGF1	12,479
			4:00-6:00	PGKN, PGZP	5,215
7/24	No	Market	6:00-8:00	PGNC	463
7/29	No	Market	5:00-7:00	PGKN, PGF1, PGZP, PGNC	18,110
			6:00-8:00	PGNP	10,604
8/16	Yes	Market	5:00-7:00	PGEB, PGSB, PGP2	23,453
			6:00-8:00	PGKN, PGF1, PGNC, PGNB	15,819
			7:00-9:00	PGNP, PGST	13,503
			8:00-10:00	PGSI	10,670
8/17	Yes	Test	4:30-7:00	All Sub-LAPs, Serial Group 1 withheld	58,998
8/19	Yes	Market	5:00-7:00	PGSI	10,655
9/2	No	Market	5:00-7:00	PGKN, PGF1, PGZP	17,513
9/5	Yes	Market	6:00-8:00	PGNP, PGSI, PGST, PGKN, PGF1 PGZP, PGNC, PGFG, PGNB, PGEB, PGSB, PGP2, PGCC	66,044
		Emergency	8:01-9:18	PGNP, PGSI, PGST, PGKN, PGF1 PGZP, PGNC, PGFG, PGNB, PGEB, PGSB, PGP2, PGCC	66,044
9/6	Yes	Test	5:00-8:00	All Sub-LAPs, Serial Group 2 withheld	58,553
		Emergency	8:01-8:42	PGNP, PGSI, PGST, PGKN, PGF1 PGZP, PGNC, PGFG, PGNB, PGEB, PGSB, PGP2, PGCC	65,963
9/7	Yes	Market	4:00-8:00	PGNP, PGSI, PGST, PGKN, PGF1 PGZP, PGNC, PGNB, PGEB, PGSB, PGP2, PGCC	64,550
9/8	Yes	Market	5:00-7:00	PGNP, PGST, PGKN, PGFG, PGNB, PGEB, PGCC	33,379
			5:00-8:00	PGSI, PGF1, PGZP, PGNC, PGSB, PGP2	32,478
9/9	No	Market	4:00-6:00	PGNP, PGSI, PGST, PGNC	27,554

SmartAC™ customers are permitted to be dually enrolled in SmartAC™ and the SmartRate™ program if they were enrolled before October 26, 2018, but subsequent new dual participation is prohibited. As of May 2022, SmartAC™ had over 74,000 active enrolled residential customers; approximately 6,400 of these customers were dually enrolled in SmartAC™ and SmartRate™. On days when both a SmartAC™ event and a SmartRate™ event is dispatched, the SmartRate™ customers are withheld from our summary of SmartAC™ events and the response from dually enrolled customers is attributed to the SmartRate™ program.

PG&E is in the process of replacing existing one-way devices with two-way devices before the one-way technology becomes obsolete. In January 2024, all remaining customers with one-way devices will be de-enrolled from the SmartAC™ program and new enrollment will be closed.

The primary goals of the evaluation include:

1. Estimate hourly ex-post load impacts for the 2022 program year, including:
    a. Hourly and average daily load impacts for each event;
    b. The distribution of hourly and average daily load impacts by customer segment, including: sub-LAP, Local Capacity Area (LCA), CARE/non-CARE customers, net-metering solar customers (NEM), housing type (i.e., detached vs. shared wall residences), AC usage intensity, and device type (i.e., two-way vs. one-way; by one-way device type: UtilityPro, Gen 1, and Gen 2);
    c. Load Impact estimates for SmartAC™-only customers as compared to customers who are dually enrolled in SmartAC™ and SmartRate™;
    d. The opt-out/override rate by customer segment[6]; and
    e. The persistence of load reductions across event-hours for multiple hour events.
2. Produce ex-ante load impact forecasts for 2023 to 2033 by sub-LAP and LCA on an aggregate and per-customer basis for a typical event day and the monthly system peak load day for May through October. Forecasts are based on the following four sets of weather conditions:
    a. PG&E's peaking conditions in a 1-in-2 weather year;
    b. PG&E's peaking conditions in a 1-in-10 weather year;
    c. CAISO peaking conditions in a 1-in-2 weather year; and
    d. CAISO peaking conditions in a 1-in-10 weather year.

The evaluation conforms to the Load Impact Protocols adopted by the California Public Utilities Commission (CPUC) in April 2008 (D.08-04-050).

This report is organized as follows: Section 2 describes the evaluation methods used in the study; Section 3 contains ex-post load impact results; Section 4 contains ex-ante forecasts; Section 5 compares ex-post and ex-ante estimates to those from previous years; and Section 6 provides recommendations. Appendices describe the results of our control group matching process, approaches used to evaluate the quality of results, and contain electronic versions of the required Protocol table generators.

[6] The opt-out rate is the portion of program participants who request by phone or website to override the control of their AC device during specific events.

2. STUDY METHODOLOGY

The primary objectives of this evaluation were outlined in Section 1. This section describes the data and methods used to produce ex-post load impacts and ex-ante forecasts.

2.1 Ex-post Load Impact Evaluation

We estimate load impacts by comparing SmartAC™ customer loads to that of a quasi-experimental matched control group of non-SmartAC™ customers on event days, net of the differences in loads on event-like non-event days. This regression-based approach, known as the difference-in-differences (D-in-D) method, can be used to produce estimates of standard errors to develop confidence intervals about the estimated event-hour or event-day load impacts. The eligible control-group customers consist of residential customers who are not enrolled in any demand response programs, including SmartAC™ or SmartRate™. We match control-group customers based on the similarity of available customer characteristics (e.g., sub-LAP, rate schedule, AC usage level, CARE status, NEM status) as well as usage patterns on non-event days.

2.1.1 Data

To address each of the load impact objectives listed in Section 1, the following data is required:

- *Customer* information for SmartAC™ customers and potential control-group customers (e.g., sub-LAP, LCA, weather station, rate schedule, AC usage level, housing type, CARE status, NEM status);
- Billing-based *interval load data* (i.e., hourly loads for each treatment and potential control group customer) for PY2022 (May 1 through October 31);
- *Weather data* (i.e., hourly temperatures and other variables for PY2022, by weather station);
- *Program event data* (i.e., dates and hours of SmartAC™ and SmartRate™ events and a list of SmartAC™ customers who are dually enrolled in both programs); and
- *Device Information* for SmartAC™ customers (i.e., the type and number of devices installed at each premise and the serial number to determine treatment and control groups for the serial event) as well as SmartAC™ customer opt-outs on each date.

2.1.2 Control Group Selection

The objective in selecting a quasi-experimental matched control group is to identify a group of customers that are as similar as possible to treatment customers, particularly in terms of their hourly load profiles. Due to the high number of potential control customers, we perform the matching in two stages. In the first stage, we use nearest neighbor matching to identify three control customers for each treatment customer that have the closest match in terms of average daily usage (based on monthly billing data), weather station and average cooling degree days, and customer characteristics such as CARE status, NEM status, dwelling type, AC usage, and rate schedule. Following the first-stage matching, we obtain interval load data for the treatment customers and the paired-down set of matched control customers.

The first-stage matching allows for a more tractable matching process in the second stage using the interval load data. The second stage of the matching process uses propensity score matching to find a single control customer for each SmartAC™ customer with the closest hourly load profile on a selection of non-event, non-holiday, weekdays. Moreover, to ensure that customers are matched based on the sensitivity of their energy usage to weather conditions, we perform this matching process using two 24-hour load profiles drawn from different temperature profiles. The first 24-hour load profile reflects usage patterns during the hottest 10 percent of non-event days. The second 24-hour load profile reflects usage over a set of cooler days taken from the middle 50 percent of non-event days. In addition to two 24-hour load profiles, customers are also matched based on CARE status, NEM status, dwelling type, and AC usage level.[7] Finally, we require that SmartAC™ customers are matched to a control customer residing in the same sub-LAP area with a similar rate schedule (i.e., TOU rates vs. other rates).

Propensity score matching involves estimating a regression to determine each customer's probability (i.e., "propensity") of being assigned treatment based upon observable characteristics. Each SmartAC™ customer is then matched to the control customer with the nearest value in terms of their predicted probability, also known as their "propensity score." For the second stage matching, we assume the probability model is a logistic function of the following form:

$$logit(SmartAC_c) = \beta_0 + \sum_{h=1}^{24} \beta_{1,h} avgkW_{c,h} + \sum_{all\ j} \beta_{2,j} X_{c,j} + \varepsilon_c$$

The variables and coefficients in the equation are described in the following table:

Table 2-1: Propensity Score Model Terms

Symbol	Description
$SmartAC_c$	Variable indicating whether customer c is a SmartAC (1) or Control (0) customer
$avgkW_{c,h}$	Average load during hour h for customer *c*
$X_{c,j}$	The value of characteristic j for customer c
β_0	Estimated constant coefficient
$\beta_{1,h}$	Estimated coefficient for hour h of 24-hour load profile
$\beta_{2,i}$	Estimated coefficient for customer characteristic j
ε_c	Error term for customer c

We estimate a logistic regression that includes two 24-hour profiles: one that averages customer load across hot days (i.e., the hottest 10 percent of non-event days) and one that averages customer load across a random selection of cooler days (i.e., days that fall between the 25th and 75th percentile of non-event days based on average temperature). Furthermore, we include indicators for CARE status, NEM status, type of dwelling, and AC usage level as customer characteristics in the regression. This model is estimated separately for three sub-LAP and rate schedule groups (E1, TOU-B/TOU-D, and other rates which includes TOU-C).

To assess the validity of the control-group matching processes, we compare the characteristics and non-event-day load profiles of the matched control-group and treatment customers. More

[7] Propensity score matching does not guarantee that treatment customers are matched with a control that has the same CARE status, NEM status, etc. However, this approach leads to a similar distribution across these characteristics for the treatment group and control group.

details about our matching process, including evaluation of match quality, are provided in Section 3.1 and Appendix A.

2.1.3 Analysis Methods

To produce estimates of ex-post load impacts, we estimate the following panel model for each hour of the day and sub-LAP:

$$kW_{c,d} = \beta_0 + \sum_{i=1}^{n}\left(\beta_{1,i} SmartAC_{i,c,d} \times Evt_{i,d}\right) + \sum_{all\ j} \beta_{2,j}\, X_{c,d,j} \times AC_c + C_c + D_d + \varepsilon_{c,d}$$

The variables and coefficients in the equation are described in the following table:

Table 2-2: Ex-Post Load Impacts Model Terms

Symbol	Description
$kW_{c,d}$	Load during a given hour for customer *c* on day *d*
$SmartAC_{c,d}$	Variable indicating whether customer *c* is a treated SmartAC customer (1) or Control (0) customer on the i^{th} event day (control customers include SmartAC customers in withheld serial groups)
$Evt_{i,d}$	Variable indicating that day *d* is the i^{th} event day (1) or not (0)
$X_{c,d,j}$	The value of weather variable *j* on day *d* for customer *c*
AC_c	Variable indicating customer *c*'s level of AC usage (no AC, low, medium, or high)
β_0	Estimated constant coefficient
$\beta_{1,i}$	Estimated load impact for event *i*
$\beta_{2,j}$	Estimated coefficient for weather variable *j*
C_c	Customer fixed effects
D_d	Date fixed effects
$\varepsilon_{c,d}$	Error term (correlated at the customer level)

The model includes date and customer fixed effects to account for factors that commonly affect all customers over time and time-invariant customer characteristics (e.g., home size). In addition, the model includes time variant weather controls such as the mean temperature across the first 17 hours of the day[8]. The $\beta_{1,i}$ coefficients represent the estimated load impacts for each hour of every event day.

For the two serial test events on August 17th and September 6th, there is an additional control group consisting of SmartAC™ customers with device serial numbers ending in 1 and 2, respectively (i.e., these serial groups were not dispatched for the event). In previous evaluations, we have estimated load impacts for serial events using a separate DID regression that compares the treated and control serial group loads on the serial event day and adjusts for differences between these groups on non-event days. We find that using a combined model that includes all events generally produces similar results to this separate serial event only model. As such, we have used one model to estimate load impacts for all events in this evaluation.

[8] The inclusion of weather variables may improve the effectiveness of the date fixed effects, particularly in models that include customers in different weather regions (e.g., models by sub-LAP). In this evaluation, we have allowed the relationship between weather and loads to vary by AC usage level. This was not necessary to do in previous evaluations, as the relationship was comparable across these groups.

We estimate this model separately for each hour of the day using only event and event-like non-event days (i.e., the hottest 10 percent of non-event days). We estimate the distribution of load impacts across different customer subgroups by interacting the event variables with indicator variables for customer subgroups of interest (e.g., CARE vs. non-CARE). While this approach produces subgroup load impacts for each event, these results are not necessarily representative of the system-wide results but are limited to the sub-LAPs dispatched for sub-LAP events. Moreover, the matching procedure used for sub-LAP events does not guarantee that treatments and matched controls have the same subgroup status.

The Load Impact Protocols require the estimation of uncertainty-adjusted load impacts. Thus, in addition to producing point estimates of the ex-post load impacts, we show the uncertainty around the estimated impacts. These methods use the estimated load-impact parameter values and the associated variances to derive scenarios of hourly load impacts. Due to variation in event hours across event days, we are not able to estimate the uncertainty associated with the typical event day.

We validated the ex-post load impact estimates against simple difference-in-difference calculations from load data. Specifically, for each sub-LAP and event day, we compared the average treatment customer hourly loads to the average control-group hourly loads. The comparisons included events during which the sub-LAP was not dispatched, which allowed us to ensure that the event information we were provided was correct and that our methods did not produce "false positives" (i.e., estimated load impacts for dates/locations in which customers were not dispatched).

2.2 Developing Ex-Ante Load Impacts

Ex-ante load impacts represent forecasts of load impacts that are expected to occur when program events are dispatched in future years under standardized weather conditions.

Estimating ex-ante load impacts requires three key pieces of information:

1. An *enrollment forecast* for relevant components of the program, which consists of forecasts of the number of customers by required type of customer;
2. *Reference loads* by customer type; and
3. A forecast of *load impacts per customer*, again by relevant customer type, where the load impact forecast also varies with weather conditions (if applicable), as determined in the ex-post evaluation.

Ex-ante load impacts are developed for the years 2023 through 2033, both for the monthly system peak load as well as a typical event day, under the four scenarios defined by both utility-specific and CAISO peaking conditions in both 1-in-2 (normal) and 1-in-10 (extreme) scenarios. Furthermore, ex-ante load impacts are developed for the following subgroups of customers:

1. Sub-LAP;
2. LCA; and
3. Customers enrolled in only SmartAC™ vs. customers dually enrolled in SmartAC™ and SmartRate™.

PG&E provided the enrollment forecasts and ex-ante weather conditions for each required scenario. This forecast accounts for changes to the SmartAC™ program approved by the CPUC such as the swap out of remaining one-way devices for two-way devices (D.21-12-015) and changes that have been proposed by PG&E such as the closure of SmartAC™ to new enrollments. The enrollment forecast provided by PG&E explicitly accounts for the swap out of one-way devices for two-way devices in 2023 and the de-enrollment of remaining one-way devices from the program in 2024. Our load impact models distinguish between the performance of one-way and two-way devices to allow program load impacts to adjust as devices are replaced.

2.2.1 Reference Loads

The *per-customer reference loads* are simulated based on regression models, which reflect customer load patterns on non-event days and estimate the relationship between load patterns and weather. Reference loads are simulated using the appropriate weather scenario data (i.e., the 1-in-2 and 1-in-10 weather-year conditions provided by the utilities) and month.

The regression model uses data for treatment customers from all non-holiday weekdays that do not coincide with SmartAC™ or SmartRate™ events from May 1 to October 31 in 2022. Average load profiles are created for each sub-LAP and enrollment segment (i.e., SmartAC™-only and dually enrolled customers). The regressions account for differences in loads by hour, day-of-week, or month by including various indicator control variables.

The ex-ante reference load regression model is as follows:

$$avgkW_{d,h} = \beta_0 + \sum_{h=1}^{24} \beta_{1,h}(CDD65_d \times H_h) + \sum_{h=1}^{24} \beta_{2,h} H_h + \sum_{h=1}^{24} \beta_{3,h}(Mon_d \times H_h) + \sum_{h=1}^{24} \beta_{4,h}(Fri_d \times H_h) + D_d + M_d + \varepsilon_{d,h}$$

The variables and coefficients in the equation are described in the following table:

Table 2-3: Ex-Ante Reference Loads Model Terms

Symbol	Description
$avgkW_{d,h}$	Average load (kWh/customer/hour) on day *d* during hour *h*
$CDD65_d$	The cooling degrees on day *d*
β_0	Estimated constant coefficient
$\beta_{1,h}$	Estimated increase in average load during hour *h* from an increase of one cooling degree
$\beta_{2,h}$	Estimated average load during hour *h*
$\beta_{3,h}$	Estimated difference in average load during hour *h* on Mondays
$\beta_{4,h}$	Estimated difference in average load during hour *h* on Fridays
H_h	Variable indicating that the hour is *h* (1) or not (0)
Mon_d	Variable indicating that day *d* is a Monday (1) or not (0)
Fri_d	Variable indicating that day *d* is a Friday (1) or not (0)
D_d	Day of the week fixed effects
M_d	Month of the year fixed effects
$\varepsilon_{d,h}$	Error term (robust)

The model includes hour fixed effects to allow loads to vary by hour of the day. Monday and Friday hourly fixed effects allow for differences in load profiles on Mondays and Fridays. Day of the week fixed effects allow the daily load level to vary by day of the week. Month fixed effects allow the daily load level to vary by month of the year. The $\beta_{1,h}$ coefficients represent the estimated increase in average loads during hour *h* due to a one cooling degree day increase. We estimate this model separately for each sub-LAP and enrollment segment to be consistent with the load impact model described in Section Load Impacts. We then aggregate results from the sub-LAP level models to LCA based on the share of customers in each sub-LAP and LCA in PY2022.

Reference loads are simulated by applying the cooling degree days from the weather scenarios provided by PG&E to the estimated $\beta_{1,h}$ coefficients along with the other relevant load shape variables and fixed effects. The estimated reference loads for each month and weather scenario are assumed to be the monthly system peak load (or typical event day) for a Wednesday event.

2.2.2 Load Impacts

The *per-customer load impacts* are derived from an analysis of the current and previous ex-post load impact evaluations, with a focus on the effect of weather on the estimated load impacts. The resulting per-customer load impacts are then coupled with the appropriate reference loads to develop the forecasted load impacts and event-day reference load profiles. PG&E has provided enrollment forecast by device type to account for the swap out of all one-way devices for two-way devices in 2023. We estimate the load impact model separately for one-way and two-way devices to allow the ex-ante load impacts to adjust as these device replacements take place.

We develop an ex-ante forecast that projects program performance during sub-LAP events. We include load impacts from all sub-LAP and serial events in PY2020, PY2021, and PY2022 and develop a model that estimates the relationship between ex-post load impacts (for both serial and sub-LAP events) and event day temperatures and simulate the model results for sub-LAP events.

We modeled the relationship between load impacts and weather conditions as follows:

$$Impact_{s,h,evt\ i} = \beta_0 + \beta_{1,h} Mean17 \times H_h + \delta_s Serial_{evt\ i} \times subLAP_s + \mu_s subLAP_s + \varepsilon_{s,h,evt\ i}$$

The variables and coefficients in the equation are described in the following table:

Table 2-4: *Ex-Ante* Load Impacts Model Terms

Symbol	Description
$Impacts_{s,h,evt\ i}$	Estimated load impact in sub-LAP *s* during hour *h* on event *i*
β_0	Estimated constant coefficient
$\beta_{1,h}$	Estimated increase in load impact in hour *h* from a 1 degree increase in the average temperature over the first 17 hours of the day
δ_s	Estimated difference in load impacts in sub-LAP*s* during serial events
μ_s	Estimated difference in load impacts for sub-LAP *s*
Mean17	Average temperature over the first 17 hours of the day
$Serial_{evt\ i}$	Variable indicating if event *i* is a serial event (1) or not (0)
$subLAP_s$	Variable indicating if the sub-LAP is *s* (1) or not (0)
H_h	Variable indicating if the hour is *h* (1) or not (0)
$\varepsilon_{s,h,evt\ i}$	Error term (robust)

The β coefficients represent the estimated increase in load impacts in hour h that results from a one-degree increase in the average temperature over the first seventeen hours of the event day. The δ coefficient measures the additional load impacts during serial events, which may vary by sub-LAP, and the μ coefficients allow load impacts to vary by sub-LAP. The standard errors from this model are the basis for the uncertainty-adjusted load impacts.

We build our ex-ante load impact forecasts based on a combination of sub-LAP and serial events dispatched in 2020, 2021, and 2022. As we discuss in Section 3.7, there were dispatch issues for some two-way devices in 2022. We give the PY2020 and PY2021 load impacts twice the weight in the regression as the PY2022 load impacts to reflect some level of operational issues in the future but allow the current dispatch issues to be partially resolved. The load impacts simulated from this model are for sub-LAP events to reflect the nature of how events will be dispatched for the SmartAC™ program in future program years.[9]

In addition, we separately estimate the model using load impacts for one-way and two-way devices. We simulate ex-ante results using different weather scenarios and compute the aggregate load impacts by using the enrollment forecast for one-way and two-way devices that explicitly accounts for the changing program composition by device type in 2023. We assume that load impacts are comparable for SmartAC™-only and dually enrolled customers based on our examination of the relative performance of these customers during sub-LAP events in 2021 and 2020[10]. We further discuss the performance of SmartAC™-only and dually enrolled customers in Section 3.5.1.

The snapback in the three hours following the event (when the customer's AC unit is running more than it would have in the absence of the event day to bring the home's temperature back to the thermostat's set point) is modeled as a share of the total event-hour load impact by sub-LAP. That is, larger event-hour load impacts are associated with higher post-event snapback.

As in all recent load impact evaluations, we present results of analyses of the relationship between current ex-post and ex-ante load impacts, focusing on key factors causing differences between them (e.g., differences between observed temperatures in 2022 and the temperatures in the various weather scenarios). We will also compare current and previous ex-post load impacts, and current and previous ex-ante load impacts. Additionally, we analyze the impact of device swap-outs on the forecasted load impacts.

3. EX-POST LOAD IMPACTS

This section documents the findings from the ex-post load impact analysis. The primary load impact results include estimates of the aggregate and per-customer event-hour load impacts for each event. Due to the nature of sub-LAP events (nine out of sixteen events), where different sub-LAPs are dispatched for different events and, in some cases, different event hours, we are not able to present results for the typical event day.[11] Instead, we average the hourly load

[9] To simulate the load impacts for sub-LAP events, we set $Serial_{evti}$ equal to zero so that the incremental load impact during serial events is not included in the simulated load impacts.

[10] We are unable to determine whether SmartAC™-only and dually enrolled customers have comparable load impacts in 2022 because all system-wide events were dual events and only 7 sub-LAPs were ever dispatched for events in SmartAC™-only events this year.

[11] Note, in the Protocol table generator, we use September 7 for the "typical event day."

impacts across all potential, full event hours, or in some cases choose an illustrative event hour or event day. Our main findings are summarized in this section in various figures and data tables, while detailed results for each hour, event, and sub-LAP or LCA are available in electronic form in Protocol table generators provided along with this report.

As described in Section 2, all results presented in this section are derived from D-in-D regression analyses of hourly data for SmartAC™ customers and a control group. In addition to the controls described in the estimated model in Section 2.1.3, we control for the eight concurrent SmartRate™ event days by including separate indicators for customers who are dually enrolled in SmartAC™ and SmartRate™. Furthermore, we drop SmartRate™-only events from the pool of SmartAC™ non-event days to ensure that non-event loads are comparable between SmartAC™ customers and controls on all non-event days.

3.1 Control Group Matching Results

In this section, we present summaries of our control group matching process used to create a control group for the sub-LAP events. Our validity assessment focuses on comparisons of treatment and control-group loads for selected event-like non-event days. We also report statistics such as the mean absolute percentage error (MAPE) and mean percent error (MPE), which provide measures of accuracy and bias in the matches, respectively.[12]

Table 3-1 provides the mean percentage error (MPE) and mean absolute percentage error (MAPE) calculated across the average 24-hour load profile as well over the RA window. We evaluate match quality based on the two 24-hour load profiles that we used in matching. The first corresponds to the average load profile over the hottest 10 percent of event-like non-event days, while the second corresponds to a random sample of cooler days taken from the middle 50 percent of days based on temperature. We also evaluate the match quality of the cooler days (i.e., the middle 50 percent of days based on temperature) that were not sampled for use in matching and the weekend non-event days, which helps assess whether there is good match quality on out-of-sample days. Additional results by sub-LAP are presented in Appendix A.

Table 3-1: Match Quality Statistics

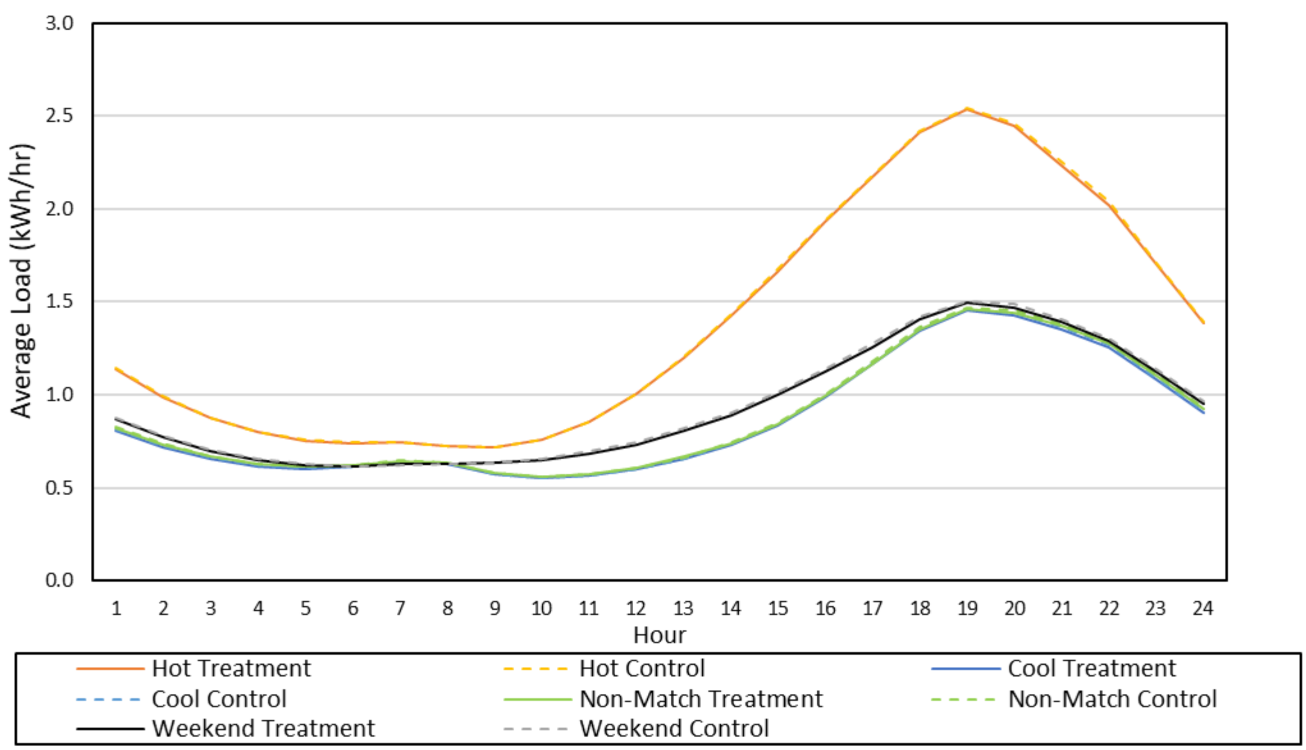
Comparison Days	MPE	MAPE	MPE RA Window	MAPE RA Window
Hot Days	0.4%	0.4%	0.5%	0.5%
Cool Days	0.5%	0.6%	0.9%	0.9%
Non-Matching Cool Days	0.4%	0.5%	0.8%	0.8%
Weekend Days	1.1%	1.2%	1.1%	1.1%

Figure 3-1 illustrates the matched load profiles for selected event-like days. This figure contains the average hourly profiles for the treatment and matched control-group customers by day type including hot days, cooler days that were used in matching, the cooler days that were not used in matching, and weekend days (not used in matching). The solid lines represent the average usage

[12] Note that “biased” matches do not necessarily adversely affect the estimated load impacts, as we employ a difference-in-differences estimation methodology that accounts for load differences during the matching period.

of treatment customers on hot days (red), cooler matching days (blue), cooler non-matching days (green), and weekend days (black). Similarly, the dashed lines represent the average usage of the matched control customers on hot days (yellow), cooler matching days (blue), cooler non-matching days (green), and weekend days (gray). Regardless of the comparison day, the average load profiles are nearly identical between treatment and control. Cool days that are used in matching have comparable loads to cool days that are not used in matching and the control loads on each type of day tracks the treatment loads very closely. Moreover, weekend loads have a comparable load shape to cool weekdays. These results also suggest that matches based on weekdays are appropriate for estimating load impacts for weekend events dispatched in PY2022.

Figure 3-1: Treatment and Control Non-Event Day Load Profiles



3.2 Overall Load Impacts

This section summarizes overall results for all SmartAC™ events. In later sections, we focus attention on sub-LAP events, serial events, and discuss how these load impacts are distributed across subgroups of interest, including for customers who are dually enrolled in SmartRate™.

The ex-post load impacts are summarized for all full event hours for the fourteen event days in Figure 3-2.[13] The bars indicate the magnitude of the average per-customer load impact (in

[13] Neither emergency event is included in this summary. The September 5th event was dispatched from 8:01 to 9:18 p.m. and did not include any full event hours. While the first hour of the event nearly spanned the full hour from 8 to 9 p.m., it takes time for devices to begin cycling AC units. In particular, load impacts tend to be lower for one-way devices during the first hour of events. An examination of load impacts during

kWh/customer/hour) during the full event hours dispatched for each event, while the labels show the maximal range of full event hours over which all customers were dispatched.[14] The gold bars indicates the average per-customer load impact during the full event hours of the serial event on August 17th and September 6th. The blue bars represent the sub-LAP events. The green bands correspond to 80 percent confidence intervals around these estimates (i.e., the 10th and 90th percentile scenarios from the uncertainty-adjusted load impacts). The orange line represents the average temperatures experienced by the customers during the event.

Overall results range from 0.13-0.36 kWh/customer/hour

These results indicate that SmartAC™ customers have statistically significant load reductions on each of the fourteen event days, ranging from 0.13 kWh/customer/hour on July 24th to 0.36 kWh/customer/hour on July 17th with an average of 0.27 kWh/customer/hour. These load impacts are lower than in previous evaluations due to two-way device dispatch issues that occurred throughout 2022. When performance is isolated to devices that had no dispatch issues in 2022, load impacts increase by an average of 0.03 kWh/customer/hour across all devices, but load impacts increase more dramatically when we compare two-way devices without dispatch issues to all two-way devices. A more detailed discussion of the two-way device dispatch issues can be found in Section 3.7.

Temperatures explain most of the variation in per-customer load impacts

Figure 3-2 also shows that events with lower load impacts correspond to cooler event temperatures. Differences in event temperature explain most of the variation of average load impacts across events. Differences in the sub-LAPs dispatched and variation in sub-LAP performance are another factor driving load impact variation across events.

Some weekend and holiday events have higher load impacts

There are four weekend or holiday SmartAC™ event days in PY2022 (July 16th, 17th, and 24th and September 5th). The events on July 17th and September 5th have the highest per-customer load impacts during PY2022, and the load impacts are higher than weekday events with comparable temperatures (September 2nd and 7th). The weekend event on July 24th has the lowest per-customer impact and the coolest average event temperature.

The serial event on September 6th has comparable load impact to sub-LAP events during the heat wave

Historically, load impacts tend to be higher during serial events, however the average load impact for the serial event on September 6th is 0.34 kWh/customer/hour compared to 0.31 kWh/customer/hour during the sub-LAP events on September 7th and 8th, when temperatures are slightly lower. Moreover, the average per-customer load impact is slightly higher on September

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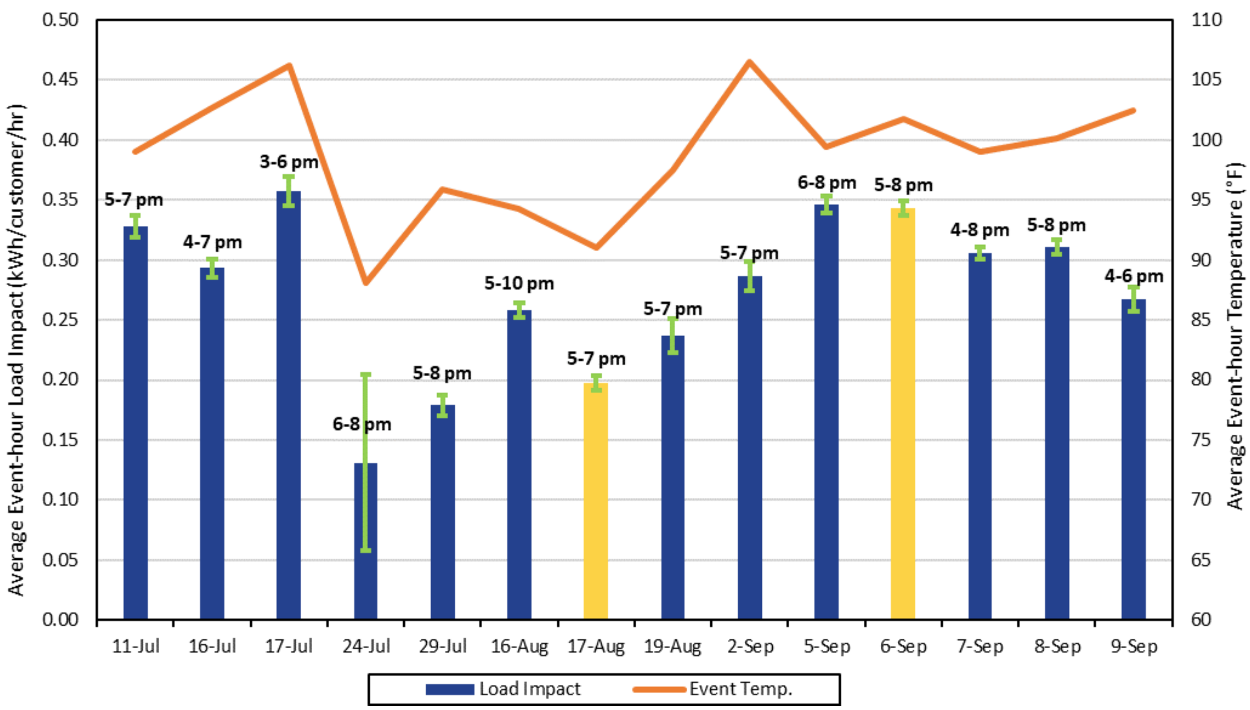
this hour suggests that they are considerably lower than the preceding event hours, suggesting the minute gap between events leads to lower load impacts compared to an emergency event that did not have any gap with the preceding event. The September 6th event, dispatched from 8:01 to 8:42 p.m., lasted less than an hour.

[14] On July 16th, July 17th, July 29th, Aug 16th and Sep 8th, sub-LAPs were dispatched for different event hours. In Figure 3-2, we aggregate across hours during which customers were dispatched, while in the Protocol table generators, the hourly load impacts are aggregated across all dispatched sub-LAPs dispatched during the event day for each hour of the day, which can dampen the estimated load impacts during hours in which only a subset of sub-LAP are dispatched.

5th at 0.35 kWh/customer/hour. The serial event on August 17th has the second coolest average event temperature, which explains the low load impact on that day.

Figure 3-2: Average Event-Hour Load Impacts by Event



The number of dispatched customers and average event temperatures drive large variation in aggregate event load impacts

Table 3-2 presents a more complete summary of event information, including the sub-LAPs dispatched, the sub-LAP-specific event hours, the type of event, and the number of customers dispatched, as well as average load impacts (per-customer and in aggregate), reference loads, and percentage load impacts across the full event hours for which each sub-LAP was dispatched for each event day. The correlation coefficient between the event temperature and per-customer load impacts is 0.78. The number of dispatched customers varies dramatically across events, from 463 customers dispatched for the sub-LAP event on July 24th to 66,044 customers in the system-wide event on September 5th. Aggregate load impacts, which averaged 11.39 MWh/hour, ranged from 0.06 MWh/hour on July 24th to 22.83 MWh/hour on September 5th.

Table 3-2: Average Event-Hour Load Impacts by Event

Date	Smart-Rate™ Event?	Type of Event	Event Hours (p.m.)	Sub-LAPs/Serial Groups Dispatched	# Dispatched	Average Event Hour				
						Reference (kW/Cust)	Impact (kW/Cust)	% Impact	Agg. Impact (MW)	Avg. Temp (°F)
7/11	Yes	Market	5:00-7:00	PGNP, PGSI, PGKN, PGZP, PGNC	24,871	2.82	0.33	11.6%	8.15	99.0
7/16	No	Market	4:00-6:00	PGSI, PGST, PGKN, PGF1, PGZP	45,206	2.71	0.29	10.8%	13.26	102.6
			5:00-7:00	PGNP						
7/17	No	Market	3:00-5:00	PGF1	17,694	3.07	0.36	11.6%	6.31	106.2
			4:00-6:00	PGKN, PGZP						
7/24	No	Market	6:00-8:00	PGNC	463	2.35	0.13	5.6%	0.06	88.1
7/29	No	Market	5:00-7:00	PGKN, PGF1, PGZP, PGNC	28,714	2.69	0.18	6.7%	5.14	95.9
			6:00-8:00	PGNP						
8/16	Yes	Market	5:00-7:00	PGEB, PGSB, PGP2	63,445	2.87	0.26	9.0%	16.37	94.2
			6:00-8:00	PGKN, PGF1, PGNC, PGNB						
			7:00-9:00	PGNP, PGST						
			8:00-10:00	PGSI						
8/17	Yes	Test	4:30-7:00	All Sub-LAPs, Serial Group 1 withheld	58,998	2.29	0.20	8.6%	11.65	91.1
8/19	Yes	Market	5:00-7:00	PGSI	10,655	2.75	0.24	8.6%	2.53	97.4
9/2	No	Market	5:00-7:00	PGKN, PGF1, PGZP	17,513	3.35	0.29	8.6%	5.02	106.5
9/5	Yes	Market	6:00-8:00	PGNP, PGSI, PGST, PGKN, PGF1, PGZP, PGNC, PGFG, PGNB, PGEB, PGSB, PGP2, PGCC	66,044	3.37	0.35	10.3%	22.83	99.4
9/6	Yes	Test	5:00-8:00	All Sub-LAPs, Serial Group 2 withheld	58,553	3.36	0.34	10.2%	20.10	101.8
9/7	Yes	Market	4:00-8:00	PGNP, PGSI, PGST, PGKN, PGF1, PGZP, PGNC, PGNB, PGEB, PGSB, PGP2, PGCC	64,550	3.05	0.31	10.0%	19.73	99.0
9/8	Yes	Market	5:00-7:00	PGNP, PGST, PGKN, PGFG, PGNB, PGEB, PGCC	65,857	3.26	0.31	9.7%	21.02	100.1
			5:00-8:00	PGSI, PGF1, PGZP, PGNC, PGSB, PGP2						
9/9	No	Market	4:00-6:00	PGNP, PGSI, PGST, PGNC	27,554	2.75	0.27	9.7%	7.36	102.4

Percentage load impacts range from 5.6 percent to 11.6 percent

There is variation in the percentage load impacts ranging from 5.6 percent of reference loads on July 24th (only PGNC was dispatched) to 11.6 percent on July 17th and July 11th. The correlation between percentage load impact and event temperatures is 0.67. Percentage load impacts also depend on which sub-LAPs are dispatched for events.

Load Impacts are persistent across event hours for multiple hour events

Table 3-3 compares average per-customer load impacts and hourly temperatures across hours within each event to analyze whether load impacts persist across event hours.[15] The event on September 7th lasts four hours and all sub-LAPs except PGFG are dispatched. There are two three-full-hour events on September 6th and September 8th. Load impacts tend to peak during the second hour of multi-hour events, which is driven by one-way devices taking time to fully dispatch at the beginning of events.[16] For events lasting three or more hours, load impacts decline during the third and fourth hours, which is driven by large declines in hourly temperatures. This effect varies by event, with load impacts declining by 0.12 kWh/customer/hour during the third hour on September 8th, while there is a smaller decline on September 6th and 7th despite large (five degree or more) drops in temperature in all cases. On September 7th, average load impact declines by 0.09 kWh/customer/hour in the fourth event hour, consistent with a six degree drop in hourly temperatures.

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[15] On July 16th, July 17th, July 29th, August 16th and September 8th, different sub-LAPs are dispatched for different event hours. Sub-LAPs dispatched at different times are summarized separately.

[16] Differences between one-way and two-way device performance were discussed in detail in the previous two evaluations.

Table 3-3: Persistence of Load Impacts Across Consecutive Events

Date	Full Event Hours (p.m.)	Smart-Rate™ Event?	Impact (kW/Cust)				Avg. Temp (°F)			
			Hour 1	Hour 2	Hour 3	Hour 4	Hour 1	Hour 2	Hour 3	Hour 4
7/11	5:00-7:00	Yes	0.31	0.34			99.7	98.3		
7/16	4:00-6:00	No	0.27	0.34			103.0	103.1		
	5:00-7:00		0.24	0.25			101.8	100.8		
7/17	3:00-5:00	No	0.26	0.31			106.4	107.1		
	4:00-6:00		0.52	0.53			105.1	104.3		
7/24	6:00-8:00	No	0.14	0.12			90.3	85.8		
7/29	5:00-7:00	No	0.22	0.24			100.9	99.6		
	6:00-8:00		0.07	0.11			90.6	86.4		
8/16	5:00-7:00	Yes	0.29	0.34			93.6	89.2		
	6:00-8:00		0.28	0.30			103.7	101.6		
	7:00-9:00		0.20	0.20			98.2	93.4		
	8:00-10:00		0.20	0.12			88.4	83.7		
8/17	4:30-7:00	Yes	0.21	0.19			91.8	90.3		
8/19	5:00-7:00	Yes	0.23	0.24			98.9	96.0		
9/2	5:00-7:00	No	0.30	0.27			107.7	105.4		
9/5	6:00-8:00	Yes	0.34	0.35			102.3	96.5		
9/6	5:00-8:00	Yes	0.28	0.40	0.34		106.7	102.5	96.1	
9/7	4:00-8:00	Yes	0.27	0.36	0.34	0.25	103.9	102.1	97.8	92.2
9/8	5:00-7:00	Yes	0.32	0.40			103.8	99.3		
	5:00-8:00		0.26	0.34	0.22		103.4	99.9	94.2	
9/9	4:00-6:00	No	0.23	0.30			102.8	102.0		

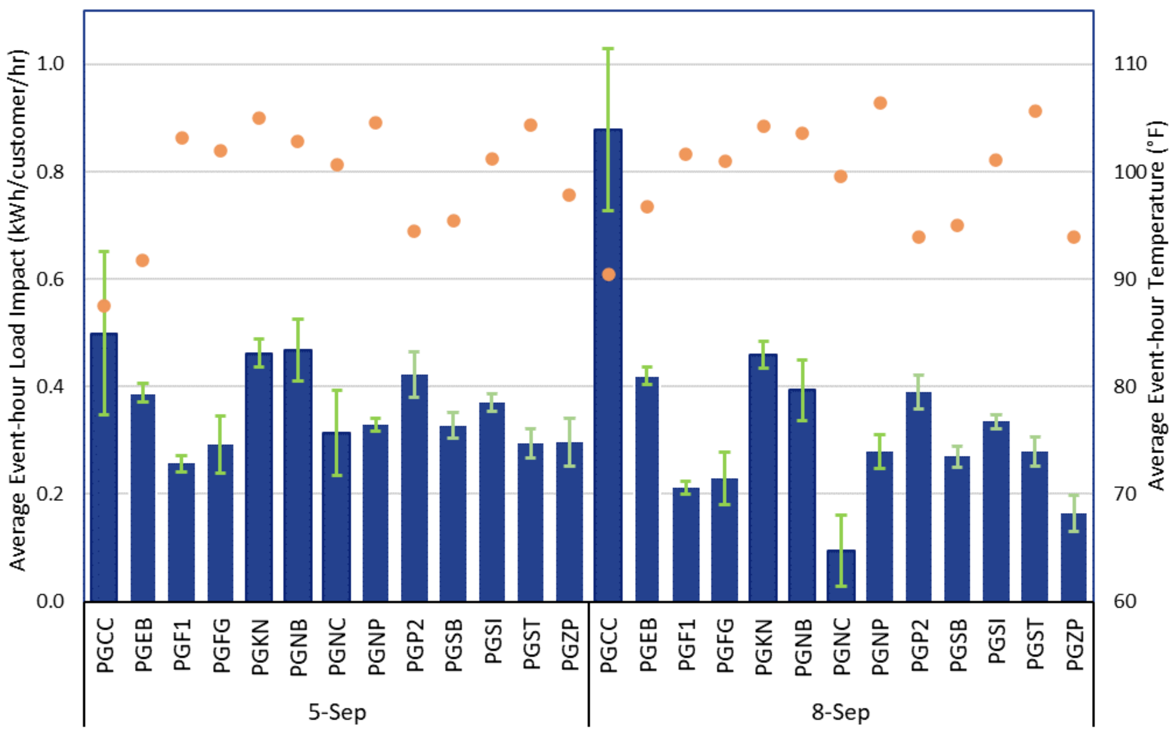
3.3 Sub-LAP Event Load Impacts

Next, we examine the results for sub-LAP events at the sub-LAP level. Figure 3-3 summarizes the sub-LAP level ex-post load impacts for the September 5th and 8th events in which all sub-LAPs were dispatched for both events. The bars indicate the magnitude of the average per-customer load impacts (in kWh/customer/hour) across the sub-LAP-specific event hours. The green bands correspond to 80 percent confidence intervals around these estimates (i.e., the 10th and 90th percentile scenarios from the uncertainty-adjusted load impacts). The orange scatter plot represents the average temperatures experienced by the customers in each sub-LAP during the event hours.

Sub-LAP event load impacts range from 0.09 to 0.88 kWh/customer/hour

Across all sub-LAPs, load impact ranges from 0.09 kWh/customer/hour for PGNC on September 8th to 0.88 kWh/customer/hour for PGCC on September 8th. Both PGCC and PGNC have large uncertainty associated with the estimated load impacts due to the low number of customers enrolled in these sub-LAPs (less than 500 customers) which makes the estimated results less reliable. Figure 3-3 illustrates that there is considerable variation in load impacts across sub-LAPs within the same event and there is large variation in temperature between sub-LAPs during the same event. There is also variation in load impacts within sub-LAPs across events, which is usually driven by differences in temperature. However, higher temperature is associated with lower per-customer load impacts for PGNB, PGNP and PGST. Across sub-LAPs, temperature variation explains some of the variation in load impacts within the same event, however some sub-LAPs perform worse than others at similar or higher temperatures. Load impacts in PGF1, PGNP and PGST are considerably lower than PGEB and PGSI despite higher temperatures. This likely relates to the dispatch issues that we discuss in Section 3.7, which do not impact all sub-LAPs equally. In fact, PGF1 and PGST are two of the sub-LAPs most impacted by dispatch issues and when we compare load impacts for the subset of devices that were successfully dispatched, load impacts increase by 0.03 kWh/customer/hour for PGF1 and 0.11 kWh/customer/hour for PGST.

Figure 3-3: Average Event-Hour Load Impacts by Sub-LAP for Sub-LAP Events



PGEB has the highest aggregate load impacts

Table 3-4 provides the number of customers dispatched, the average event load impacts (per-customer and in aggregate), reference loads, and percentage load impacts for each sub-LAP event in 2022. The customers dispatched varies across sub-LAPs leading to aggregate load impacts that range from 0.04 MWh/hour for PGNC on September 8th to 5.96 MWh/hour for PGEB on September 8th. In percentage terms, the load impacts range from 3.3 percent of reference loads for PGNC on September 8th to 23.9 percent for PGCC on September 8th.

Table 3-4: Average Event-Hour Load Impacts by Sub-LAP and Event for Sub-LAP Events

Date	Sub-LAP	Full Event Hours (p.m.)	Smart Rate™ Event?	# Dis-patched	Average Event Hour				
					Reference (kW/Cust)	Impact (kW/Cust)	% Impact	Agg. Impact (MW)	Avg. Temp (°F)
7/11	PGKN	5:00-7:00	Yes	3,235	3.08	0.53	17.2%	1.71	103.3
	PGNC	5:00-7:00		408	2.76	0.43	15.4%	0.17	92.9
	PGNP	5:00-7:00		9,145	2.79	0.30	10.9%	2.78	99.3
	PGSI	5:00-7:00		10,704	2.83	0.30	10.5%	3.18	98.6
	PGZP	5:00-7:00		1,379	2.43	0.22	8.9%	0.30	91.4
7/16	PGF1	4:00-6:00	No	12,480	2.99	0.28	9.2%	3.45	105.9
	PGKN	4:00-6:00		3,656	2.92	0.49	16.6%	1.77	104.8
	PGNP	5:00-7:00		10,636	2.53	0.24	9.6%	2.59	101.3
	PGSI	4:00-6:00		11,656	2.55	0.30	11.7%	3.46	101.2
	PGST	4:00-6:00		5,219	2.61	0.28	10.8%	1.48	100.1
	PGZP	4:00-6:00		1,559	2.62	0.33	12.5%	0.51	99.7
7/17	PGF1	3:00-5:00	No	12,479	3.01	0.29	9.5%	3.57	106.8
	PGKN	4:00-6:00		3,656	3.40	0.61	18.1%	2.24	107.3
	PGZP	4:00-6:00		1,559	2.76	0.32	11.7%	0.50	98.8
7/24	PGNC	6:00-8:00	No	463	2.35	0.13	5.6%	0.06	88.1
7/29	PGF1	5:00-7:00	No	12,449	3.05	0.16	5.2%	1.96	100.2
	PGKN	5:00-7:00		3,643	3.28	0.52	15.9%	1.90	105.5
	PGNC	5:00-7:00		462	2.73	0.10	3.6%	0.05	92.0
	PGNP	6:00-8:00		10,604	2.14	0.09	4.2%	0.96	88.5
	PGZP	5:00-7:00		1,556	2.28	0.18	7.9%	0.28	90.4
8/16	PGEB	5:00-7:00	Yes	14,290	2.92	0.31	10.7%	4.45	92.2
	PGF1	6:00-8:00		11,125	3.38	0.25	7.4%	2.77	103.7
	PGKN	6:00-8:00		3,217	3.45	0.45	13.1%	1.46	103.5
	PGNB	6:00-8:00		1,070	2.53	0.24	9.5%	0.26	92.1
	PGNC	6:00-8:00		407	2.79	0.29	10.4%	0.12	93.1
	PGNP	7:00-9:00		9,114	2.86	0.20	7.0%	1.83	95.8
	PGP2	5:00-7:00		2,914	2.47	0.31	12.7%	0.91	89.4
	PGSB	5:00-7:00		6,249	2.29	0.33	14.3%	2.04	90.4
	PGSI	8:00-10:00		10,670	2.51	0.16	6.2%	1.66	86.1
	PGST	7:00-9:00		4,389	3.10	0.20	6.4%	0.87	95.8
8/19	PGSI	5:00-7:00	Yes	10,655	2.75	0.24	8.6%	2.53	97.4
9/2	PGF1	5:00-7:00	No	12,364	3.33	0.22	6.6%	2.74	106.9
	PGKN	5:00-7:00		3,601	3.44	0.51	14.9%	1.84	106.3
	PGZP	5:00-7:00		1,548	3.29	0.28	8.6%	0.44	103.7
9/5	PGCC	6:00-8:00	Yes	203	3.61	0.50	13.8%	0.10	87.5
	PGEB	6:00-8:00		14,253	3.34	0.39	11.6%	5.53	91.8
	PGF1	6:00-8:00		11,049	3.57	0.26	7.2%	2.84	103.2
	PGFG	6:00-8:00		1,361	3.17	0.29	9.2%	0.40	102.0
	PGKN	6:00-8:00		3,188	3.69	0.46	12.5%	1.47	105.0
	PGNB	6:00-8:00		1,064	3.21	0.47	14.5%	0.50	102.8
	PGNC	6:00-8:00		406	3.03	0.31	10.4%	0.13	100.6
	PGNP	6:00-8:00		9,070	3.46	0.33	9.5%	2.98	104.5

Date	Sub-LAP	Full Event Hours (p.m.)	Smart Rate™ Event?	# Dis-patched	Average Event Hour				
					Reference (kW/Cust)	Impact (kW/Cust)	% Impact	Agg. Impact (MW)	Avg. Temp (°F)
	PGP2	6:00-8:00		2,912	3.11	0.42	13.6%	1.23	94.5
	PGSB	6:00-8:00		6,225	2.76	0.33	11.9%	2.04	95.5
	PGSI	6:00-8:00		10,614	3.41	0.37	10.8%	3.93	101.2
	PGST	6:00-8:00		4,328	3.60	0.29	8.2%	1.28	104.3
	PGZP	6:00-8:00		1,371	3.46	0.30	8.6%	0.41	97.9
9/7	PGCC	4:00-8:00	Yes	203	3.06	0.63	20.7%	0.13	86.3
	PGEB	4:00-8:00		14,229	2.86	0.34	11.8%	4.79	91.5
	PGF1	4:00-8:00		11,030	3.51	0.26	7.5%	2.91	107.4
	PGKN	4:00-8:00		3,183	3.67	0.48	13.1%	1.53	108.3
	PGNB	4:00-8:00		1,060	2.45	0.28	11.5%	0.30	94.0
	PGNC	4:00-8:00		404	2.64	0.15	5.5%	0.06	95.8
	PGNP	4:00-8:00		9,051	2.97	0.25	8.5%	2.30	102.1
	PGP2	4:00-8:00		2,904	2.72	0.33	12.1%	0.96	90.7
	PGSB	4:00-8:00		6,203	2.36	0.28	11.9%	1.74	92.1
	PGSI	4:00-8:00		10,591	3.14	0.33	10.7%	3.55	100.9
	PGST	4:00-8:00		4,321	3.26	0.26	7.9%	1.12	100.8
	PGZP	4:00-8:00		1,371	3.32	0.25	7.7%	0.35	101.7
9/8	PGCC	5:00-7:00	Yes	203	3.67	0.88	23.9%	0.18	90.5
	PGEB	5:00-7:00		14,215	3.36	0.42	12.5%	5.96	96.8
	PGF1	5:00-8:00		11,026	3.33	0.21	6.4%	2.33	101.7
	PGFG	5:00-7:00		1,355	3.04	0.23	7.5%	0.31	101.0
	PGKN	5:00-7:00		3,182	3.43	0.46	13.4%	1.46	104.3
	PGNB	5:00-7:00		1,058	3.01	0.39	13.1%	0.42	103.6
	PGNC	5:00-8:00		402	2.87	0.09	3.3%	0.04	99.5
	PGNP	5:00-7:00		9,047	3.38	0.28	8.3%	2.53	106.4
	PGP2	5:00-8:00		2,902	3.10	0.39	12.6%	1.13	94.0
	PGSB	5:00-8:00		6,194	2.76	0.27	9.8%	1.67	95.0
	PGSI	5:00-8:00		10,584	3.32	0.34	10.1%	3.55	101.0
	PGST	5:00-7:00		4,319	3.57	0.28	7.8%	1.21	105.6
	PGZP	5:00-8:00		1,370	2.88	0.16	5.7%	0.23	93.9
9/9	PGNC	4:00-6:00	No	455	2.43	0.15	6.2%	0.07	97.3
	PGNP	4:00-6:00		10,502	2.80	0.26	9.2%	2.70	103.6
	PGSI	4:00-6:00		11,512	2.59	0.28	10.8%	3.22	101.1
	PGST	4:00-6:00		5,085	3.06	0.27	8.8%	1.38	103.3

Load impacts are similar across sub-LAP event hours with large post-event snapback

Figure 3-4 shows an example of the aggregate hourly reference loads, observed loads, and estimated load impacts using the September 7th sub-LAP event, in which over 97 percent enrolled SmartAC™ customers were dispatched for the same event hours from 4 to 8 p.m. Table 3-5 contains the hourly results for September 7th in the manner required by the Protocols, including hourly temperatures and uncertainty adjusted load impacts (not displayed in Figure 3-4). Notice that the load impacts peak at 23.3 MWh during the second hour of this event (5 to 6 p.m.). Furthermore, there is statistically significant post-event snapback, when loads increase by 18.9 MWh the first hour after the event. The snapback declines over the course of the evening.

Figure 3-4: Hourly Load Impacts on September 7, 2022

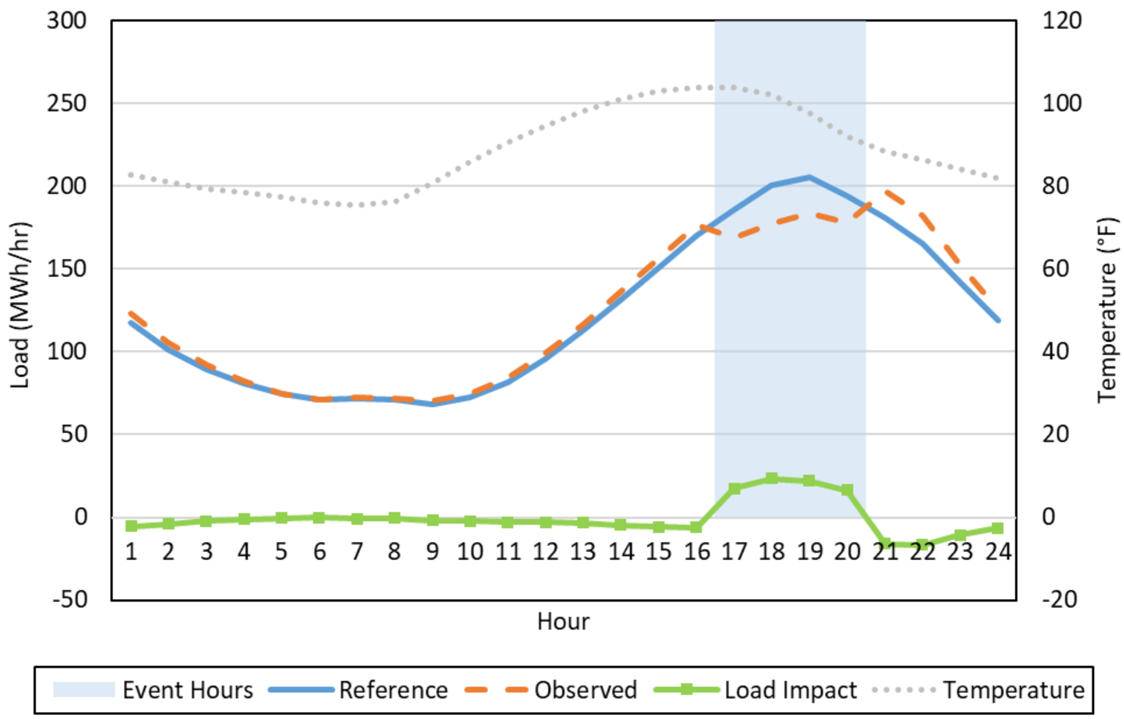


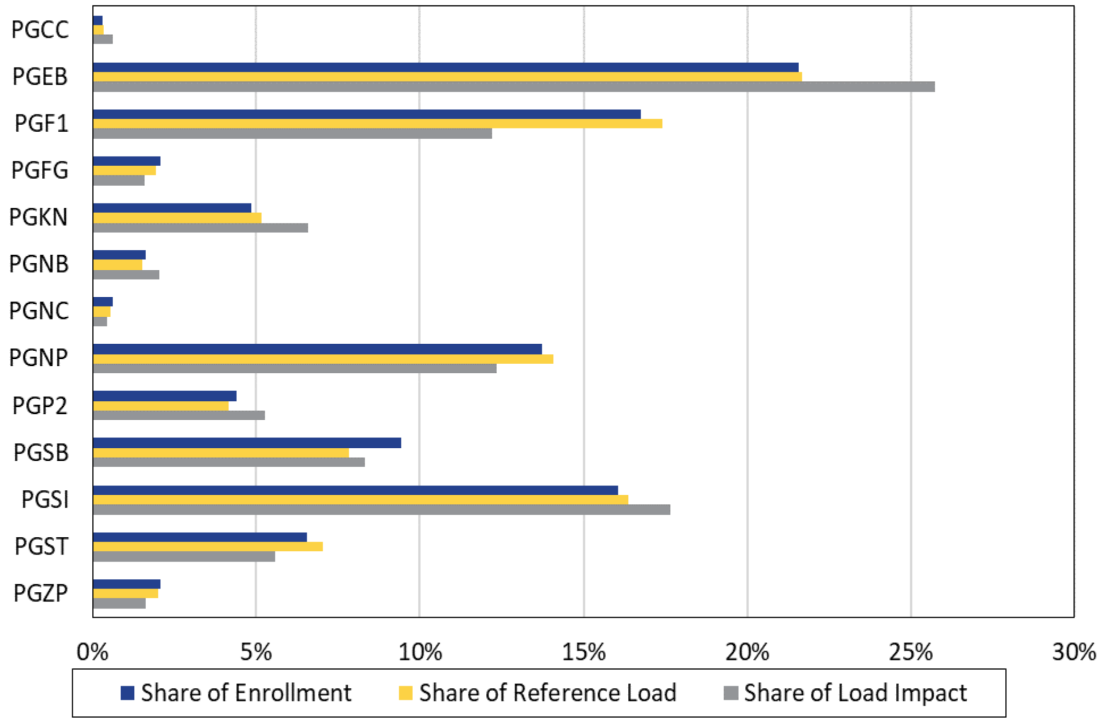
Table 3-5: Hourly Load Impacts and Uncertainty Adjusted Estimates on September 7, 2022

Hour Ending	Estimated Reference Load (MWh/hour)	Observed Event Day Load (MWh/hour)	Estimated Load Impact (MWh/hour)	Weighted Average Temperature (°F)	Uncertainty Adjusted Impact (MWh/hour)- Percentiles				
					10th%ile	30th%ile	50th%ile	70th%ile	90th%ile
1	117.6	122.9	-5.30	82.8	-5.84	-5.52	-5.30	-5.07	-4.75
2	101.7	105.6	-3.94	81.2	-4.44	-4.14	-3.94	-3.73	-3.43
3	89.7	92.1	-2.36	79.5	-2.82	-2.55	-2.36	-2.16	-1.89
4	80.8	82.1	-1.27	78.7	-1.70	-1.45	-1.27	-1.09	-0.84
5	74.3	74.9	-0.54	77.5	-0.93	-0.70	-0.54	-0.38	-0.14
6	71.2	71.5	-0.26	76.0	-0.62	-0.41	-0.26	-0.11	0.10
7	71.6	72.4	-0.75	75.4	-1.11	-0.90	-0.75	-0.61	-0.39
8	71.1	71.8	-0.69	76.2	-1.07	-0.85	-0.69	-0.53	-0.31
9	68.5	70.4	-1.93	80.7	-2.33	-2.09	-1.93	-1.76	-1.52
10	72.6	74.8	-2.15	85.9	-2.59	-2.33	-2.15	-1.97	-1.71
11	81.9	84.7	-2.85	90.6	-3.32	-3.04	-2.85	-2.65	-2.37
12	95.9	99.0	-3.15	94.5	-3.66	-3.36	-3.15	-2.94	-2.64
13	113.7	117.1	-3.44	98.2	-3.99	-3.66	-3.44	-3.21	-2.89
14	131.8	136.4	-4.64	101.1	-5.22	-4.88	-4.64	-4.40	-4.06
15	150.6	156.4	-5.81	103.0	-6.41	-6.05	-5.81	-5.57	-5.21
16	170.5	176.5	-6.07	104.0	-6.68	-6.32	-6.07	-5.82	-5.46
17	186.1	168.8	17.26	103.9	16.66	17.02	17.26	17.51	17.87
18	200.5	177.3	23.25	102.1	22.64	23.00	23.25	23.51	23.87
19	205.9	183.9	21.96	97.8	21.35	21.71	21.96	22.20	22.56
20	194.4	177.9	16.45	92.2	15.88	16.22	16.45	16.68	17.01
21	180.8	196.8	-16.02	88.5	-16.61	-16.26	-16.02	-15.78	-15.43
22	165.5	182.4	-16.88	86.5	-17.46	-17.12	-16.88	-16.64	-16.30
23	142.3	153.0	-10.62	84.2	-11.16	-10.84	-10.62	-10.39	-10.07
24	119.0	125.4	-6.41	82.0	-6.92	-6.62	-6.41	-6.21	-5.91
By Period:	Estimated Reference Energy Use (MWh/hour)	Observed Event Day Energy Use (MWh/hour)	Estimated Change in Energy Use (MWh/hour)	Cooling Degree Hours (Base 75° F)	Uncertainty Adjusted Impact (MWh/hour) - Percentiles				
					10th	30th	50th	70th	90th
Daily	2,958.2	2,974.3	-16.14	322.3	-21.97	-18.53	-16.14	-13.75	-10.30
Avg. Event Hour	196.7	177.0	19.73	95.9	19.43	19.61	19.73	19.85	20.03

PGEB, PGSI, PGNP and PGF1 produced 68 percent of load reductions

Next, we look at how load impacts are distributed across sub-LAPs. We focus this analysis on the load impacts from events on September 5th from 6 to 8 p.m. and September 8th from 5 to 7 p.m. All sub-LAPs were dispatched for both events. Figure 3-5 compares the sub-LAP shares of estimated aggregate event-hour load impacts, reference loads, and enrollments. PGEB, PGSI, PGNP and PGF1 have 68 percent of enrolled customers and produce 68 percent of the total load reductions. The share of load impacts for PGEB exceeds the share of enrollments and reference loads by over 4 percent, which is the largest among all sub-LAPs. The share of load impacts for PGKN and PGSI also exceed the share of enrollments and reference loads. On the other hand, the share of load impacts for PGF1, PGNP, and PGST are lower than the share of enrollments and reference loads. These results may be impacted by dispatch issues in 2022, which disproportionately affected some sub-LAPs.

Figure 3-5: Share of Load Impacts by Sub-LAP for September 5, 2022 (6-8 p.m.) and September 8, 2022 (5-7 p.m.)



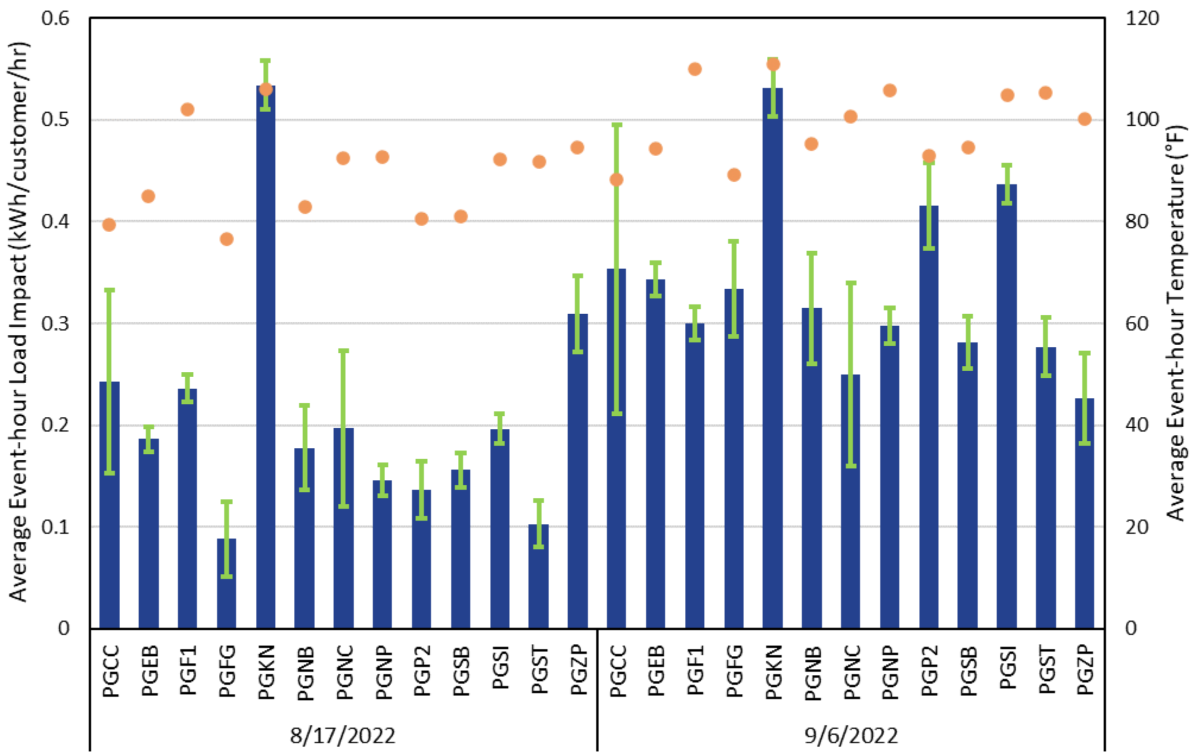
3.4 Serial Event Load Impacts

Next, we examine the results for the serial events on August 17th and September 6th. Figure 3-6 summarizes the load impacts by sub-LAP. The bars indicate the magnitude of the average per-customer load impacts (in kWh/customer/hour) across the full serial event hours. The green bands correspond to 80 percent confidence intervals around these estimates (i.e., the 10th and 90th percentile scenarios from the uncertainty-adjusted load impacts). The orange scatter plot represents the average event temperatures for each sub-LAP.

Serial events load impacts range from 0.09 to 0.53 kWh/customer/hour

Across the two serial events, load impact ranges from 0.09 kWh/customer/hour for PGFG on August 17th to 0.53 kWh/customer/hour for PGKN on both days. Across all sub-LAPs, temperatures were lower on August 17th than September 6th, which explains the lower per-customer load impacts.

Figure 3-6: Average Event-Hour Load Impacts by Sub-LAP for the Serial Events



The serial event load impact on September 6th is lower than the serial event in PY2020 with comparable temperatures

The serial event on September 6th has similar average event temperatures as the serial event in PY2020, but the average load impact is much lower—0.34 compared to 0.59 kWh/customer/hour. Dispatch issues of two-way devices contribute to the performance gap. If we compare devices that successfully dispatched on September 6th the load impacts increase by 0.06 kWh/customer/hour for PGF1, 0.12 kWh/customer/hour for PGKN, and 0.11 kWh/customer/hour for PGST. These sub-LAPs were most impacted by two-way device dispatch issues in 2022, as we discuss in Section 3.7. The serial event on August 17th has much cooler temperatures, which explains why all sub-LAPs except PGKN and PGZP have lower per-customer load impacts on August 17th.

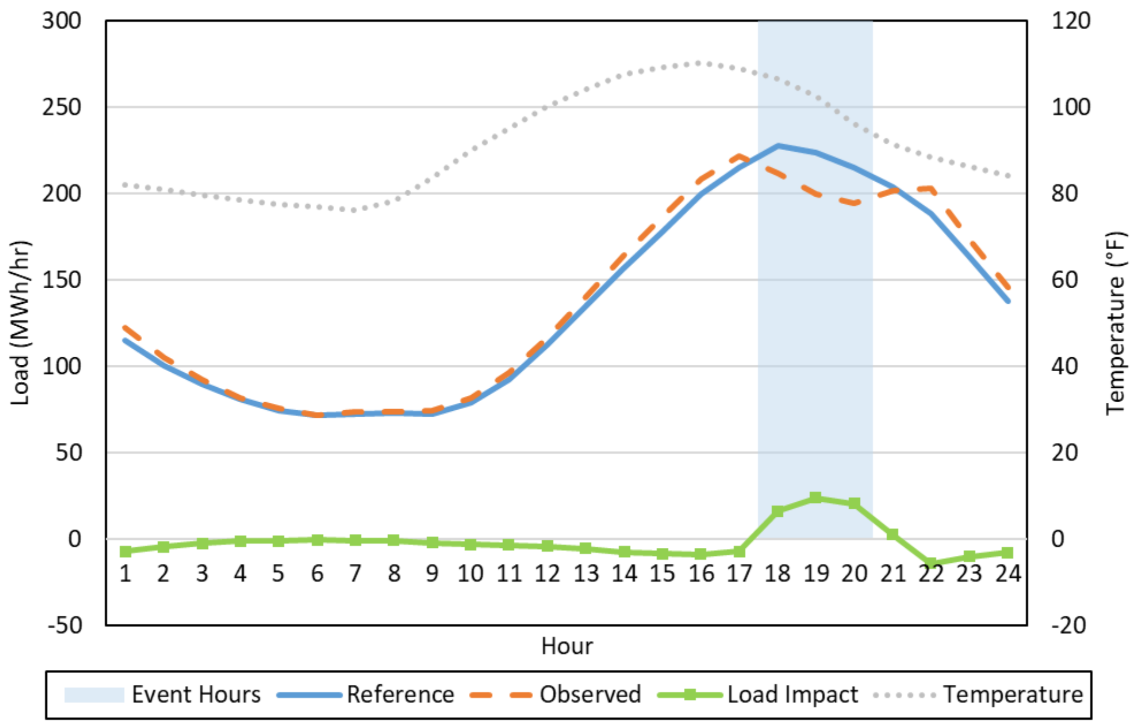
Table 3-6: Average Event-Hour Load Impacts by Sub-LAP for the Serial Event

Date	Event Hours (p.m.)	SmartRate™ Event?	Sub-LAP	# Dispatched	Average Event Hour				
					Reference (kW/Cust)	Impact (kW/Cust)	% Impact	Agg. Impact (MW)	Avg. Temp (°F)
8/17	4:30-7:00	Yes	PGCC	173	1.30	0.24	18.7%	0.04	79.4
			PGEB	12,627	2.02	0.19	9.2%	2.35	85.0
			PGF1	9,959	3.08	0.24	7.7%	2.35	102.2
			PGFG	1,247	1.56	0.09	5.6%	0.11	76.5
			PGKN	2,857	3.46	0.53	15.4%	1.53	106.0
			PGNB	948	1.57	0.18	11.3%	0.17	82.9
			PGNC	363	2.38	0.20	8.3%	0.07	92.5
			PGNP	8,168	2.17	0.15	6.7%	1.19	92.8
			PGP2	2,557	1.80	0.14	7.6%	0.35	80.6
			PGSB	5,560	1.59	0.16	9.8%	0.87	81.0
			PGSI	9,442	2.26	0.20	8.7%	1.86	92.3
			PGST	3,895	2.29	0.10	4.5%	0.40	91.8
			PGZP	1,202	2.72	0.31	11.4%	0.37	94.7
9/6	5:00-8:00	Yes	PGCC	182	2.94	0.35	12.0%	0.06	88.2
			PGEB	12,570	3.29	0.34	10.4%	4.31	94.3
			PGF1	9,860	3.74	0.30	8.0%	2.96	110.1
			PGFG	1,198	2.79	0.33	12.0%	0.40	89.3
			PGKN	2,816	3.88	0.53	13.7%	1.50	111.0
			PGNB	956	2.76	0.31	11.4%	0.30	95.2
			PGNC	359	3.05	0.25	8.2%	0.09	100.7
			PGNP	8,009	3.37	0.30	8.8%	2.38	105.8
			PGP2	2,591	2.95	0.42	14.1%	1.08	93.0
			PGSB	5,503	2.72	0.28	10.3%	1.55	94.6
			PGSI	9,402	3.41	0.44	12.8%	4.11	104.8
			PGST	3,892	3.72	0.28	7.4%	1.08	105.3
			PGZP	1,215	3.28	0.23	6.9%	0.27	100.2

Load impacts for the serial event on September 6th peak during the second hour

Figure 3-7 shows the average aggregate hourly reference loads, observed loads, and estimated load impacts on September 6th during the serial event (5 to 8 p.m.). Table 3-7 contains the hourly results in the manner required by the Protocols, including hourly temperatures and uncertainty adjusted load impacts (not displayed in Figure 3-7). There are load reductions for SmartAC™ customers in the hour after the serial event because a system-wide emergency event was dispatched for from 8:01 to 8:44 p.m. These results show hourly load impacts that are averaged across all customers dispatched for an event at any point during the day. The load impacts during the serial event hours are averaged across all customers, including the withheld serial group, which diminishes the reported load impacts. [17] Notice that the load impacts peak at 23.8 MWh during the second hour of this event (6 to 7 p.m.), similar to Figure 3-4. The first full event hour has the lowest load impact at 16.32 MWh despite having the highest temperature at 106.7°F.

Figure 3-7: Hourly Load Impacts on September 6, 2022



Post-event snapback is lower due to the emergency event that followed the serial event

Figure 3-7 also illustrates that there is also significant post-event snapback for the serial event, beginning after the emergency event concludes at 8:44 p.m. Post-event snapback as a share of event load impacts is lower for the serial event compared to the sub-LAP event example in Figure 3-4. For the serial event, the peak post-event snapback (9 to 10 p.m.) is 59 percent of the peak load impacts (6 to 7 p.m.) compared to73 percent for the sub-LAP event on September 7th.

[17] By contrast, the results summarized for this event day in Sections 3.2 and in Figure 3-6 and Table 3-6 are limited to the customers dispatched for the serial event (excludes serial group 2).

Table 3-7: Hourly Load Impacts and Uncertainty Adjusted Estimates on September 6, 2022

Hour Ending	Estimated Reference Load (MWh/hour)	Observed Event Day Load (MWh/hour)	Estimated Load Impact (MWh/hour)	Weighted Average Temperature (°F)	Uncertainty Adjusted Impact (MWh/hour)- Percentiles				
					10th%ile	30th%ile	50th%ile	70th%ile	90th%ile
1	115.4	122.6	-7.21	82.0	-7.77	-7.43	-7.21	-6.98	-6.64
2	100.7	105.3	-4.56	80.9	-5.08	-4.77	-4.56	-4.34	-4.03
3	89.6	92.1	-2.44	79.6	-2.92	-2.64	-2.44	-2.24	-1.95
4	80.8	82.0	-1.25	78.5	-1.69	-1.43	-1.25	-1.07	-0.81
5	74.4	75.4	-1.00	77.5	-1.41	-1.17	-1.00	-0.84	-0.60
6	71.6	72.1	-0.51	76.9	-0.88	-0.66	-0.51	-0.35	-0.13
7	72.5	73.5	-0.95	76.2	-1.32	-1.10	-0.95	-0.80	-0.58
8	72.8	73.6	-0.77	78.3	-1.17	-0.93	-0.77	-0.61	-0.38
9	72.1	74.1	-2.02	83.7	-2.46	-2.20	-2.02	-1.85	-1.59
10	78.9	82.0	-3.12	90.0	-3.60	-3.31	-3.12	-2.92	-2.64
11	92.6	96.2	-3.57	95.1	-4.10	-3.78	-3.57	-3.35	-3.04
12	112.2	116.4	-4.14	100.2	-4.73	-4.38	-4.14	-3.90	-3.56
13	135.1	140.5	-5.44	104.1	-6.07	-5.70	-5.44	-5.18	-4.80
14	157.2	164.5	-7.31	107.6	-7.98	-7.58	-7.31	-7.03	-6.64
15	177.8	186.4	-8.59	109.2	-9.27	-8.87	-8.59	-8.31	-7.90
16	199.5	208.3	-8.78	110.2	-9.47	-9.06	-8.78	-8.50	-8.09
17	214.8	221.9	-7.08	109.1	-7.78	-7.37	-7.08	-6.80	-6.39
18	228.0	211.7	16.32	106.7	15.63	16.04	16.32	16.60	17.02
19	223.9	200.1	23.78	102.5	23.08	23.49	23.78	24.06	24.48
20	215.1	194.6	20.50	96.1	19.86	20.23	20.50	20.76	21.14
21	204.0	201.5	2.52	91.3	1.91	2.27	2.52	2.78	3.14
22	188.8	202.9	-14.09	88.3	-14.72	-14.35	-14.09	-13.83	-13.46
23	164.1	174.1	-10.04	86.2	-10.64	-10.28	-10.04	-9.79	-9.43
24	137.6	145.5	-7.96	84.1	-8.52	-8.19	-7.96	-7.73	-7.39

By Period:	Estimated Reference Energy Use (MWh/hour)	Observed Event Day Energy Use (MWh/hour)	Estimated Change in Energy Use (MWh/hour)	Cooling Degree Hours (Base 75° F)	Uncertainty Adjusted Impact (MWh/hour) - Percentiles				
					10th	30th	50th	70th	90th
Daily	3,279.5	3,317.2	-37.70	394.2	-44.38	-40.43	-37.70	-34.97	-31.03
Avg. Event Hour	222.3	202.1	20.20	80.3	19.81	20.04	20.20	20.36	20.59

3.5 Subgroup Load Impacts

This section summarizes how SmartAC™ load impacts are distributed across subgroups of interest including: CARE/non-CARE customers, NEM/non-NEM customers, housing type, AC usage intensity, device type (one-way versus two-way and by one-way device type) and different rate groups.[18] Typically, we also compare the load impacts for customers who are enrolled in SmartAC™ to customers who are dually enrolled in SmartRate™ during SmartAC™-only events, however all system-wide events dispatched in PY2022 were dual event days, which precludes such a comparison for 2022. As a result, all comparisons include SmartAC™-only customers, with no dually enrolled customers in these analyses. A comparison between SmartAC™-only and dually enrolled customers for all events can be found in Section 3.5.1. These comparisons are based on the weighted average load impacts from August 17th, September 5th, September 6th, September 7th,

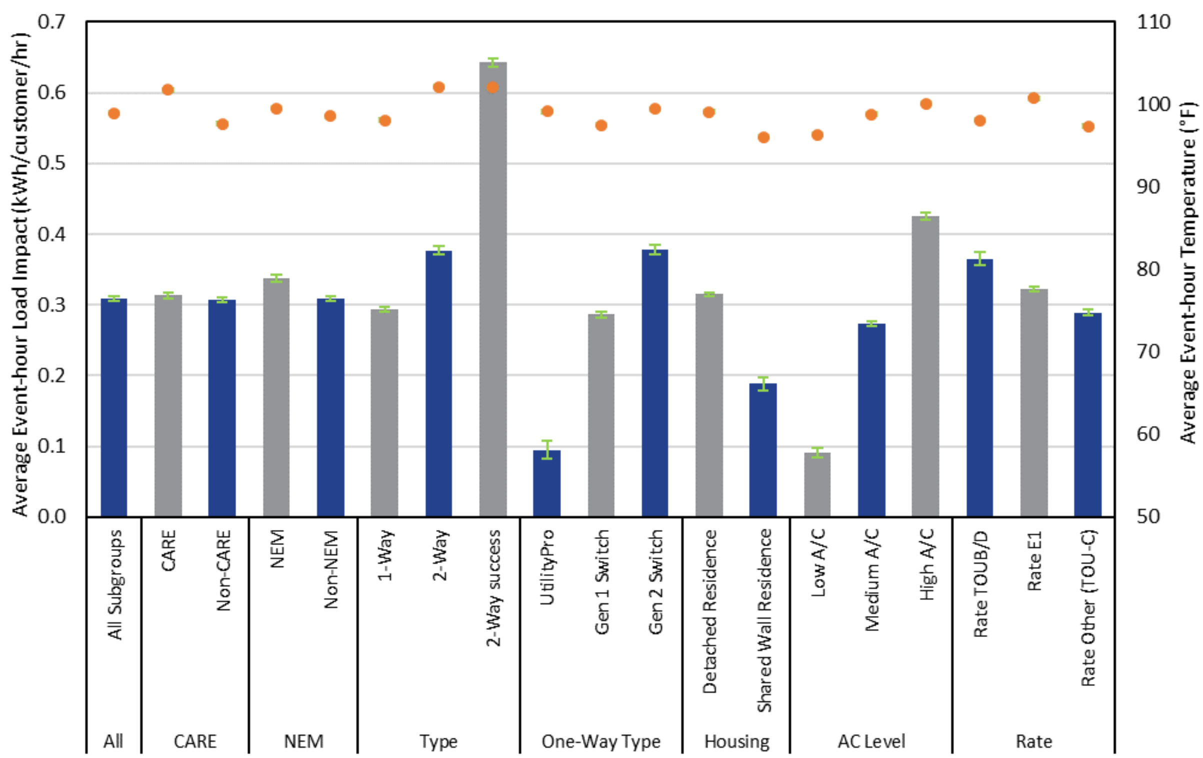
[18] ExpressStat customers are excluded from the analysis because there are too few customers in this subgroup to estimate load impacts reliably.

September 8th during the full event hours across all sub-LAPs[19]. Additional results for these subgroups, including the load profiles, can be found in electronic form in Protocol table generators provided along with this report.

The weighted average ex-post load impacts are summarized for each subgroup in Figure 3-8. The blue and gray bars indicate the magnitude of the average per-customer load impact (in kWh/customer/hour) within each subgroup. The green bands correspond to 80 percent confidence intervals around these estimates. The orange scatter plot represents the average temperatures experienced by customers in each subgroup.

Figure 3-8 shows that there are statistically significant load impacts for every subgroup. Customers in the various subgroups are not evenly distributed across PG&E's service territory and there are large differences in temperatures between groups because of the wide variation in event temperatures across sub-LAPs during the system-wide events.

Figure 3-8: Average Event-Hour Load Impacts by Subgroup



Results that are similar to past evaluations include:

[19] PGFG was not dispatched on September 7th.

- Gen 1 and Gen 2 switches had significantly higher load impacts than UtilityPro thermostats. Load impacts for UtilityPro thermostats are 0.28 kWh/customer/hour lower than Gen 1 switches despite comparable event temperatures.
- Load impacts (and temperatures) increase with AC usage intensity, with high AC usage customers having significantly higher load impacts than medium and low AC usage customers.
- Detached (single family) residences have higher load impacts than Shared Wall (multi-family) residences.
- One-way devices have lower load impacts compared to two-way devices, but this is partly driven by higher temperatures for customers with two-way devices. The load impacts of two-way devices that were successfully dispatched are more than twice as high as load impacts of one-way devices. Further information on the two-way dispatch issue can be found in Section 3.7.

Results that differ from past evaluations include:

- NEM customers have higher load impacts (and slightly higher temperatures) compared to non-NEM customers.[20]
- CARE customers have comparable load impacts as non-CARE customers.[21]

In this year's evaluation, we also compare the load impacts by different rate groups. Rate E1 is a non-TOU rate plan with tiered rates. The largest share of customers belongs to the "Rate Other" group, which is primarily customers with a TOU-C rate. Customers that have a TOU-B or D rate have the highest per-customer load impact, followed by customers with an E1 rate, and finally by the TOU-C rate group. The decline in load impacts across these rate groups is commensurate with the decline in reference loads, which suggests that differences in load impacts are driven by differences in customer usage levels, as percent load impacts are comparable between the three groups.

Comparing subgroups by percentage load impacts can lead to different results

Table 3-8: provides the detailed information underlying Figure 3-8: , including the average number of customers dispatched, the total number of enrolled customers in each subgroup, the average load impacts, reference loads, percentage load impacts, and temperatures. While comparisons by percentage load impacts mostly follow the same patterns as per-customer load impacts, a different pattern emerges by NEM status. Non-NEM customers have higher percentage load impacts than NEM customers. Also, as previously discussed, customers in different rate groups have comparable percentage load impacts.

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[20] In the past evaluations, NEM customers had comparable or lower load impacts than non-NEM customers. The events used in this comparison are mostly in September, while events that occurred in earlier months were used in past evaluations. Solar irradiance declines throughout the summer after peaking in June, which could lead NEM customers to have higher loads in September compared to earlier months for comparable temperatures. As a result, NEM customers may have higher potential for load reductions for events that occur later in the summer.

[21] This is different from PY2021 and PY2019 when CARE customers had higher load impacts than non-CARE customers but is consistent with PY2020.

Table 3-8: Average Event-Hour Load Impacts by Subgroup

Subgroup	# Dis-patched	# Enrolled	Average Load Impacts				
			Reference (kW/Cust)	Impact (kW/Cust)	% Impact	Agg. Impact (MW)	Avg. Temp (°F)
All SmartAC™ Customers	62,743	66,023	3.10	0.31	9.96%	19.37	98.9
CARE	19,494	20,383	3.21	0.31	9.78%	6.12	101.8
Non-CARE	42,801	45,172	3.05	0.31	10.05%	13.12	97.6
NEM	21,639	22,781	3.34	0.34	10.11%	7.30	99.6
Non-NEM	40,655	42,775	2.98	0.31	10.33%	12.53	98.6
1-Way	49,763	52,475	3.04	0.29	9.65%	14.61	98.1
2-Way	12,743	13,289	3.33	0.38	11.33%	4.81	102.1
2-Way Success	7,081	13,289	3.57	0.64	18.01%	4.55	102.1
UtilityPro	2,814	2,982	3.18	0.10	2.99%	0.27	99.1
Gen 1 Switch	34,571	36,437	2.98	0.29	9.59%	9.89	97.5
Gen 2 Switch	11,341	11,927	3.18	0.38	11.90%	4.29	99.5
Detached Residence	59,539	62,656	3.15	0.32	9.99%	18.76	99.1
Shared Wall Residence	3,157	3,316	2.07	0.19	9.11%	0.60	96.0
Low A/C	7,543	7,972	1.60	0.09	5.67%	0.69	96.4
Medium A/C	24,412	25,678	2.66	0.27	10.29%	6.67	98.8
High A/C	27,663	29,059	4.11	0.43	10.36%	11.76	100.1
Rate TOUB/D	6,996	7,375	3.62	0.37	10.10%	2.55	98.1
Rate E1	27,372	28,688	3.19	0.32	10.11%	8.84	100.8
Rate Other (TOU-C)	28,375	29,961	2.89	0.29	10.00%	8.20	97.3

3.5.1 Dually Enrolled Customers

This section compares results for SmartAC™-only customers to customers who are dually enrolled in SmartAC™ and SmartRate™. We present results for the average full event-hour for each event day. On dual event days we limit the comparison to hours where events overlap for the two programs. Additional results for these customers can be found in electronic form in Protocol table generators provided along with this report.

Table 3-9: summarizes the results for SmartAC™-only and dually enrolled customers for each event, including the number of customers dispatched, load impacts, reference loads, and percentage load impacts. Eight out of fourteen event days in PY2022 are dual event days. For dual event days, we only keep the full SmartAC™ event hours within the SmartRate™ event hours (4-9 p.m.). Less than 10 percent of SmartAC™ customers were dually enrolled in SmartRate™ in 2022, which explains the higher aggregate load impacts for SmartAC™-only customers. The per-customer load impacts are higher for dually enrolled customers during dual events, consistent with previous evaluations. On July 24th, less than 100 dually enrolled customers are dispatched, making the estimate unreliable. Dually enrolled customers have higher load impact for two of the five SmartAC™-only events in

2022 (September 2nd and 9th) and lower load impacts for the remaining three (July 16th, 17th and 29th), which may be influenced by which sub-LAPs are dispatched for the events.[22]

Table 3-9: Average Event-Hour Load Impacts by Event, SmartAC™-only vs. Dually Enrolled

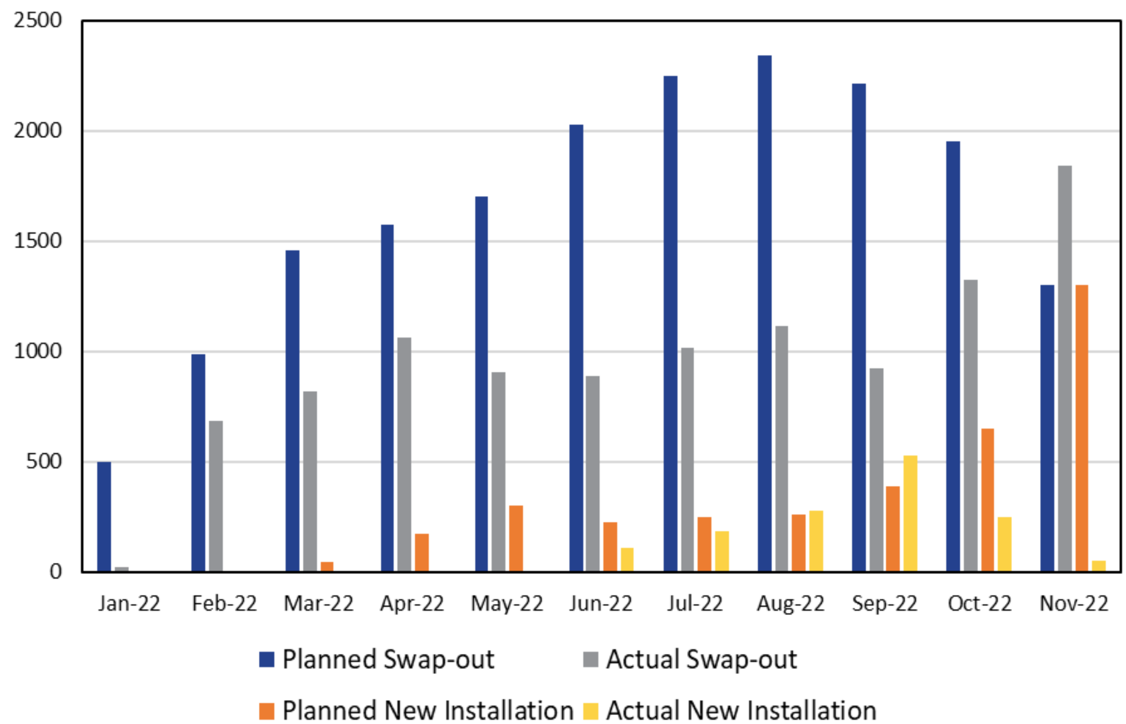
Enrollment Segment	Date	Smart-Rate™ Event?	# Dis-patched	Average Event Hour				
				Reference (kW/Cust)	Impact (kW/Cust)	% Impact	Aggregate Impact (MW)	Avg. Temp (°F)
Dually Enrolled	7/11	Yes	3,132	2.37	0.38	16.0%	1.2	98.9
	7/16	No	5,228	2.46	0.18	7.2%	0.6	102.4
	7/17	No	1,956	3.00	0.24	7.8%	0.3	106.2
	7/24	No	[redacted]					
	7/29	No	3,493	2.24	0.09	4.0%	0.2	94.9
	8/16	Yes	4,117	2.45	0.38	15.7%	1.0	95.9
	8/17	Yes	5,458	2.02	0.21	10.6%	1.2	94.1
	8/19	Yes	946	2.35	0.51	21.5%	0.5	97.2
	9/2	No	1,904	2.99	0.41	13.8%	0.8	106.8
	9/5	Yes	6,056	2.84	0.54	19.1%	3.3	101.0
	9/6	Yes	5,407	2.98	0.54	18.1%	2.9	104.5
	9/7	Yes	5,986	2.72	0.42	15.4%	2.5	101.3
	9/8	Yes	6,045	2.81	0.49	17.6%	2.4	101.5
	9/9	No	3,225	2.52	0.35	14.1%	1.1	102.3
SmartAC™ Only	7/11	Yes	24,871	2.83	0.33	11.8%	8.3	99.0
	7/16	No	39,978	2.74	0.31	11.3%	8.2	102.7
	7/17	No	15,738	3.08	0.37	12.1%	3.9	106.2
	7/24	No	[redacted]					
	7/29	No	25,221	2.75	0.19	7.0%	3.2	96.0
	8/16	Yes	39,272	2.92	0.27	9.3%	7.9	95.2
	8/17	Yes	58,998	2.30	0.20	8.7%	11.8	91.1
	8/19	Yes	10,655	2.75	0.24	8.6%	2.5	97.4
	9/2	No	15,609	3.39	0.27	8.0%	4.2	106.5
	9/5	Yes	66,044	3.37	0.35	10.3%	23.1	99.4
	9/6	Yes	58,553	3.35	0.33	9.9%	19.5	101.8
	9/7	Yes	64,550	3.05	0.31	10.1%	19.8	99.0
	9/8	Yes	65,857	3.26	0.31	9.6%	17.1	100.1
	9/9	No	24,329	2.78	0.26	9.2%	6.2	102.4

[22] In the past two evaluations, SmartAC™-only and dually enrolled customers had comparable load impacts during SmartAC™-only events. We continue this assumption in the PY2022 ex-ante forecast as there were no SmartAC™-only system-wide events in 2022 that would be needed to re-evaluate this assumption.

3.6 Device Swap-outs

This section summarizes the progress on swap-outs of one-way devices during 2022. Figure 3-9 summarizes the number of swap-outs and new enrollments compared to what the plan outlined in the PY2021 report.[23] Device swap-outs took longer to ramp up in 2022 than planned. The actual number of device swap-outs is lower than the planned number in every month of 2022 except in November. There were over 10,000 device swap-outs completed by November 2022 as well as more than 1,400 new customers enrolled in the program, however this falls short of the more than 18,000 device swap-outs and 3,500 new enrollments that were planned for 2022.

Figure 3-9: Number of Actual versus Planned Device Installation



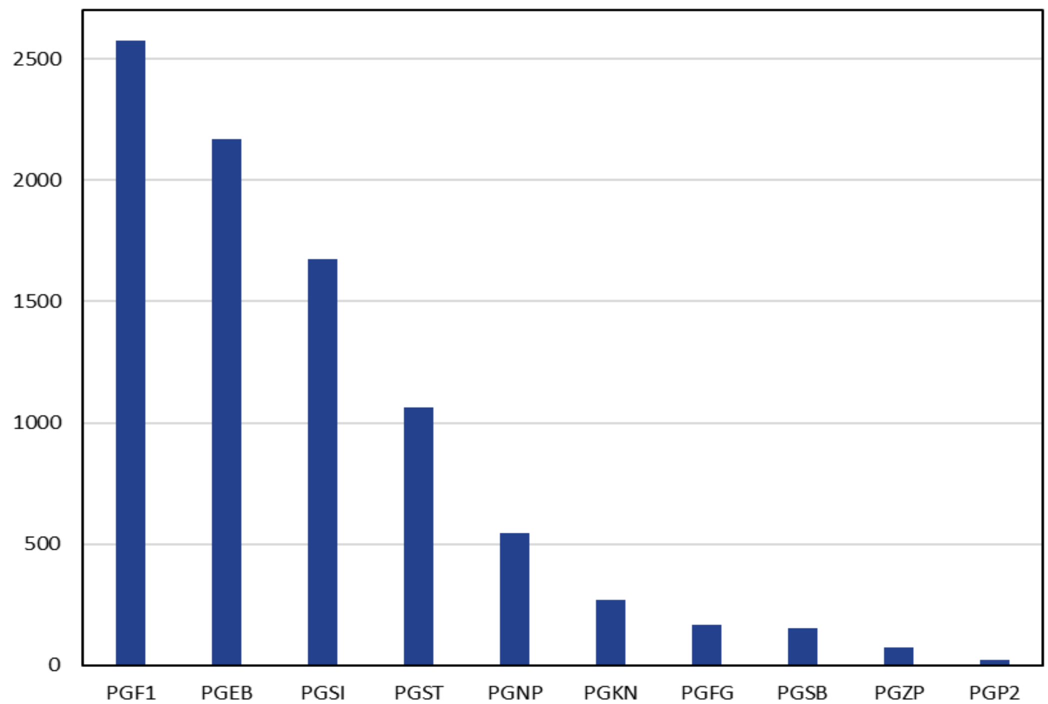
There are two main drivers of the lower rates of swap-outs and new customer enrollments in 2022. First, there was a shortage of technicians to perform device swap-outs. PG&E, facing a tight labor market, had difficulty recruiting the number of technicians that would have been needed to accomplish the planned number of swap-outs. By the fourth quarter of 2022, PG&E had anticipated having 19 technicians servicing the program, but due to the labor market constraints there were only 14 staffed technicians. As a result, resources were shifted to device swap-outs, away from new

[23] Device installation data provided by PG&E ended in mid-December, so we only show a comparison between actual and planned device installation through November 2022.

customer recruitment. Second, the rate of SmartAC™ customers that refused a device swap-out or were not reachable was higher than anticipated.

Figure 3-10 summarizes total number of new two-way devices installed in 2022 by sub-LAP, including device swap-outs and new enrollments[24]. New two-way devices are concentrated in six sub-LAPs: PGF1, PGEB, PGSI, PGST, PGNP and PGKN, which account for 95 percent of device installations.

Figure 3-10: Total Number of Two-Way Device Installation in 2022



3.7 Two-way Device Dispatch Issues

This section discusses dispatch issues that occurred for two-way devices in 2022, which impacted a significant percentage of two-way devices. While dispatch issues were more likely to impact newly installed two-way devices than devices installed before 2022, a significant share of older two-way devices was also impacted. PG&E anticipates that the cause of the dispatch issue will be resolved by 2023 and that it will be avoidable in future years either by manual intervention or through a patch for an automated solution.[25]

[24] PGNB, PGCC and PGNC are not shown because these sub-LAPs had fewer than 10 device installations.

[25] The source of the dispatch issue was a web service call being made between PG&E's Demand Response Management System (DRMS) and the head end management system of the 2-way devices in which customer dispatch group assignments were overwritten and ultimately removed. Upon the discovery of this issue, a manual remedy was determined which updates customer

To determine the impact of dispatch issues on two-way customer performance and overall load impacts, we re-estimate load impacts after dropping SmartAC™ customers with dispatch issues for each event. We compare load impacts for all customers and customers without dispatch issues for each sub-LAP across all events in 2022. More detailed comparisons by event and sub-LAP are available in Appendix C. Table 3-10 summarizes the load impacts for all two-way devices compared to the subset of two-way devices that are successfully dispatched in 2022. In PGST, 57 percent of 2-way devices have dispatch issues, which is the highest share among all sub-LAPs. Figure D-12 in the appendix illustrates that the load impacts for two-way devices in PGST are much lower in 2022 than in the previous two evaluations for similar event temperatures. Average per-customer load impacts for two-way devices in PGST improve by more than 0.3 kwh/customer/hour when re-estimated for the subset of customers without dispatch issues. PGEB and PGF1 have more than 40 percent of two-way devices with dispatch issues and the per-customer load impacts improve by more than 0.25 kwh/customer/hour when re-estimated for customers that were successfully dispatched. PGCC, PGFG and PGNB have less than 100 customers with 2-way devices, which make their estimated load impacts less reliable. The remaining sub-LAPs have 20 to 30 percent or more of two-way devices with dispatch issues and an improvement of 0.1 kwh/customer/hour or more when customers with dispatch issues are left out of the estimation. On average, 41 percent of two-way devices have dispatch issues. Overall, per-customer load impacts improve from 0.36 kwh/customer/hour to 0.60 kwh/customer/hour when customers with dispatch issues are excluded from the estimation.

Table 3-10: Average Event-Hour Load Impacts by Sub-LAP for Two-way Devices With and Without Dispatch Issues

Sub-LAP	# Dis-patched	% with Dispatch Issue	Per-Customer Load Impact		Percentage Load Impact	
			All	Success Only	All	Success Only
PGCC	[redacted]					
PGEB	2,202	47%	0.35	0.63	11.5%	19.1%
PGF1	4,093	45%	0.36	0.63	10.7%	17.3%
PGFG	[redacted]					
PGKN	1,413	28%	0.54	0.73	15.4%	19.7%
PGNB	[redacted]					
PGNC						
PGNP	1,088	33%	0.44	0.61	14.8%	19.5%
PGP2	155	31%	0.47	0.65	14.4%	19.2%
PGSB	519	39%	0.18	0.40	7.3%	14.8%
PGSI	2,011	35%	0.34	0.47	12.3%	16.5%
PGST	1,242	57%	0.16	0.49	4.9%	13.7%
PGZP	293	28%	0.45	0.58	13.5%	17.0%
All	**13,226**	**41%**	**0.36**	**0.60**	**11.4%**	**17.7%**

dispatch group assignments and a fix to the automatic dispatch group assignment is actively being pursued prior to the 2023 DR season start.

Table 3-11 shows the comparison of overall per-customer and percentage load impacts for all customers compared to results that exclude customers with dispatch issues. PGF1 and PGST have the highest percentage of device failure, at 16 percent. Higher percentages of device failure are generally associated with larger increases in load impacts when limiting the data to successfully dispatched customers. Per-customer load impacts increase by more than 0.04 kwh/customer/hour in PGST, PGF1 and PGKN, which have more than 10 percent of all devices with a failed dispatch in 2022. On average, eight percent of devices have dispatch issues and per-customer load impacts improve by 0.03 kwh/customer/hour. The device failure rate and load impact improvements are much lower than for two-way devices alone because the majority of SmartAC™ devices in 2022 are one-way devices, which dilutes the improvement in load impacts.

Table 3-11: Average Event-Hour Load Impacts by Sub-LAP With and Without Dispatch Issues

Sub-LAP	# Dis-patched	% with Dispatch Issue	Per-Customer Load Impact		Percentage Load Impact	
			All	Success Only	All	Success Only
PGCC	193	1%	0.53	0.54	17.9%	18.2%
PGEB	13,697	8%	0.33	0.36	11.2%	12.1%
PGF1	11,382	16%	0.24	0.29	7.4%	8.9%
PGFG	1,290	1%	0.24	0.24	8.9%	8.9%
PGKN	3,294	12%	0.51	0.57	14.9%	16.9%
PGNB	1,026	1%	0.31	0.32	12.1%	12.3%
PGNC	413	5%	0.21	0.23	7.7%	8.6%
PGNP	9,335	4%	0.24	0.25	8.4%	8.7%
PGP2	2,797	2%	0.34	0.34	12.5%	12.7%
PGSB	5,989	3%	0.28	0.29	11.4%	12.1%
PGSI	10,583	7%	0.29	0.31	10.2%	10.7%
PGST	4,431	16%	0.25	0.32	7.9%	10.3%
PGZP	1,413	6%	0.26	0.27	8.9%	9.4%
All	**65,843**	**8%**	**0.29**	**0.32**	**9.9%**	**10.9%**

3.8 Event Override Rate

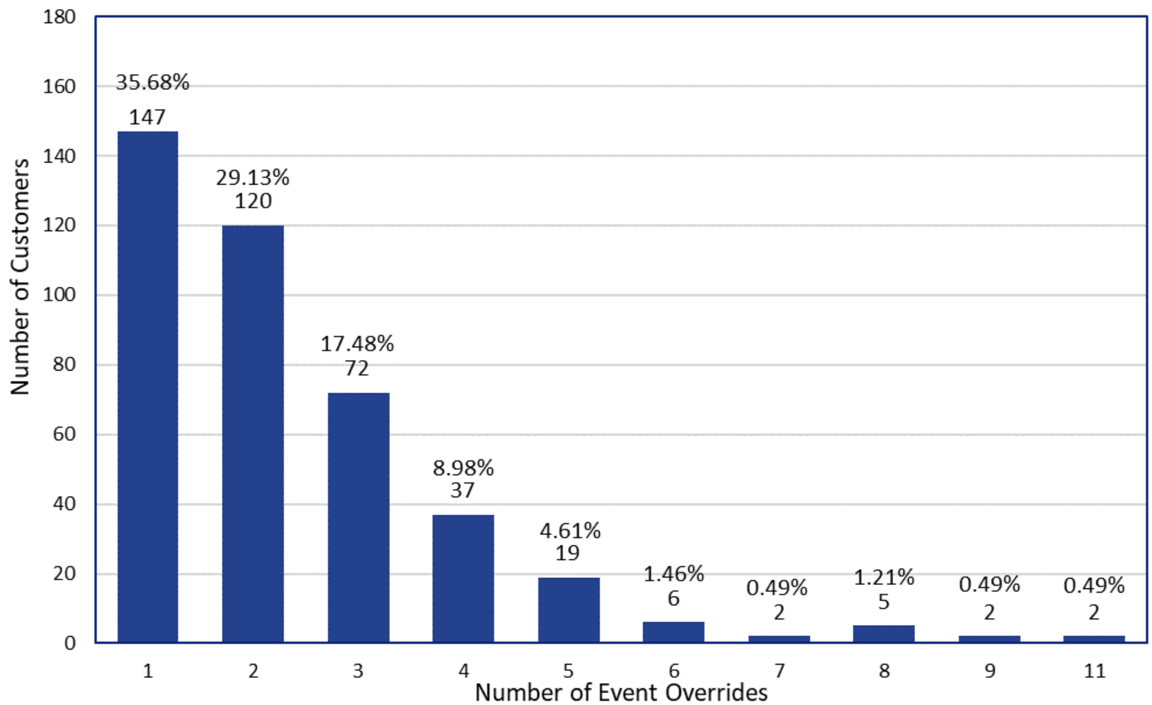
Customers can override (opt out of) SmartAC™ events. Table 3-12 summarizes the number of overrides by event day, including the number of enrolled customers in the sub-LAPs dispatched for each event. In total, the overrides correspond to only 0.2 percent of dispatched customers during PY2022 events. There were no events with high override rates, all were below one percent. Additional tables in Appendix B break down override rates by sub-LAP for each event. All sub-LAPs have override rates below 1 percent.

Table 3-12: Customer Overrides by Event Day

Date	Event Hours (p.m.)	Sub-LAPs Dispatched	Smart-Rate™ Event?	# Overrides	# Dis-patched	Override Rate
7/11	5:00-7:00	PGNP, PGSI, PGKN, PGZP, PGNC	Yes	20	24,871	0.1%
7/16	4:00-6:00	PGSI, PGST, PGKN, PGF1, PGZP	No	17	45,206	0.0%
	5:00-7:00	PGNP				
7/17	3:00-5:00	PGF1	No	7	17,694	0.0%
	4:00-6:00	PGKN, PGZP				
7/24	6:00-8:00	PGNC	No	0	463	0.0%
7/29	5:00-7:00	PGKN, PGF1, PGZP, PGNC	No	5	28,714	0.0%
	6:00-8:00	PGNP				
8/16	5:00-7:00	PGSF, PGSB, PGP2	Yes	38	63,445	0.1%
	6:00-8:00	PGKN, PGF1, PGNC, PGNB				
	7:00-9:00	PGNP, PGST				
	8:00-10:00	PGSI				
8/17	4:30-7:00	All Sub-LAPs, Serial Group 1 withheld	Yes	44	58,998	0.1%
8/19	5:00-7:00	PGSI	Yes	15	10,655	0.1%
9/2	5:00-7:00	PGKN, PGF1, PGZP	No	9	17,513	0.1%
9/5	6:00-8:00	PGNP, PGSI, PGST, PGKN, PGF1 PGZP, PGNC, PGFG, PGNB, PGEB, PGSB, PGP2, PGCC	Yes	116	66,044	0.2%
	8:01-9:18	PGNP, PGSI, PGST, PGKN, PGF1 PGZP, PGNC, PGFG, PGNB, PGEB, PGSB, PGP2, PGCC				
9/6	5:00-8:00	All Sub-LAPs, Serial Group 2 withheld	Yes	174	65,963	0.3%
	8:01-8:42	PGNP, PGSI, PGST, PGKN, PGF1 PGZP, PGNC, PGFG, PGNB, PGEB, PGSB, PGP2, PGCC				
9/7	4:00-8:00	PGNP, PGSI, PGST, PGKN, PGF1 PGZP, PGNC, PGNB, PGEB, PGSB, PGP2, PGCC	Yes	238	64,550	0.4%
9/8	5:00-7:00	PGNP, PGST, PGKN, PGFG, PGNB, PGEB, PGCC	Yes	234	65,857	0.4%
	5:00-8:00	PGSI, PGF1, PGZP, PGNC, PGSB, PGP2				
9/9	4:00-6:00	PGNP, PGSI, PGST, PGNC	No	59	27,554	0.2%
			Total	**976**	**557,527**	**0.2%**

Figure 3-10 illustrates the extent to which customers opted out of multiple events. About 35 percent of the customers that opted out of any event in 2022 did so only once, while 29 percent of customers opted out of two events, and 17 percent of customers opted out of three events. A much higher percentage of customers opted out of multiple events in 2022 compared to previous evaluations. For comparison, 70 percent of customers in the event override data opted out of one event in PY2021.

Figure 3-11: Number of Event Day Overrides by Customer



4. EX-ANTE LOAD IMPACTS

This section provides the SmartAC™ ex-ante load impact forecast for the period from 2023 to 2033. The forecasts are based on analyses of per-customer load impacts from ex-post evaluations, weather-sensitive reference loads, and incorporation of PG&E's forecasts of program enrollments. The forecast reflects the updated plan for swapping out one-way devices to two-way devices in 2023. The PY2022 ex-ante forecast also reflects SmartAC™ performance during sub-LAP events, consistent with recent evaluations.

Results are presented for customers who are enrolled in SmartAC™-only and for customers who are dually enrolled in SmartAC™ and SmartRate™. We present the following: figures showing the PG&E's enrollment forecast by LCA and by device type; a figure showing the forecast of aggregate load impacts; a table and figures showing the hourly reference loads and load impacts on a typical event day; a figure summarizing how ex-ante load impacts vary by month and weather scenario; and a figure showing the share of load impacts on a typical event day by LCA. Detailed results for each hour, weather scenario, month, forecast year, and enrollment segment (i.e., SmartAC™-only and dually enrolled customers) are available in electronic form in Protocol table generators provided along with this report.

Figure 4-1 shows PG&E's enrollment forecast by LCA from 2023 to 2033. The total enrollments in July of each year are displayed above the chart. Enrollments decreases slightly over the first year of the forecast but dramatically drop in January of 2024, reflecting the de-enrollment of any remaining one-way devices from the SmartAC™ program. PG&E assumes that approximately 29,500 customers with one-way devices will not be swapped out before January 2024, when one-way device technology will no longer supported in the SmartAC™ program. This is due to customers not consenting to a device swap-out, customers who are unreachable, or customers with incompatible technology.[26] This de-enrollment reflects a higher share of SmartAC™ customers compared to the 20,000 that was assumed in the PY2021 enrollment forecast.

After the de-enrollment in January 2024, enrollments continue to decline over the remainder of the forecast. Beginning in 2024, new enrollment in the SmartAC™ program will be closed. As a result, the enrollment forecast reflects the approximately 9.5 percent rate of annual attrition for SmartAC™-only customers and a higher attrition rate of approximately 19 percent for customers who are dually enrolled in SmartRate.[27]

In 2024, Greater Bay Area has the largest decline in enrollments. Greater Bay Area had about 34 percent of SmartAC™ customers in 2023, and the share declines to 30 percent in 2024. On the contrary, the share for Greater Fresno Area increases by about 4 percent in 2024. After 2024, there is little change in the enrollment shares for each LCA.

[26] To mitigate customer attrition, PG&E offers a one-time incentive of $25 for customers to swap out their one-way device for a two-way device so long as they are enrolled at the time of the upgrade (D.21-12-015).

[27] The higher rate of attrition for dually enrolled customers is driven by customers joining Community Choice Aggregators (CCA's), after which they are no longer eligible to participate in SmartRate™.

Figure 4-1: Changes in Enrollment by LCA (2023-2033)

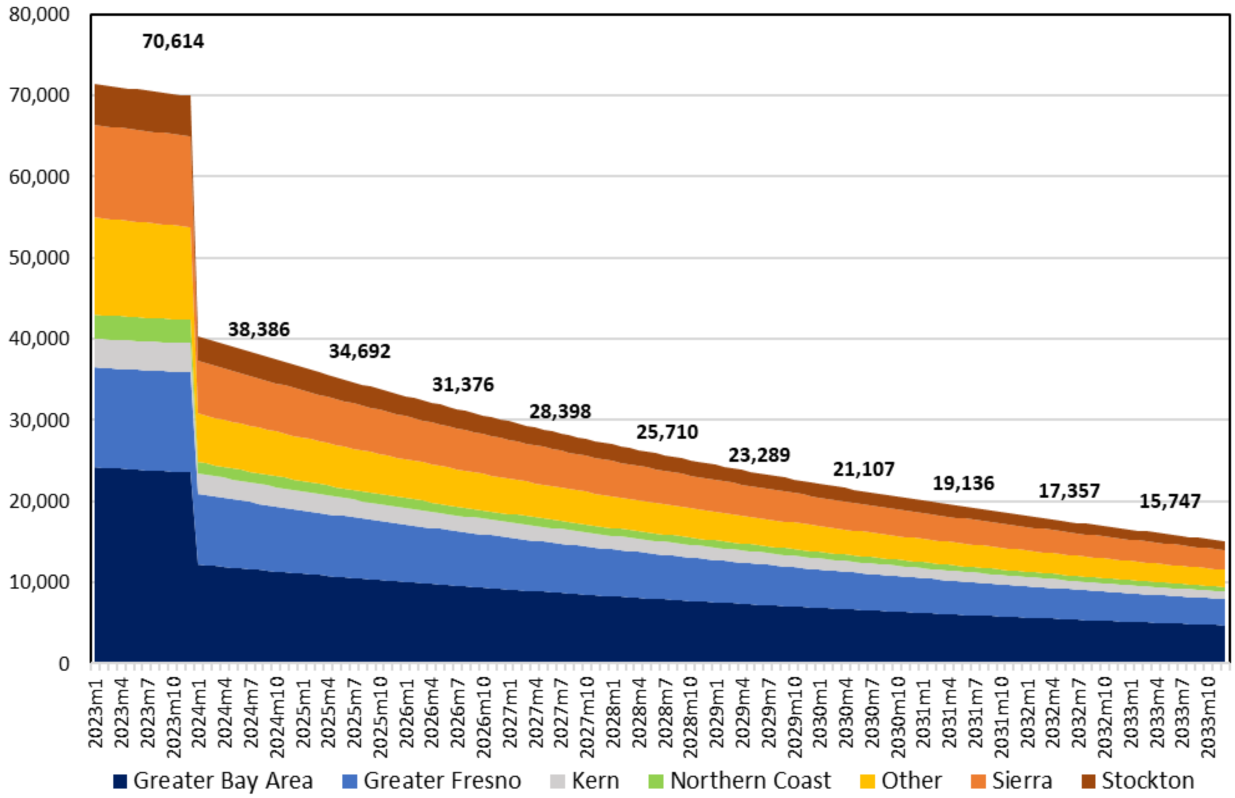


Figure 4-2: shows PG&E's assumptions about device swap-outs that will occur during 2023, including new two-way device installations. The enrollment forecast assumes that device swap-outs between 1,400 and 2,100 per month will be accomplished during 2023. New device installations of around 250 per month will also be completed in 2023.

Figure 4-2: Device Swapouts and New Installations, 2022-2023

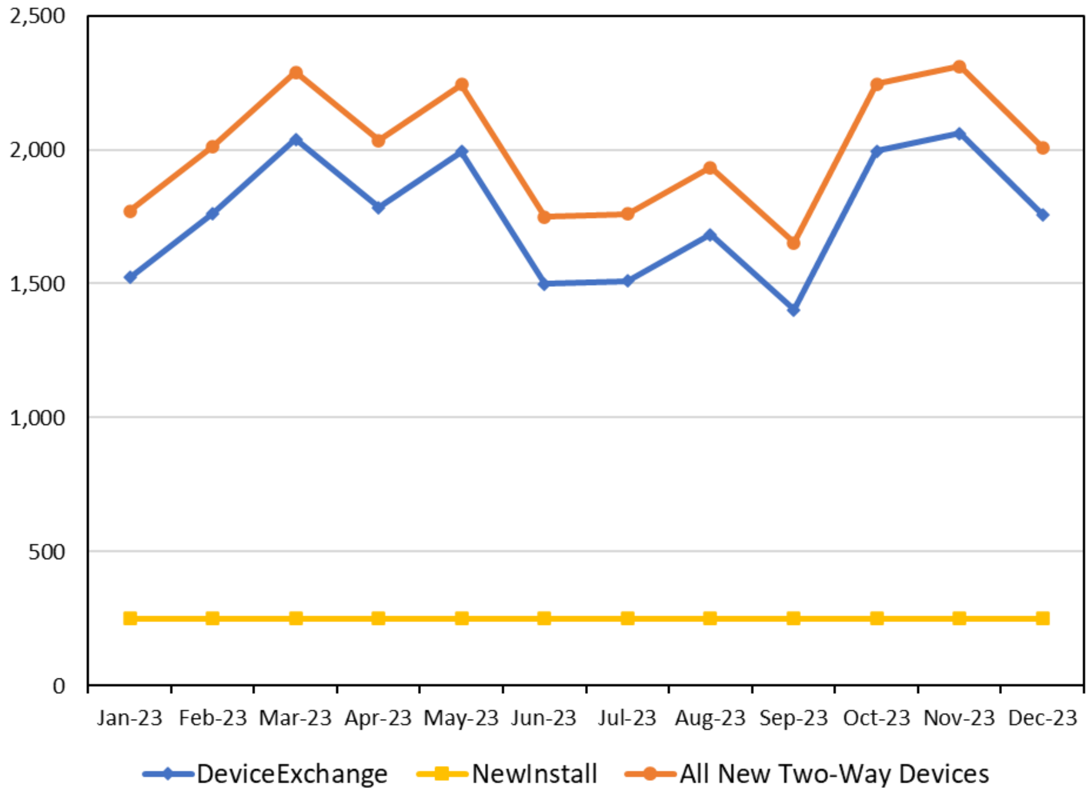


Figure 4-3: illustrates the changes in aggregate load impacts during the Resource Adequacy (RA) window from 4 to 9 p.m. over the forecast period by comparing load impacts for all SmartAC™ customers by LCA for the PG&E 1-in-2 scenario for a July peak day. Aggregate load impacts decrease from 24.8 MWh/hour to 15.2 MWh/hour from July 2022 to July 2023, which is a 38.6 percent drop. The decrease in aggregate load impacts is driven by a 45.6 percent decline in enrollments, which is mitigated by the higher load impacts achieved by two-way devices relative to one-way devices. From 2024 onwards, aggregate load impacts decrease by about 9.5 percent per year, which is consistent with the percentage decline of enrollments.

Figure 4-3: Aggregate Load Impacts over RA Window by LCA for PG&E 1-in-2 July Peak Scenario (2023-2033)

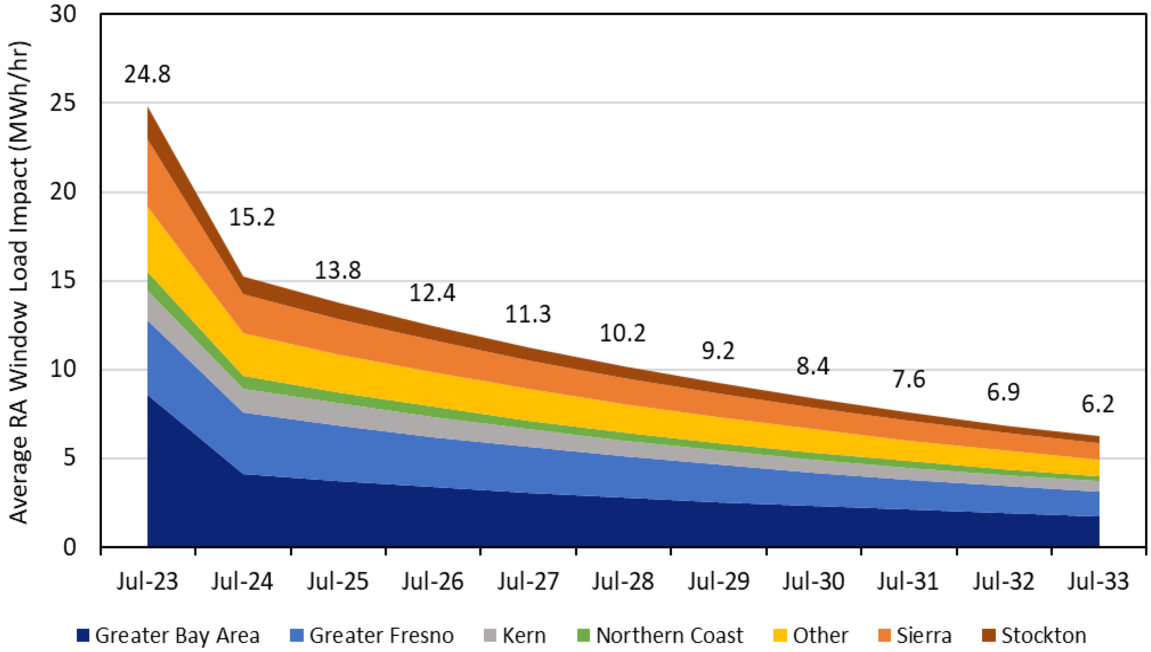


Figure 4-4: illustrates the aggregate reference loads, observed loads, and load impacts for all SmartAC™ customers on a July peak day in 2024 for the PG&E 1-in-2 weather scenario. Ex-ante load impacts peak during the first event hour, reflecting the performance of two-way devices. This contrasts the pattern observed in Figure 3-4, which reflects a majority of one-way devices remaining in the SmartAC™ program. The average RA window load impact is 15.2 MWh/hour, or 15.9 percent of the average RA window reference loads.

Figure 4-4: Aggregate Hourly Loads and Load Impacts for July Peak, *PG&E 1-in-2 Scenario* in 2024: All SmartAC™ Customers

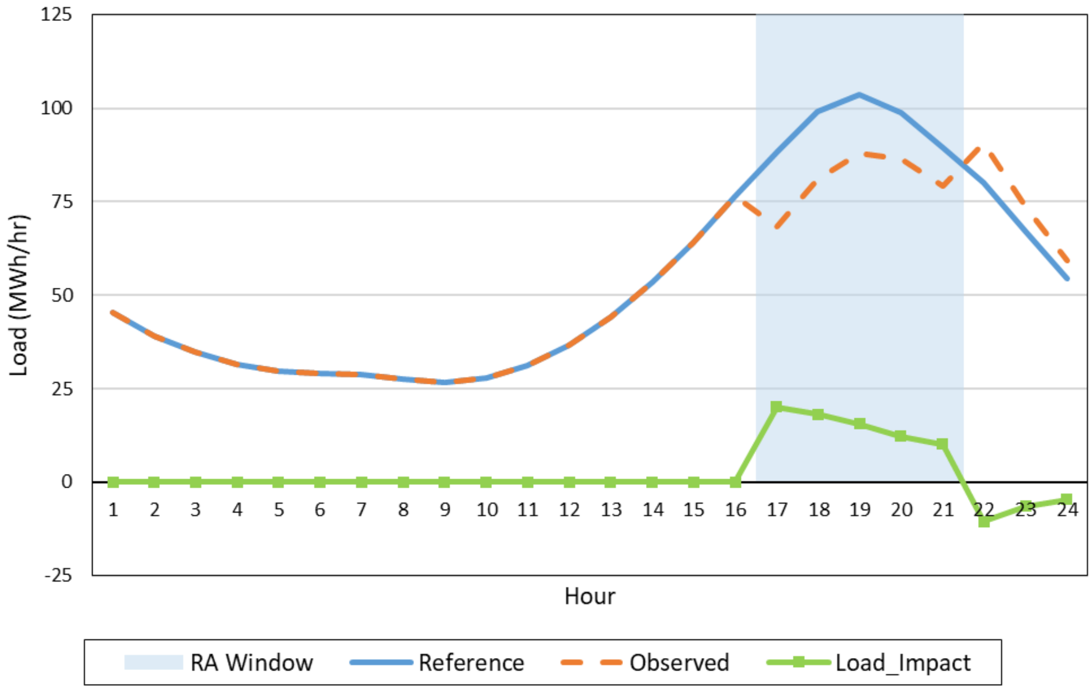


Figure 4-5: illustrates the aggregate reference loads, observed loads, and load impacts for SmartAC™-only customers on a July peak day in 2024 for the PG&E 1-in-2 weather scenario. The shape of the ex-ante loads and load impacts is similar to the results for all SmartAC™ program customers. The average RA window load impact is 14.1 MWh/hour, or 15.7 percent of the average RA window reference loads.

Figure 4-5: Aggregate Hourly Loads and Load Impacts for July Peak, *PG&E 1-in-2* Scenario in 2024: SmartAC™-only Customers

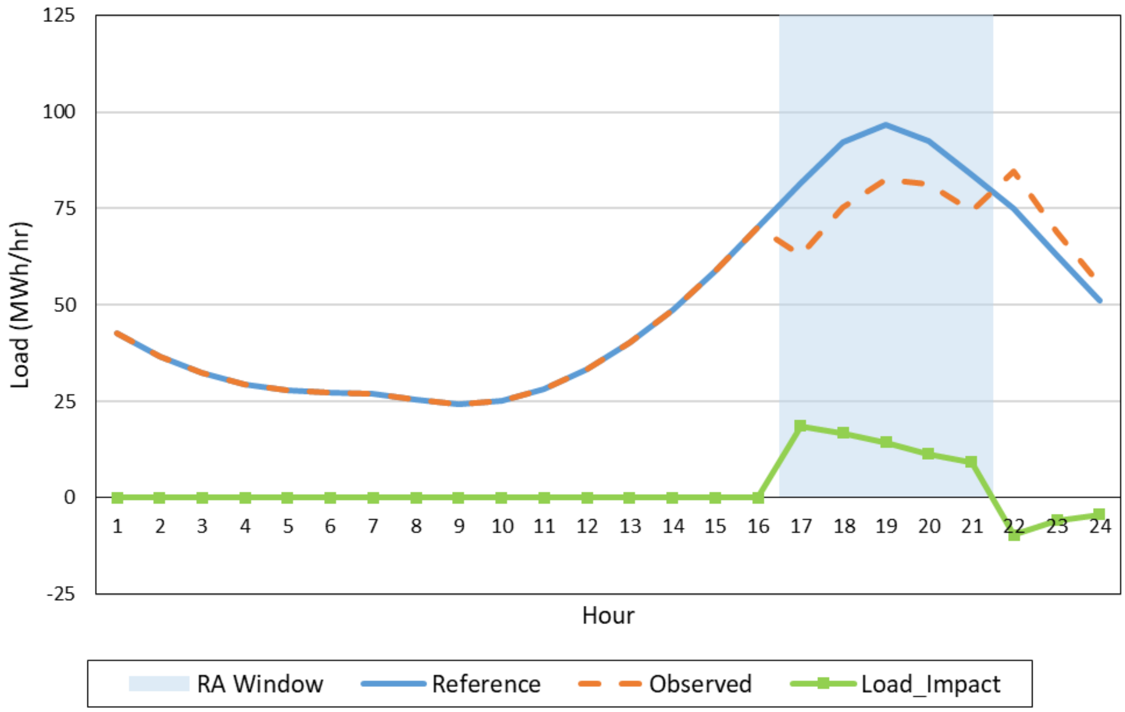


Figure 4-6: illustrates the aggregate reference load, observed load, and load impact for customers who are dually enrolled in SmartAC™ and SmartRate™ on a July peak day in 2024 for the PG&E 1-in-2 weather scenario. The shape of the reference loads differs for dually enrolled customers, with a peak at HE 18 instead of the HE 19 peak for SmartAC™-only customers. The magnitude of the aggregate loads and load impacts is much smaller compared to SmartAC™-only customers due to lower enrollments. The average RA window load impact is 1.2 MWh/hour, or 18 percent of the average RA window reference loads.

Figure 4-6: Aggregate Hourly Loads and Load Impacts for July Peak, *PG&E 1-in-2* Scenario in 2024: Dually Enrolled Customers

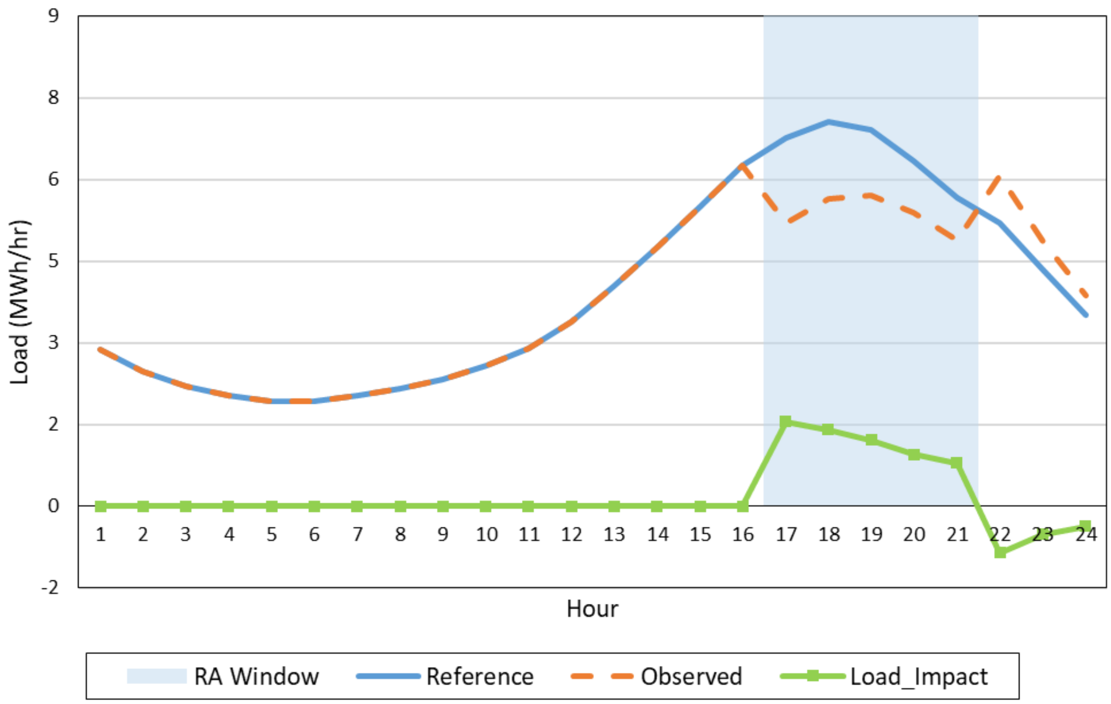


Table 4-1: summarizes average loads and load impacts, percentage load impacts, and average temperatures for the RA window on a July peak day in 2024 for the PG&E 1-in-2 weather scenario by LCA and enrollment segment. Per-customer load impacts range from 0.35 (kWh/customer/hour) for Stockton and Greater Bay Area to 0.56 for Kern. The differences are due to temperatures and historical performance of two-way devices in these LCAs. There is large variation in aggregate load impacts due to the distribution of enrolled customers across LCAs. Greater Bay Area has the largest aggregate load impacts of 4.1 MWh/hour, and Northern Coast has the largest percent load impact of 31.9 percent of reference loads from dually enrolled customers.

Table 4-1: Average RA Window Load Impacts for *PG&E 1-in-2* July Peak Day in 2024 by LCA and Enrollment Segment

Enrollment Segment	LCA	Enrolled	Average RA Window Hour				
			Reference (kW/Cust)	Impact (kW/Cust)	% Load Impact	Aggregate Impact (MW)	Avg. Temp (°F)
All	Greater Bay Area	11,624	1.96	0.35	17.9%	4.1	89.8
	Greater Fresno	8,268	3.03	0.42	13.9%	3.5	102.2
	Kern	2,441	3.05	0.56	18.2%	1.4	102.6
	Northern Coast	1,336	1.89	0.51	27.3%	0.7	86.2
	Other	5,638	2.43	0.43	17.5%	2.4	98.4
	Sierra	6,148	2.60	0.36	13.7%	2.2	97.5
	Stockton	2,931	2.85	0.35	12.2%	1.0	97.6
	Total	**38,386**	**2.50**	**0.40**	**15.9%**	**15.2**	**96.3**
Dually Enrolled	Greater Bay Area	331	1.77	0.37	21.0%	0.1	92.3
	Greater Fresno	800	2.64	0.42	16.0%	0.3	102.2
	Kern	242	2.85	0.56	19.5%	0.1	102.6
	Northern Coast	60	1.56	0.50	31.9%	0.0	88.4
	Other	647	2.05	0.43	20.8%	0.3	98.5
	Sierra	464	2.11	0.36	16.8%	0.2	97.5
	Stockton	329	2.32	0.35	15.0%	0.1	97.6
	Total	**2,873**	**2.28**	**0.41**	**18.0%**	**1.2**	**98.7**
SmartAC™ Only	Greater Bay Area	11,293	1.97	0.35	17.8%	4.0	89.7
	Greater Fresno	7,468	3.07	0.42	13.7%	3.1	102.2
	Kern	2,199	3.08	0.56	18.1%	1.2	102.6
	Northern Coast	1,276	1.90	0.52	27.1%	0.7	86.1
	Other	4,991	2.48	0.43	17.2%	2.1	98.4
	Sierra	5,684	2.64	0.36	13.5%	2.0	97.5
	Stockton	2,602	2.91	0.35	11.9%	0.9	97.6
	Total	**35,513**	**2.52**	**0.40**	**15.7%**	**14.1**	**96.1**

Figure 4-7: illustrates the seasonality and variation by weather scenario in the forecasted load impacts by comparing aggregate load impacts for the average hour in the Resource Adequacy (RA) window in 2024 across months and weather scenarios. The highest load impact comes from the PG&E 1-in-10 scenario in June (17.80 MWh/hour), and the second highest load impact comes from the PG&E 1-in-10 scenario in September (17.67 MWh/hour). The load impact is also highest in June for the PG&E 1-in-2 scenario (15.53 MWh/hour). For the CAISO 1-in-2 scenario, the load impacts are highest in July (15.43 MWh/hour). For the CAISO 1-in-10 scenario, the load impacts are highest in August (16.56 MWh/hour). This seasonality in the patterns of load impacts for SmartAC differs from previous evaluations due to a change in the weather scenarios in 2022. In PY2021, load impacts were highest in July in three out of the four weather scenarios, and

September was never in the top two in terms of load impacts for all scenarios. The load impacts are always the lowest in October, with a minimum of 7.08 MWh/hour from the utility 1-in-2 scenario.

Figure 4-7: Aggregate Load Impacts over RA Window in 2024 by Month and Weather Scenario

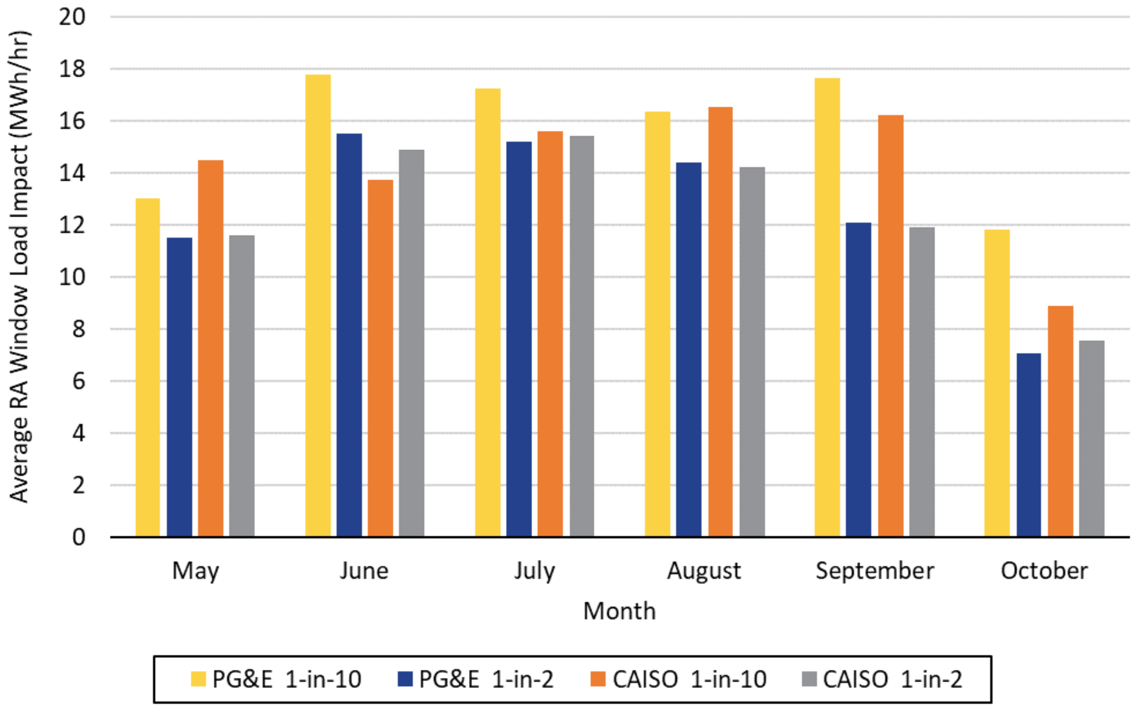
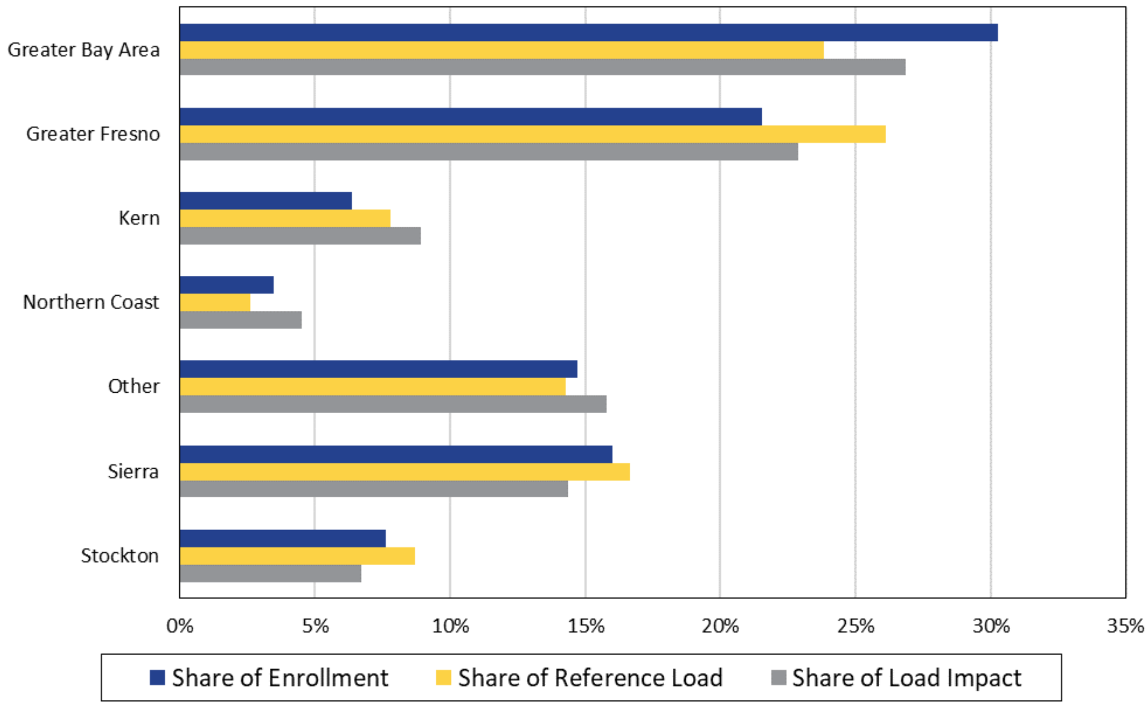


Figure 4-8: compares the LCA shares of average RA window load impacts, reference loads, and enrollments on a July peak day for the PG&E 1-in-2 scenario in 2024. The load impacts for the SmartAC™ program are highest in the Greater Bay Area with 27 percent of aggregate load impacts, 30 percent of enrolled customers, and 24 percent of reference loads. The top four LCAs in terms of enrollments and load impacts, including the Greater Bay Area, Greater Fresno, Other, and Sierra, contribute 80 percent of the aggregate load reductions for SmartAC™. Kern, Other, and Northern Coast have a higher share of load impacts compared to the share of enrollments or reference loads. The rest of the LCAs have a lower share of load impacts compared to the share of enrollments or reference loads.

Figure 4-8: RA Window Load Impacts for *PG&E 1-in-2* July Peak Day in 2024 by LCA



5. LOAD IMPACT RECONCILIATIONS

In a continuing effort to clarify the relationships between ex-post and ex-ante results, this section compares several sets of estimated load impacts for SmartAC™, including the following:

- Ex-post load impacts from the current and previous studies;
- Ex-ante load impacts from the current and previous studies;
- Current ex-post and previous ex-ante load impacts; and
- Current ex-post and ex-ante load impacts.

The term "current" refers to the present study, which includes ex-post and ex-ante results for PY2022. The term "previous" refers to findings in reports for PY2021. In the final comparison above, we illustrate the linkage between the PY2022 ex-post load impacts and the "current" ex-ante forecast. We show the ex-ante forecast for both 2023 and 2024 to reflect the change of load impacts due to PG&E's planned device swap-outs.

5.1 Previous vs. Current Ex-Post

In this section we compare ex-post load impacts from the current and previous studies. We compare results for sub-LAP events to the results from PY2021.

Table 5-1 compares the average per-customer reference loads, load impacts, and temperatures for sub-LAP events for the current and previous program years across the most common event hours from 5 to 7 p.m. Of the eight sub-LAPs that had sub-LAP events in both years, six sub-LAPs had lower load impacts in PY2022 compared to PY2021. PGEB, PGF1, PGNC, PGNP and PGSI had lower load impacts with lower event temperatures. PGST had lower load impacts despite higher event temperature. On the contrary, PGKN and PGZP had higher load impacts with lower event temperatures in PY2022. Some of this difference in load impacts can be explained by two-way device dispatch issues as discussed in Section 3.7.

The bottom row of the table compares average load impacts across sub-LAPs that had events in both years. About 8,100 fewer customers were dispatched for sub-LAP events in 2022 relative to 2021 due to program attrition[28]. The reference loads in PY2022 are slightly lower than PY2021. Overall, load impacts were 0.1 kWh/customer/hour lower in PY2022, with the average event hour temperature being 4.9 degrees lower.

[28] The number of dispatched customers for PY2021 is the sum of average number of customers dispatched for each sub-LAP on SmartAC™-only event days. For PY2022, six sub-LAPs only have dual events (PGCC, PGEB, PGFG, PGNB, PGP2, PGSB), so the average number of customers dispatched for these sub-LAPs exclude dually enrolled customers. PGEB was dispatched for sub-LAP events in both PY2021 and PY2022. About 750 dually enrolled customers are excluded from the customer count in PY2022.

Table 5-1: Previous vs. Current Ex-Post Load Impacts (5-7 p.m.)

sub-LAP	Avg. # dispatched		Reference (kW/cust)		Load Impact (kW/cust)		Avg Temp (°F)	
	PY2021	PY2022	PY2021	PY2022	PY2021	PY2022	PY2021	PY2022
PGCC		203		3.48		0.74		89.4
PGEB	16,808	14,246	2.97	3.12	0.52	0.37	107.3	93.9
PGF1	13,953	12,421	3.50	3.34	0.37	0.24	107.9	104.7
PGFG		1,357		3.10		0.23		102.5
PGKN	4,050	3,633	3.65	3.41	0.42	0.52	110.5	105.7
PGNB		1,062		2.84		0.34		99.8
PGNC	515	461	2.86	2.76	0.34	0.21	98.2	95.6
PGNP	11,775	10,595	2.91	2.90	0.31	0.26	102.9	101.8
PGP2		2,907		2.86		0.36		93.5
PGSB		6,217		2.55		0.32		94.5
PGSI	13,104	11,584	3.13	3.03	0.43	0.33	103.9	101.2
PGST	5,900	5,152	3.21	3.32	0.44	0.29	101.5	103.3
PGZP	1,687	1,554	3.04	2.91	0.21	0.27	101.0	97.2
Common Sub-LAPs	**67,792**	**59,646**	**3.16**	**3.14**	**0.41**	**0.31**	**105.47**	**100.60**

5.2 Previous vs. Current Ex-Ante

In this section, we compare the ex-ante forecast from the previous study to the ex-ante forecast contained in the current study. We focus on average load impacts across the RA window from 4 to 9 p.m.

Table 5-2 reports the average RA window load impacts for the July 2023 peak day and July 2024 peak day under PG&E 1-in-2 weather conditions to contrast the impact of device swap-outs on the ex-ante forecast. To account for temperature differences in PG&E 1-in-2 weather conditions due to the change of weather scenarios, Table 5-2 also includes CAISO 1-in-2 weather conditions for PY2022, which is more comparable to PG&E 1-in-2 scenario in PY2021. For all scenarios in both years, per-customer load impacts increase from 2023 to 2024 due to completion of device swapouts. When comparing the CAISO 1-in-2 scenario in PY2022 and PG&E 1-in-2 scenario in PY2021, the per-customer load impacts are lower in PY2022 forecast for both 2023 and 2024, reflecting some amount of ongoing dispatch issues that occurred in 2022. The aggregate load impacts are lower in PY2022 due to both the decline of enrollments and per-customer load impacts. In 2023, the aggregate load impacts are 16 percent lower in PY2022 CAISO 1-in-2 scenario than PY2021 PG&E 1-in-2 scenario. Per-customer load impacts decrease by 5 percent and enrollments decline by 12 percent. In 2024, the aggregate load impacts are 39 percent lower in PY2022 CAISO 1-in-2 scenario than PY2021 PG&E 1-in-2 scenario. Per-customer load impacts decrease by 5 percent and enrollments decline by 36 percent.

Table 5-2: Previous vs. Current Ex-Ante Load Impacts (RA Window)

Level	Outcome	July Peak 2023			July Peak 2024		
		PY2021 Utility 1 in 2	PY2022 Utility 1 in 2	PY2022 CAISO 1 in 2	PY2021 Utility 1in 2	PY2022 Utility 1 in 2	PY2022 CAISO 1 in 2
Total	Enrollments	79,852	70,614	70,614	60,274	38,386	38,386
	Reference (MW)	201.6	171.7	178.9	155.8	95.9	100.2
	Load Impact (MW)	29.7	24.8	25.0	25.4	15.2	15.4
	Avg. RA Window Temp (°F)	98.7	96.5	98.5	99.1	97.2	99.0
	Avg. Daily Temp (°F)	86.1	84.7	86.0	86.5	85.3	86.7
	% Load Impact	14.8%	14.4%	14.0%	16.3%	15.9%	15.4%
Per-Participant	Reference (kW)	2.52	2.43	2.53	2.58	2.50	2.61
	Load Impact (kW)	0.37	0.35	0.35	0.42	0.40	0.40

5.3 Previous Ex-ante vs. Current Ex-Post

In this section, we compare the ex-ante forecast from the previous study to the ex-post results during sub-LAP events contained in the current study. We limit the comparison to the full event hours of the system-wide sub-LAP event on September 5th. We compare these load impacts to the forecast for a July Peak Day for the PG&E 1-in-10 Scenario to get a closer match of temperatures to September 5th event.[29] Since September 5th is a dual event day, load reductions from dually enrolled customers are not counted in the SmartAC™ program load impacts. As such, we use the ex-ante scenario for SmartAC™-only customers in this comparison.

Table 5-3 provides a comparison of the PY2021 ex-ante forecast of 2022 load impacts to the ex-post load impacts on September 5, 2022. There are about 3,000 fewer customers in ex-post compared to the ex-ante forecast. The per-customer load impact is 0.11 kwh/customer/hour lower in ex-post than ex-ante despite comparable temperatures due to two-way device dispatch issues and a lower share of two-way devices than planned. In the PY2021 forecast, about 29 percent of devices are two-way devices, but only 20 percent of devices were two-way devices as of September 5th. The reference loads are higher on September 5th compared to the forecast, likely because it is a holiday event. The percentage load impacts are lower on September 5th because of lower per-customer load impacts combined with higher reference loads.

[29] The September Peak Day was cooler in the previous ex-ante weather scenario, and the new weather scenarios have updated the September Peak Day temperatures to better reflect the ex-post conditions.

Table 5-3: Previous Ex-Ante vs. Current Ex-Post Load Impacts (6-8 p.m.)

Level	Outcome	PY2021 Ex-Ante	PY2022 Ex-Post
Total	Enrollments	69,301	66,044
	Reference (MW)	205.1	222.6
	Load Impact (MW)	31.6	22.8
	Avg. Event Hour Temp (°F)	100.1	99.4
	Avg. Daily Temp (°F)	90.0	89.5
	% Load Impact	15.4%	10.3%
Per Participant	Reference (kW)	2.96	3.37
	Load Impact (kW)	0.46	0.35

5.4 Current Ex-Post vs. Current Ex-Ante

In this section, we compare the ex-post findings by device type to the ex-ante forecast for 2023 and 2024 contained in the current study during the event hours from 5 to 7 p.m.

Table 5-4 compares the ex-post load impacts across all sub-LAP events in 2022 by device type to the ex-ante load impact forecast for an August peak day with PG&E 1-in-10 weather conditions in 2023 and 2024. The 1-in-10 weather conditions were used because they better reflect the high average temperatures observed during PY2022 events. The forecasted temperature is about 0.5 degrees higher in 2024 than in 2023, reflecting enrollment shifts to hotter regions in the forecast. The per-customer load impacts in 2024 are higher than 2023 due to the completion of device swapouts and de-enrollment of remaining one-way devices from the SmartAC™ program. The per-customer load impacts in both 2023 and 2024 are higher than the per-customer load impact of two-way devices in 2022 given comparable temperatures, which reflects some improvement in the dispatch issues experienced in 2022 based on PG&E's anticipated ability to remedy the dispatch issues as discussed in Section 3.7.

Table 5-4: Current Ex-Post vs. Ex-Ante Load Impacts (5-7 p.m.)

Level	Outcome	PY2022 Sub-LAP Event Load Impacts			PY2022 Forecast	
		1-Way	2-Way	All	2023	2024
Total	Enrollments	56,518	14,479	70,997	70,475	38,061
	Reference (MW)	170.7	47.4	218.1	204.9	113.1
	Load Impact (MW)	16.9	5.7	22.6	29.9	18.0
	Avg. Event Temp (°F)	99.1	102.3	99.8	102.1	102.6
	Avg. Daily Temp (°F)	87.1	89.7	87.6	87.8	88.3
	% Load Impact	9.9%	12.0%	10.4%	14.6%	16.0%
Per Participant	Reference (kW)	3.02	3.28	3.07	2.91	2.97
	Load Impact (kW)	0.30	0.39	0.32	0.42	0.47

Table 5-5 documents the various potential reasons for differences between the ex-post and ex-ante load impacts. There are two main reasons for higher per-customer load impacts in the ex-ante forecast. First, more devices are two-way devices in 2023 and 2024, which will produce higher per-customer load impacts. Second, a significant percentage of two-way customers have dispatch issues in the ex-post results, but in the ex-ante forecast the dispatch issues are assumed to be mostly resolved either by manual intervention or through a patch for an automated solution. The aggregate load impacts in 2023 are higher than ex-post though enrollments are slightly lower. The aggregate load impacts in 2024 decrease by 20 percent compared to ex-post as enrollments drops by 46 percent.

Table 5-5: Comparison of Ex-Post and Ex-Ante Factors

Factor	Ex-Post	Ex-Ante	Expected Impact
Weather	Average event-hour temperature of 99.1°F for one-way devices, and 102.3°F for two-way devices.	Average event-hour temperature of 102.1 °F in 2023, and 102.6 °F in 2024.	The comparable temperatures between ex-ante and ex-post of two-way devices may produce similar per-customer load impacts (ceteris paribus).
Device Composition	About 20% are two-way devices.	2023: 47% two-way devices 2024: 100% two-way devices	Higher percentage of two-way devices leads to higher per-customer load impacts in ex-ante.
% of resource dispatched	A substantial percentage of two-way devices have dispatch issues in PY2022.	Close to 100 percent	The dispatch issues in ex-post lowers per-customer load impact.
Enrollment	70,997	2023: 70,475 2024: 38,061	Lower ex-ante enrollments lower the aggregate load impacts.
Methodology	Difference-in-Differences with matched control group.	Simulated load impacts from the ex-post using events in 2020-2022.	Incorporating events in 2020-2021 may increase the per-customer load impacts.

6. RECOMMENDATIONS

We continue to recommend that there be some system-wide or serial events dispatched in isolation going forward for the purpose of load impact estimation. While several system-wide events were dispatched in 2022 and more consideration was given to dispatching events over a variety of temperatures to produce more robust forecast models, the coincidence of all system-wide events in 2022 and dual SmartRate™ events impedes the analysis of differences between SmartAC™-only and dually enrolled customer performance. We recommend calling at least one system-wide SmartAC™-only event in the future for the purpose of load impact evaluation.

7. APPENDICES

The following Appendices accompany this report. Appendix A presents further information about the match quality by sub-LAP in our ex-post analysis. Appendix B provides further details of event override rates by sub-LAP and event. Appendix C provides further information about dispatch issues in 2022 by sub-LAP and event. Finally, Appendix D illustrates how we evaluated the quality of our ex-post load impact evaluation and ex-ante forecast. Additional appendices consist of Excel files that can produce the tables required by the Protocols.

Appendix E 4a. PGE_2022_SAC_Ex_Post_PUBLIC

Appendix F 4b. PGE_2022_SAC_Ex_Ante_PUBLIC

Note that the Excel-based tables do not contain confidential information.

Appendix A. Additional Control Group Matching Results

Table A-1 provides the mean percentage error (MPE) and mean absolute percentage error (MAPE) calculated across the average 24-hour load profile as well as over the RA window. Also included are the mean error (ME) and mean absolute error (MAE) which show the errors in terms of kWh/customer/hour differences rather than percentage differences. Again, we evaluate match quality based on 24-hour load profiles for hot days and cooler days used in matching as well as days not using in matching.

The MPE and MAPE are higher by sub-LAP than the overall results. The average MAPE is 1.8 percent for all hours and for the RA window. Table A-1 demonstrates that all ME and MAE values are less than 0.05 kWh/customer/hour in absolute terms except for PGCC, which only has about 200 customers.

Table A-1: Match Quality Statistics by Sub-LAP

Sub-LAP	Comparison Days	24 Hour Load Profile				RA Window			
		MPE (%)	ME (kW)	MAPE (%)	MAE (kW)	MPE (%)	ME (kW)	MAPE (%)	MAE (kW)
PGCC	Hot Days	2.2%	0.04	6.6%	0.07	9.2%	0.03	9.2%	0.04
	Cool Days	-2.3%	-0.02	5.7%	0.05	5.1%	0.02	6.4%	0.02
	Non-Matching Cool Days	-1.9%	-0.01	4.9%	0.04	4.3%	0.02	5.6%	0.02
	Weekend Days	1.1%	0.02	6.2%	0.05	7.8%	0.02	7.8%	0.03
PGEB	Hot Days	-0.3%	0.00	0.5%	0.00	0.1%	0.03	0.3%	0.04
	Cool Days	-0.3%	0.00	0.6%	0.00	-0.2%	0.02	0.2%	0.02
	Non-Matching Cool Days	-0.3%	0.00	0.5%	0.00	0.0%	0.02	0.1%	0.02
	Weekend Days	0.0%	0.00	0.5%	0.00	0.0%	0.02	0.3%	0.03
PGF1	Hot Days	0.5%	0.01	0.6%	0.01	0.4%	0.03	0.4%	0.04
	Cool Days	0.6%	0.01	0.9%	0.01	1.0%	0.02	1.0%	0.02
	Non-Matching Cool Days	0.5%	0.01	0.8%	0.01	0.8%	0.02	0.8%	0.02
	Weekend Days	1.1%	0.01	1.1%	0.01	1.0%	0.02	1.0%	0.03
PGFG	Hot Days	1.7%	0.02	2.3%	0.03	2.9%	0.03	2.9%	0.04
	Cool Days	0.5%	0.01	1.6%	0.01	3.2%	0.02	3.2%	0.02
	Non-Matching Cool Days	0.1%	0.00	1.6%	0.01	2.6%	0.02	2.6%	0.02
	Weekend Days	2.5%	0.02	2.8%	0.02	3.9%	0.02	3.9%	0.03
PGKN	Hot Days	1.0%	0.02	1.1%	0.02	0.7%	0.03	0.8%	0.04
	Cool Days	1.3%	0.01	1.3%	0.01	1.1%	0.02	1.1%	0.02
	Non-Matching Cool Days	1.1%	0.01	1.3%	0.01	1.0%	0.02	1.1%	0.02
	Weekend Days	1.9%	0.02	1.9%	0.02	1.0%	0.02	1.0%	0.03
PGNB	Hot Days	-2.2%	-0.02	2.2%	0.02	-2.3%	0.03	2.3%	0.04
	Cool Days	-0.2%	0.00	1.9%	0.01	2.0%	0.02	2.0%	0.02

Sub-LAP	Comparison Days	24 Hour Load Profile				RA Window			
		MPE (%)	ME (kW)	MAPE (%)	MAE (kW)	MPE (%)	ME (kW)	MAPE (%)	MAE (kW)
	Non-Matching Cool Days	-0.4%	0.00	1.7%	0.01	1.7%	0.02	1.7%	0.02
	Weekend Days	-0.1%	0.00	1.7%	0.01	1.6%	0.02	1.6%	0.03
PGNC	Hot Days	0.7%	0.02	2.4%	0.03	4.0%	0.03	4.0%	0.04
	Cool Days	0.3%	0.01	3.0%	0.02	3.1%	0.02	3.1%	0.02
	Non-Matching Cool Days	-0.5%	0.00	1.9%	0.01	1.9%	0.02	1.9%	0.02
	Weekend Days	1.5%	0.02	3.1%	0.03	3.2%	0.02	3.2%	0.03
PGNP	Hot Days	-0.4%	0.00	0.4%	0.01	- 0.2%	0.03	0.3%	0.04
	Cool Days	-0.3%	0.00	0.4%	0.00	0.1%	0.02	0.2%	0.02
	Non-Matching Cool Days	-0.7%	-0.01	0.7%	0.01	- 0.3%	0.02	0.3%	0.02
	Weekend Days	0.3%	0.00	0.7%	0.01	0.3%	0.02	0.3%	0.03
PGP2	Hot Days	1.2%	0.01	1.3%	0.01	0.7%	0.03	0.9%	0.04
	Cool Days	2.3%	0.02	2.3%	0.02	1.7%	0.02	1.7%	0.02
	Non-Matching Cool Days	1.7%	0.01	1.7%	0.01	0.6%	0.02	0.6%	0.02
	Weekend Days	2.1%	0.02	2.1%	0.02	0.8%	0.02	0.8%	0.03
PGSB	Hot Days	0.3%	0.00	0.7%	0.01	0.6%	0.03	0.6%	0.04
	Cool Days	-0.1%	0.00	0.6%	0.00	0.2%	0.02	0.4%	0.02
	Non-Matching Cool Days	0.0%	0.00	0.6%	0.00	0.6%	0.02	0.7%	0.02
	Weekend Days	0.6%	0.01	1.0%	0.01	0.7%	0.02	0.7%	0.03
PGSI	Hot Days	1.0%	0.02	1.0%	0.02	1.0%	0.03	1.0%	0.04
	Cool Days	1.5%	0.01	1.5%	0.01	2.3%	0.02	2.3%	0.02
	Non-Matching Cool Days	1.8%	0.02	1.8%	0.02	2.6%	0.02	2.6%	0.02
	Weekend Days	2.6%	0.02	2.6%	0.02	2.9%	0.02	2.9%	0.03
PGST	Hot Days	0.3%	0.01	0.6%	0.01	0.3%	0.03	0.3%	0.04
	Cool Days	0.6%	0.01	0.8%	0.01	0.7%	0.02	0.7%	0.02
	Non-Matching Cool Days	0.5%	0.01	0.8%	0.01	1.0%	0.02	1.0%	0.02
	Weekend Days	1.2%	0.01	1.4%	0.01	1.3%	0.02	1.3%	0.03
PGZP	Hot Days	2.6%	0.03	2.6%	0.03	1.3%	0.03	1.3%	0.04
	Cool Days	3.2%	0.03	3.2%	0.03	2.3%	0.02	2.3%	0.02
	Non-Matching Cool Days	2.5%	0.02	2.5%	0.02	0.8%	0.02	0.8%	0.02
	Weekend Days	2.7%	0.02	2.7%	0.02	1.3%	0.02	1.3%	0.03

Appendix B. Event Overrides by Event and Location

Table B-1 shows customers overrides by sub-LAP for each event day. All override rates are below one percent.

Table B-1: Overrides by Sub-LAP and Event Day

Date	Sub-LAP	Full Event Hours (p.m.)	SmartRate™ Event?	# Overrides	# Dis-patched	Override Rate
7/11	PGKN	5:00-7:00	Yes	2	3,235	0.1%
	PGNC	5:00-7:00		1	408	0.2%
	PGNP	5:00-7:00		10	9,145	0.1%
	PGSI	5:00-7:00		4	10,704	0.0%
	PGZP	5:00-7:00		1	1,379	0.1%
7/16	PGF1	4:00-6:00	No	2	12,480	0.0%
	PGKN	4:00-6:00		1	3,656	0.0%
	PGNP	5:00-7:00		6	10,636	0.1%
	PGSI	4:00-6:00		4	11,656	0.0%
	PGST	4:00-6:00		4	5,219	0.1%
	PGZP	4:00-6:00		0	1,559	0.0%
7/17	PGF1	3:00-5:00	No	3	12,479	0.0%
	PGKN	4:00-6:00		4	3,656	0.1%
	PGZP	4:00-6:00		0	1,559	0.0%
7/24	PGNC	6:00-8:00	No	0	463	0.0%
7/29	PGF1	5:00-7:00	No	1	12,449	0.0%
	PGKN	5:00-7:00		1	3,643	0.0%
	PGNC	5:00-7:00		0	462	0.0%
	PGNP	6:00-8:00		3	10,604	0.0%
	PGZP	5:00-7:00		0	1,556	0.0%
8/16	PGEB	5:00-7:00	Yes	11	14,290	0.1%
	PGF1	6:00-8:00		5	11,125	0.0%
	PGKN	6:00-8:00		4	3,217	0.1%
	PGNB	6:00-8:00		0	1,070	0.0%
	PGNC	6:00-8:00		0	407	0.0%
	PGNP	7:00-9:00		5	9,114	0.1%
	PGP2	5:00-7:00		1	2,914	0.0%
	PGSB	5:00-7:00		7	6,249	0.1%
	PGSI	8:00-10:00		3	10,670	0.0%
	PGST	7:00-9:00		2	4,389	0.0%
8/17	PGCC	4:30-7:00	Yes	0	173	0.0%
	PGEB	4:30-7:00		11	12,627	0.1%
	PGF1	4:30-7:00		7	9,959	0.1%

Date	Sub-LAP	Full Event Hours (p.m.)	Smart-Rate™ Event?	# Overrides	# Dis-patched	Override Rate
	PGFG	4:30-7:00		0	1,247	0.0%
	PGKN	4:30-7:00		3	2,857	0.1%
	PGNB	4:30-7:00		0	948	0.0%
	PGNC	4:30-7:00		0	363	0.0%
	PGNP	4:30-7:00		6	8,168	0.1%
	PGP2	4:30-7:00		2	2,557	0.1%
	PGSB	4:30-7:00		7	5,560	0.1%
	PGSI	4:30-7:00		4	9,442	0.0%
	PGST	4:30-7:00		2	3,895	0.1%
	PGZP	4:30-7:00		1	1,202	0.1%
8/19	PGSI	5:00-7:00	Yes	5	10,655	0.0%
9/2	PGF1	5:00-7:00	No	4	12,364	0.0%
	PGKN	5:00-7:00		3	3,601	0.1%
	PGZP	5:00-7:00		2	1,548	0.1%
9/5	PGCC	6:00-8:00	Yes	0	203	0.0%
	PGEB	6:00-8:00		30	14,253	0.2%
	PGF1	6:00-8:00		9	11,049	0.1%
	PGFG	6:00-8:00		6	1,361	0.4%
	PGKN	6:00-8:00		4	3,188	0.1%
	PGNB	6:00-8:00		1	1,064	0.1%
	PGNC	6:00-8:00		0	406	0.0%
	PGNP	6:00-8:00		16	9,070	0.2%
	PGP2	6:00-8:00		5	2,912	0.2%
	PGSB	6:00-8:00		20	6,225	0.3%
	PGSI	6:00-8:00		16	10,614	0.2%
	PGST	6:00-8:00		5	4,328	0.1%
	PGZP	6:00-8:00		1	1,371	0.1%
9/6	PGCC	5:00-8:00	Yes	1	203	0.5%
	PGEB	5:00-8:00		45	14,242	0.3%
	PGF1	5:00-8:00		13	11,040	0.1%
	PGFG	5:00-8:00		8	1,355	0.6%
	PGKN	5:00-8:00		8	3,185	0.3%
	PGNB	5:00-8:00		5	1,062	0.5%
	PGNC	5:00-8:00		1	404	0.2%
	PGNP	5:00-8:00		16	9,059	0.2%
	PGP2	5:00-8:00		12	2,908	0.4%
	PGSB	5:00-8:00		30	6,212	0.5%
	PGSI	5:00-8:00		25	10,599	0.2%

Date	Sub-LAP	Full Event Hours (p.m.)	Smart-Rate™ Event?	# Overrides	# Dis-patched	Override Rate
	PGST	5:00-8:00		5	4,323	0.1%
	PGZP	5:00-8:00		3	1,371	0.2%
9/7	PGCC	4:00-8:00	Yes	1	203	0.5%
	PGEB	4:00-8:00		60	14,229	0.4%
	PGF1	4:00-8:00		16	11,030	0.1%
	PGKN	4:00-8:00		11	3,183	0.3%
	PGNB	4:00-8:00		9	1,060	0.8%
	PGNC	4:00-8:00		2	404	0.5%
	PGNP	4:00-8:00		29	9,051	0.3%
	PGP2	4:00-8:00		16	2,904	0.6%
	PGSB	4:00-8:00		42	6,203	0.7%
	PGSI	4:00-8:00		36	10,591	0.3%
	PGST	4:00-8:00		12	4,321	0.3%
	PGZP	4:00-8:00		2	1,371	0.1%
9/8	PGCC	5:00-7:00	Yes	1	203	0.5%
	PGEB	5:00-7:00		62	14,215	0.4%
	PGF1	5:00-8:00		14	11,026	0.1%
	PGFG	5:00-7:00		4	1,355	0.3%
	PGKN	5:00-7:00		9	3,182	0.3%
	PGNB	5:00-7:00		7	1,058	0.7%
	PGNC	5:00-8:00		1	402	0.2%
	PGNP	5:00-7:00		23	9,047	0.3%
	PGP2	5:00-8:00		15	2,902	0.5%
	PGSB	5:00-8:00		38	6,194	0.6%
	PGSI	5:00-8:00		42	10,584	0.4%
	PGST	5:00-7:00		13	4,319	0.3%
	PGZP	5:00-8:00		2	1,370	0.1%
9/9	PGNC	4:00-6:00	No	1	455	0.2%
	PGNP	4:00-6:00		19	10,502	0.2%
	PGSI	4:00-6:00		25	11,512	0.2%
	PGST	4:00-6:00		12	5,085	0.2%

Appendix C. Comparison of Load Impacts with and without dispatch issues

Table C-1 and Table C-2 present a comparison of load impacts estimated for all customers versus customers that were actually dispatched for each event in 2022. Table C-1 is the comparison of load impacts for customers with two-way devices, and Table C-2 is the comparison of overall load impacts.

Table C-1: Average Event-Hour Load Impacts by Sub-LAP and Event for Two-way Devices With and Without Dispatch Issues

Date	Sub-LAP	Full Event Hours (p.m.)	SmartRate™ Event?	# Dispatched	% with Dispatch Issue	Per-Customer Load Impact		Percentage Load Impact		Avg. Temp (°F)
						All	Success Only	All	Success Only	
7/11	PGKN	5:00-7:00	Yes	1,293	22%	0.53	0.65	16.6%	19.5%	103.3
	PGNC	5:00-7:00		[redacted]						
	PGNP	5:00-7:00		1,015	23%	0.53	0.70	18.1%	22.7%	99.4
	PGSI	5:00-7:00		1,733	28%	0.36	0.50	13.2%	17.1%	99.0
	PGZP	5:00-7:00		[redacted]						
7/16	PGF1	4:00-6:00	No	4,378	36%	0.39	0.64	12.3%	18.8%	106.4
	PGKN	4:00-6:00		1,547	23%	0.50	0.61	15.9%	18.7%	104.8
	PGNP	5:00-7:00		1,166	25%	0.42	0.53	15.5%	18.8%	101.5
	PGSI	4:00-6:00		2,105	28%	0.35	0.49	13.7%	18.2%	101.8
	PGST	4:00-6:00		1,155	41%	0.31	0.46	10.9%	15.4%	100.1
	PGZP	4:00-6:00		332	23%	0.52	0.70	16.7%	21.2%	101.7
7/17	PGF1	3:00-5:00	No	4,378	36%	0.44	0.70	14.0%	20.4%	107.6
	PGKN	4:00-6:00		1,547	23%	0.79	0.93	21.7%	24.6%	107.3
	PGZP	4:00-6:00		332	23%	0.48	0.53	14.8%	16.1%	102.6
7/24	PGNC	6:00-8:00	No	124	16%	0.41	0.48	17.3%	19.5%	80.0
7/29	PGF1	5:00-7:00	No	4,493	37%	0.34	0.57	10.8%	16.8%	101.3
	PGKN	5:00-7:00		1,574	24%	0.58	0.73	17.1%	20.4%	105.5
	PGNC	5:00-7:00		124	16%	0.47	0.62	17.7%	21.9%	84.5
	PGNP	6:00-8:00		1,179	28%	0.22	0.30	9.7%	13.2%	88.4
	PGZP	5:00-7:00		331	24%	0.27	0.41	9.4%	13.6%	97.8
8/16	PGEB	5:00-7:00	Yes	2,261	45%	0.35	0.65	12.0%	20.1%	95.2
	PGF1	6:00-8:00		3,844	44%	0.31	0.56	9.0%	15.1%	104.3
	PGKN	6:00-8:00		1,367	26%	0.44	0.59	12.5%	16.2%	103.5
	PGNB	6:00-8:00		[redacted]						
	PGNC	6:00-8:00		[redacted]						
	PGNP	7:00-9:00		1,079	33%	0.29	0.42	10.1%	14.1%	96.4
	PGP2	5:00-7:00		158	27%	0.42	0.66	13.8%	20.2%	89.8
	PGSB	5:00-7:00		530	35%	0.21	0.44	8.9%	16.9%	90.0
	PGSI	8:00-10:00		1,908	34%	0.08	0.19	3.8%	8.3%	89.5
	PGST	7:00-9:00		1,230	50%	0.06	0.23	1.7%	6.7%	97.2

Date	Sub-LAP	Full Event Hours (p.m.)	SmartRate™ Event?	# Dis-patched	% with Dispatch Issue	Per-Customer Load Impact		Percentage Load Impact		Avg. Temp (°F)
						All	Success Only	All	Success Only	
8/17	PGCC	5: 00-7:00	Yes	[redacted]						
	PGEB	5:00-7:00		2,041	47%	0.15	0.25	7.2%	11.4%	86.4
	PGF1	5:00-7:00		3,446	47%	0.27	0.50	8.3%	14.4%	103.2
	PGFG	5:00-7:00		[redacted]						
	PGKN	5:00-7:00		1,219	30%	0.51	0.71	14.2%	18.6%	106.0
	PGNB	5:00-7:00		[redacted]						
	PGNC	5:00-7:00								
	PGNP	5:00-7:00		959	36%	0.26	0.32	11.1%	13.2%	92.7
	PGP2	5:00-7:00		144	29%	0.14	0.22	6.3%	9.6%	80.8
	PGSB	5:00-7:00		477	37%	0.08	0.19	4.4%	10.5%	80.7
	PGSI	5:00-7:00		1,724	36%	0.25	0.25	11.6%	11.7%	91.9
	PGST	5:00-7:00		1,092	51%	0.08	0.20	3.4%	7.8%	92.1
	PGZP	5:00-7:00		241	31%	0.37	0.51	11.6%	15.3%	100.2
8/19	PGSI	5:00-7:00	Yes	1,931	36%	0.29	0.40	11.4%	15.1%	97.8
9/2	PGF1	5:00-7:00	No	4,811	47%	0.38	0.68	10.9%	18.0%	107.8
	PGKN	5:00-7:00		1,629	33%	0.54	0.76	15.2%	20.1%	106.3
	PGZP	5:00-7:00		335	29%	0.63	0.78	17.5%	20.8%	104.2
9/5	PGCC	6:00-8:00	Yes	[redacted]						
	PGEB	6:00-8:00		2,290	47%	0.38	0.74	11.5%	20.2%	96.6
	PGF1	6:00-8:00		3,987	50%	0.36	0.64	9.9%	16.2%	103.1
	PGFG	6:00-8:00		[redacted]						
	PGKN	6:00-8:00		1,380	31%	0.47	0.70	12.5%	17.8%	105.0
	PGNB	6:00-8:00		[redacted]						
	PGNC	6:00-8:00								
	PGNP	6:00-8:00		1,087	36%	0.53	0.76	15.1%	20.2%	104.8
	PGP2	6:00-8:00		161	29%	0.79	1.07	21.7%	27.5%	94.6
	PGSB	6:00-8:00		540	39%	0.26	0.50	9.3%	16.2%	95.9
	PGSI	6:00-8:00		2,115	38%	0.36	0.59	11.2%	17.2%	104.0
	PGST	6:00-8:00		1,289	62%	0.14	0.63	3.9%	15.1%	104.6
	PGZP	6:00-8:00		278	30%	0.52	0.67	14.1%	17.3%	101.3
9/6	PGCC	5:00-8:00	Yes	[redacted]						
	PGEB	5:00-8:00		2,042	50%	0.38	0.68	11.5%	18.8%	96.6
	PGF1	5:00-8:00		3,581	51%	0.42	0.75	11.0%	18.1%	110.5
	PGFG	5:00-8:00		[redacted]						
	PGKN	5:00-8:00		1,224	34%	0.52	0.81	13.1%	19.2%	111.0
	PGNB	5:00-8:00		[redacted]						
	PGNC	5:00-8:00								
	PGNP	5:00-8:00		968	39%	0.52	0.75	14.8%	20.2%	106.2
	PGP2	5:00-8:00		[redacted]						

Date	Sub-LAP	Full Event Hours (p.m.)	Smart-Rate™ Event?	# Dis-patched	% with Dispatch Issue	Per-Customer Load Impact		Percentage Load Impact		Avg. Temp (°F)
						All	Success Only	All	Success Only	
	PGSB	5:00-8:00		486	43%	0.19	0.44	6.9%	14.5%	94.9
	PGSI	5:00-8:00		1,893	40%	0.71	0.82	21.8%	24.4%	106.6
	PGST	5:00-8:00		1,167	63%	0.16	0.65	4.2%	15.1%	105.3
	PGZP	5:00-8:00		250	34%	0.49	0.69	13.2%	17.7%	105.9
9/7	PGCC	4:00-8:00	Yes	[redacted]						
	PGEB	4:00-8:00		2,289	48%	0.34	0.60	11.6%	18.9%	93.3
	PGF1	4:00-8:00		3,997	50%	0.38	0.71	10.4%	17.9%	108.0
	PGKN	4:00-8:00		1,381	31%	0.56	0.83	14.8%	20.3%	108.3
	PGNB	4:00-8:00		[redacted]						
	PGNC	4:00-8:00		[redacted]						
	PGNP	4:00-8:00		1,093	37%	0.48	0.69	15.3%	20.5%	102.2
	PGP2	4:00-8:00		160	30%	0.31	0.46	9.6%	13.6%	91.1
	PGSB	4:00-8:00		539	41%	0.14	0.34	5.7%	13.0%	92.3
	PGSI	4:00-8:00		2,116	38%	0.35	0.52	11.7%	16.3%	102.7
	PGST	4:00-8:00		1,289	62%	0.14	0.56	4.2%	14.8%	100.9
	PGZP	4:00-8:00		278	31%	0.56	0.75	15.1%	19.2%	104.5
9/8	PGCC	5:00-7:00	Yes	[redacted]						
	PGEB	5:00-7:00		2,287	48%	0.45	0.83	13.3%	22.0%	98.5
	PGF1	5:00-8:00		4,014	50%	0.32	0.56	9.4%	15.3%	101.5
	PGFG	5:00-7:00		[redacted]						
	PGKN	5:00-7:00		1,383	35%	0.51	0.76	14.4%	20.0%	104.3
	PGNB	5:00-7:00		[redacted]						
	PGNC	5:00-8:00		[redacted]						
	PGNP	5:00-7:00		1,096	38%	0.62	0.91	17.6%	23.7%	106.7
	PGP2	5:00-8:00		160	31%	0.58	0.74	15.6%	19.2%	94.1
	PGSB	5:00-8:00		539	41%	0.20	0.47	7.1%	15.4%	95.0
	PGSI	5:00-8:00		2,119	39%	0.34	0.55	10.9%	16.3%	103.8
	PGST	5:00-7:00		1,290	62%	0.19	0.72	5.0%	16.7%	105.8
	PGZP	5:00-8:00		277	31%	0.39	0.51	11.7%	15.0%	98.3
9/9	PGNC	4:00-6:00	No	123	19%	0.24	0.47	10.0%	17.7%	93.5
	PGNP	4:00-6:00		1,234	38%	0.53	0.79	17.2%	23.7%	103.8
	PGSI	4:00-6:00		2,461	37%	0.29	0.43	11.5%	16.0%	102.5
	PGST	4:00-6:00		1,422	62%	0.22	0.61	6.8%	16.8%	103.6

Table C-2: Average Event-Hour Load Impacts by Sub-LAP and Event With and Without Dispatch Issues

Date	Sub-LAP	Full Event Hours (p.m.)	Smart-Rate™ Event?	# Dis-patched	% with Dispatch Issue	Per-Customer Load Impact		Percentage Load Impact		Avg. Temp (°F)
						All	Success Only	All	Success Only	
7/11	PGKN	5:00-7:00	Yes	3,235	9%	0.53	0.57	17.2%	18.6%	103.3
	PGNC	5:00-7:00		408	5%	0.43	0.45	15.4%	16.4%	92.9
	PGNP	5:00-7:00		9,145	3%	0.30	0.31	10.9%	11.2%	99.3
	PGSI	5:00-7:00		10,704	4%	0.30	0.31	10.5%	11.0%	98.6
	PGZP	5:00-7:00		1,379	5%	0.22	0.23	8.9%	9.6%	91.4
7/16	PGF1	4:00-6:00	No	12,480	13%	0.28	0.33	9.2%	11.0%	105.9
	PGKN	4:00-6:00		3,656	10%	0.48	0.52	16.6%	18.0%	104.8
	PGNP	5:00-7:00		10,636	3%	0.24	0.25	9.6%	9.8%	101.3
	PGSI	4:00-6:00		11,656	5%	0.30	0.31	11.6%	12.3%	101.2
	PGST	4:00-6:00		5,219	9%	0.28	0.30	10.8%	11.7%	100.1
	PGZP	4:00-6:00		1,559	5%	0.33	0.35	12.4%	13.5%	99.7
7/17	PGF1	3:00-5:00	No	12,479	13%	0.29	0.33	9.5%	11.0%	106.8
	PGKN	4:00-6:00		3,656	10%	0.61	0.65	18.1%	19.2%	107.3
	PGZP	4:00-6:00		1,559	5%	0.32	0.32	11.7%	11.8%	98.8
7/24	PGNC	6:00-8:00	No	463	4%	0.13	0.13	5.6%	5.8%	88.1
7/29	PGF1	5:00-7:00	No	12,449	13%	0.16	0.19	5.1%	6.2%	100.2
	PGKN	5:00-7:00		3,643	11%	0.52	0.57	15.9%	17.4%	105.5
	PGNC	5:00-7:00		462	4%	0.10	0.11	3.6%	4.2%	92.0
	PGNP	6:00-8:00		10,604	3%	0.09	0.09	4.2%	4.4%	88.5
	PGZP	5:00-7:00		1,556	5%	0.18	0.20	7.8%	8.9%	90.4
8/16	PGEB	5:00-7:00	Yes	14,290	7%	0.31	0.34	10.7%	11.6%	92.2
	PGF1	6:00-8:00		11,125	15%	0.25	0.29	7.3%	8.7%	103.7
	PGKN	6:00-8:00		3,217	11%	0.45	0.51	13.1%	14.9%	103.5
	PGNB	6:00-8:00		1,070	1%	0.24	0.24	9.5%	9.5%	92.1
	PGNC	6:00-8:00		407	6%	0.29	0.33	10.4%	11.7%	93.1
	PGNP	7:00-9:00		9,114	4%	0.20	0.21	7.0%	7.3%	95.8
	PGP2	5:00-7:00		2,914	1%	0.31	0.32	12.7%	13.1%	89.4
	PGSB	5:00-7:00		6,249	3%	0.33	0.34	14.3%	15.0%	90.4
	PGSI	8:00-10:00		10,670	6%	0.16	0.17	6.2%	6.9%	86.1
	PGST	7:00-9:00		4,389	14%	0.20	0.25	6.4%	8.2%	95.8
8/17	PGCC	5:00-7:00	Yes	173	1%	0.24	0.25	18.4%	19.1%	79.4
	PGEB	5:00-7:00		12,627	8%	0.19	0.20	9.2%	10.0%	85.0
	PGF1	5:00-7:00		9,959	16%	0.24	0.29	7.6%	9.3%	102.2
	PGFG	5:00-7:00		1,247	1%	0.09	0.09	5.7%	5.6%	76.5
	PGKN	5:00-7:00		2,857	13%	0.53	0.61	15.4%	17.6%	106.0
	PGNB	5:00-7:00		948	1%	0.18	0.18	11.3%	11.6%	82.9

Date	Sub-LAP	Full Event Hours (p.m.)	Smart-Rate™ Event?	# Dis-patched	% with Dispatch Issue	Per-Customer Load Impact		Percentage Load Impact		Avg. Temp (°F)
						All	Success Only	All	Success Only	
	PGNC	5:00-7:00		363	4%	0.20	0.23	8.3%	9.6%	92.5
	PGNP	5:00-7:00		8,168	4%	0.15	0.15	6.7%	6.8%	92.8
	PGP2	5:00-7:00		2,557	2%	0.14	0.14	7.6%	7.8%	80.6
	PGSB	5:00-7:00		5,560	3%	0.16	0.17	9.9%	10.5%	81.0
	PGSI	5:00-7:00		9,442	7%	0.20	0.19	8.6%	8.5%	92.3
	PGST	5:00-7:00		3,895	14%	0.10	0.13	4.5%	5.7%	91.8
	PGZP	5:00-7:00		1,202	6%	0.31	0.32	11.3%	12.2%	94.7
8/19	PGSI	5:00-7:00	Yes	10,655	6%	0.24	0.25	8.6%	8.9%	97.4
9/2	PGF1	5:00-7:00	No	12,364	18%	0.22	0.27	6.6%	8.1%	106.9
	PGKN	5:00-7:00		3,601	15%	0.51	0.59	14.9%	17.1%	106.3
	PGZP	5:00-7:00		1,548	6%	0.28	0.29	8.6%	8.8%	103.7
9/5	PGCC	6:00-8:00	Yes	203	1%	0.50	0.51	13.7%	14.0%	87.5
	PGEB	6:00-8:00		14,253	8%	0.39	0.42	11.6%	12.6%	91.8
	PGF1	6:00-8:00		11,049	18%	0.26	0.30	7.2%	8.3%	103.2
	PGFG	6:00-8:00		1,361	1%	0.29	0.30	9.2%	9.3%	102.0
	PGKN	6:00-8:00		3,188	13%	0.46	0.55	12.5%	14.8%	105.0
	PGNB	6:00-8:00		1,064	1%	0.47	0.47	14.5%	14.7%	102.8
	PGNC	6:00-8:00		406	5%	0.31	0.33	10.3%	11.1%	100.6
	PGNP	6:00-8:00		9,070	4%	0.33	0.34	9.5%	9.8%	104.5
	PGP2	6:00-8:00		2,912	2%	0.42	0.43	13.6%	13.9%	94.5
	PGSB	6:00-8:00		6,225	3%	0.33	0.34	11.9%	12.4%	95.5
	PGSI	6:00-8:00		10,614	8%	0.37	0.40	10.8%	11.7%	101.2
	PGST	6:00-8:00		4,328	19%	0.29	0.40	8.2%	11.2%	104.3
	PGZP	6:00-8:00		1,371	6%	0.30	0.30	8.5%	8.8%	97.9
9/6	PGCC	5:00-8:00	Yes	182	1%	0.35	0.36	12.0%	12.2%	88.2
	PGEB	5:00-8:00		12,570	8%	0.34	0.38	10.4%	11.4%	94.3
	PGF1	5:00-8:00		9,860	19%	0.30	0.36	8.0%	9.7%	110.1
	PGFG	5:00-8:00		1,198	1%	0.33	0.33	12.0%	11.9%	89.3
	PGKN	5:00-8:00		2,816	15%	0.53	0.65	13.7%	16.7%	111.0
	PGNB	5:00-8:00		956	1%	0.31	0.32	11.4%	11.7%	95.2
	PGNC	5:00-8:00		359	4%	0.25	0.27	8.2%	8.9%	100.7
	PGNP	5:00-8:00		8,009	5%	0.30	0.31	8.8%	9.3%	105.8
	PGP2	5:00-8:00		2,591	2%	0.42	0.42	14.1%	14.3%	93.0
	PGSB	5:00-8:00		5,503	4%	0.28	0.30	10.3%	11.0%	94.6
	PGSI	5:00-8:00		9,402	8%	0.44	0.44	12.8%	12.7%	104.8
	PGST	5:00-8:00		3,892	19%	0.28	0.39	7.4%	10.6%	105.3
	PGZP	5:00-8:00		1,215	7%	0.23	0.24	6.9%	7.4%	100.2
9/7	PGCC	4:00-8:00	Yes	203	1%	0.63	0.64	20.6%	20.9%	86.3

Date	Sub-LAP	Full Event Hours (p.m.)	SmartRate™ Event?	# Dis-patched	% with Dispatch Issue	Per-Customer Load Impact		Percentage Load Impact		Avg. Temp (°F)
						All	Success Only	All	Success Only	
	PGEB	4:00-8:00		14,229	8%	0.34	0.36	11.8%	12.6%	91.5
	PGF1	4:00-8:00		11,030	18%	0.26	0.32	7.5%	9.0%	107.4
	PGKN	4:00-8:00		3,183	14%	0.48	0.57	13.1%	15.5%	108.3
	PGNB	4:00-8:00		1,060	1%	0.28	0.29	11.5%	11.8%	94.0
	PGNC	4:00-8:00		404	5%	0.15	0.17	5.5%	6.3%	95.8
	PGNP	4:00-8:00		9,051	4%	0.25	0.26	8.6%	8.9%	102.1
	PGP2	4:00-8:00		2,904	2%	0.33	0.34	12.2%	12.4%	90.7
	PGSB	4:00-8:00		6,203	4%	0.28	0.30	11.9%	12.6%	92.1
	PGSI	4:00-8:00		10,591	8%	0.33	0.36	10.6%	11.3%	100.9
	PGST	4:00-8:00		4,321	19%	0.26	0.35	8.0%	10.8%	100.8
	PGZP	4:00-8:00		1,371	6%	0.25	0.26	7.6%	7.9%	101.7
9/8	PGCC	5:00-7:00	Yes	203	1%	0.87	0.89	23.8%	24.3%	90.5
	PGEB	5:00-7:00		14,215	8%	0.42	0.45	12.5%	13.4%	96.8
	PGF1	5:00-8:00		11,026	18%	0.21	0.24	6.4%	7.4%	101.7
	PGFG	5:00-7:00		1,355	1%	0.23	0.23	7.6%	7.7%	101.0
	PGKN	5:00-7:00		3,182	15%	0.46	0.53	13.4%	15.7%	104.3
	PGNB	5:00-7:00		1,058	1%	0.39	0.41	13.1%	13.5%	103.6
	PGNC	5:00-8:00		402	5%	0.10	0.12	3.3%	4.3%	99.5
	PGNP	5:00-7:00		9,047	5%	0.28	0.29	8.3%	8.6%	106.4
	PGP2	5:00-8:00		2,902	2%	0.39	0.40	12.6%	12.8%	94.0
	PGSB	5:00-8:00		6,194	4%	0.27	0.29	9.8%	10.4%	95.0
	PGSI	5:00-8:00		10,584	8%	0.33	0.36	10.1%	10.9%	101.0
	PGST	5:00-7:00		4,319	19%	0.28	0.39	7.8%	10.9%	105.6
	PGZP	5:00-8:00		1,370	6%	0.16	0.17	5.7%	6.0%	93.9
9/9	PGNC	4:00-6:00	No	455	5%	0.15	0.20	6.2%	8.1%	97.3
	PGNP	4:00-6:00		10,502	4%	0.26	0.27	9.2%	9.6%	103.6
	PGSI	4:00-6:00		11,512	8%	0.28	0.30	10.8%	11.5%	101.1
	PGST	4:00-6:00		5,085	17%	0.27	0.34	8.8%	11.1%	103.3

Appendix D. Scatterplots of Load Impacts and Temperature

Figure D-1 through Figure D-13 show scatterplots of hourly ex-post and ex-ante load impacts compared to average temperatures from PY2022 for all sub-LAPs by device type. The red dots show the ex-post load impacts in 2022, while the red line shows the linear relationship between load impacts and hourly temperatures in 2022. The blue dots and line show the ex-post load impacts in 2020 and 2021. The green dots and line show the ex-ante load impacts from the PY2022 forecast. The results are limited to the hours where ex-post and ex-ante have overlapping event hours from 4 to 9 p.m. For the ex-ante load impacts we use the June, July, August, September, and October peak month weather conditions for the PG&E 1-in-10 weather scenario for 2022.

For most sub-LAPs, ex-post results in 2022 are lower than 2020-2021 for two-way devices due to dispatch issues. Given similar temperatures, the forecasted ex-ante load impacts tend to be between the 2020-2021 ex-post results and the 2022 ex-post results as all three years are used for the ex-ante forecast, so the forecast accounts for some level of operational issues in the future. Furthermore, the forecasts by device type have slightly different relationships between per-customer load impacts and temperature. Compared to PY2021, the new weather scenarios have hotter temperatures in some sub-LAPs, but in hotter sub-LAPs the highest ex-post temperatures are still higher than the weather scenarios encompass.

Figure D-1: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGCC

[redacted]

Figure D-2: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGEB

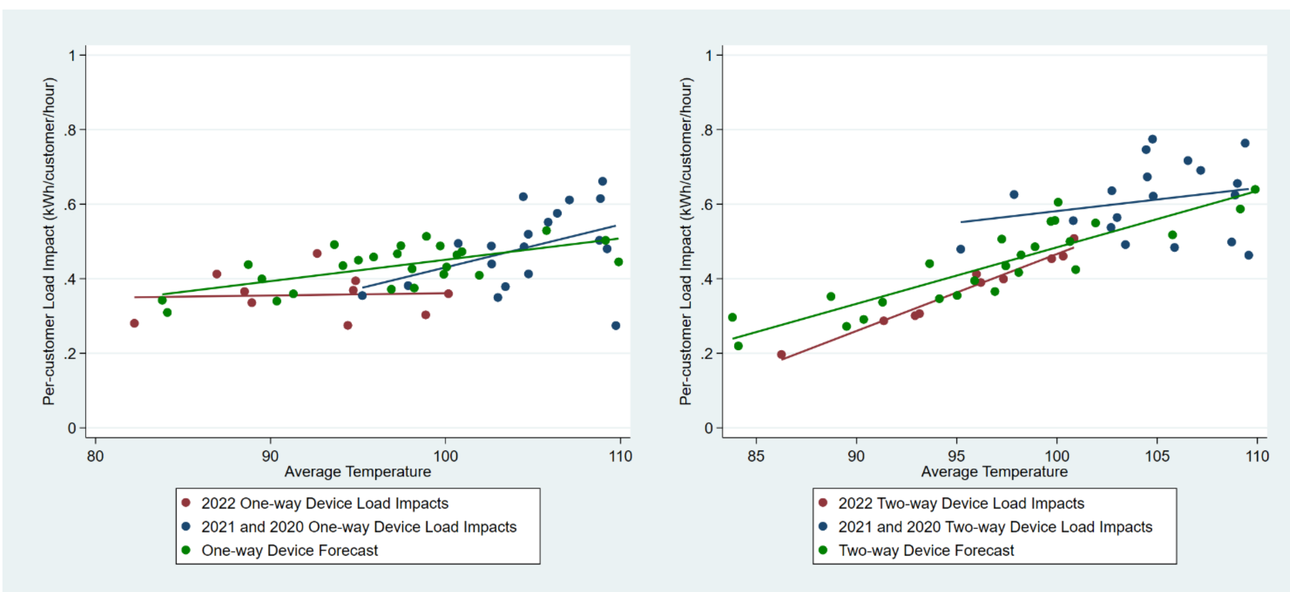


Figure D-3: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGF1

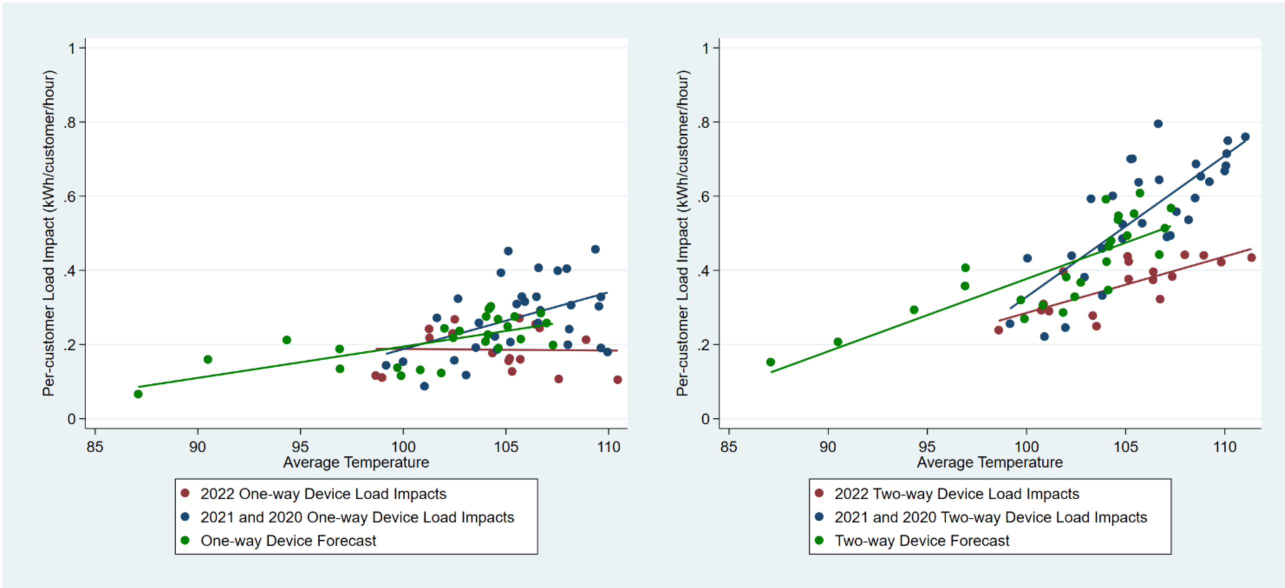


Figure D-4: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGFG

[redacted]

Figure D-5: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGKN

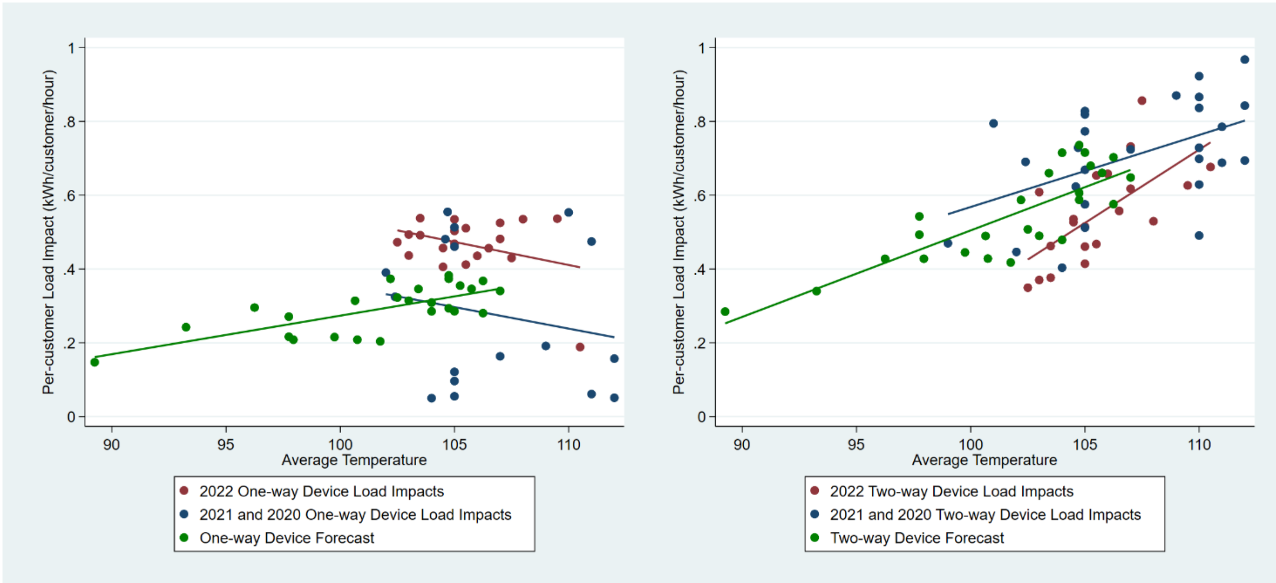


Figure D-6: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGNB

[redacted]

Figure D-7: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGNC

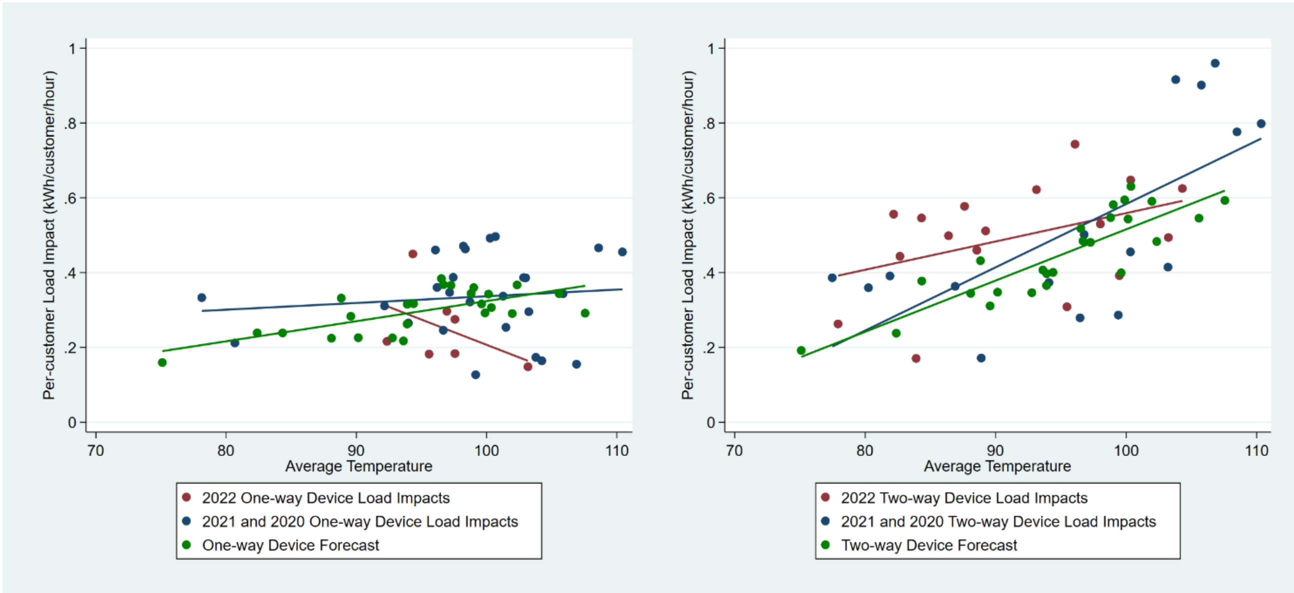


Figure D-8: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGNP

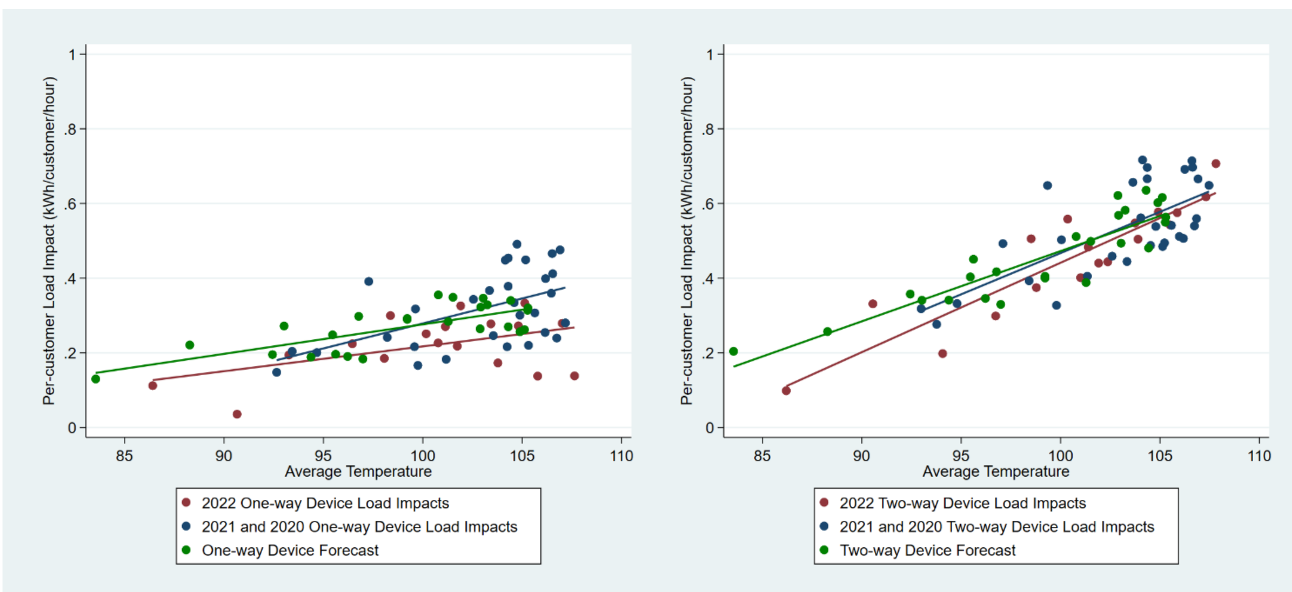


Figure D-9: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGP2

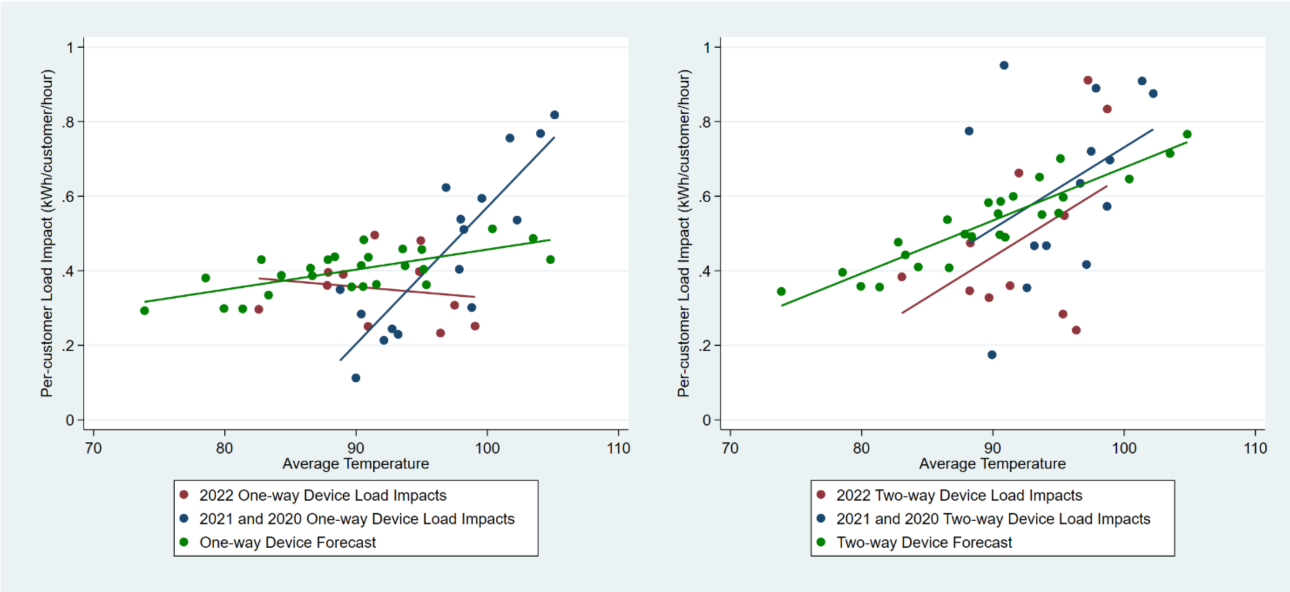


Figure D-10: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGSB

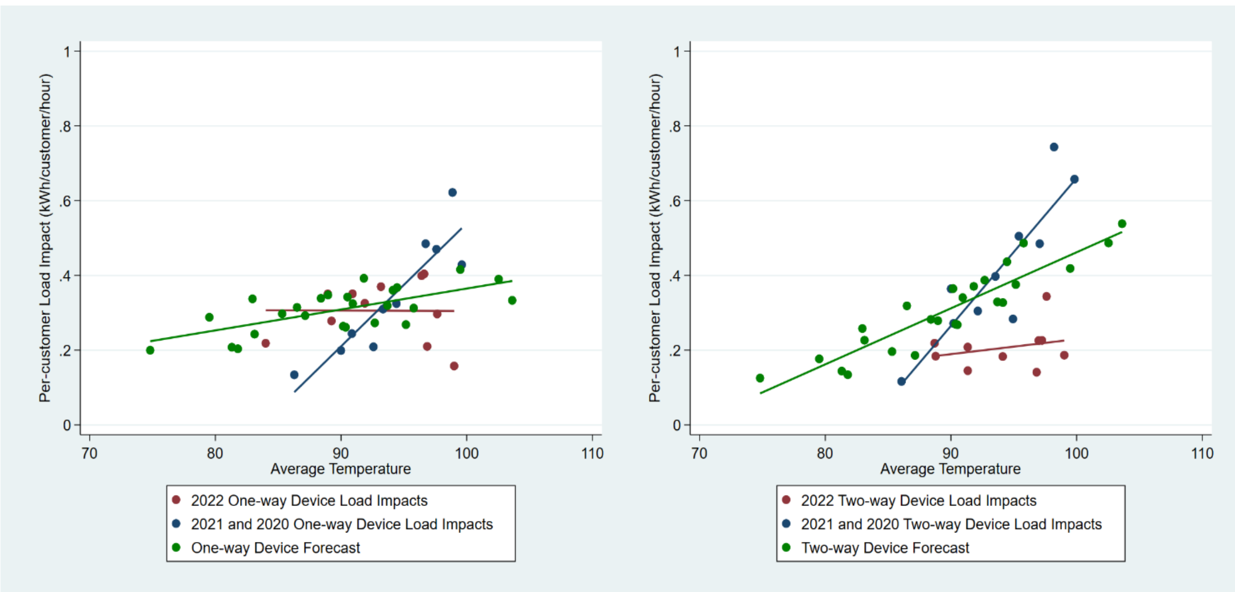


Figure D-11: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGSI

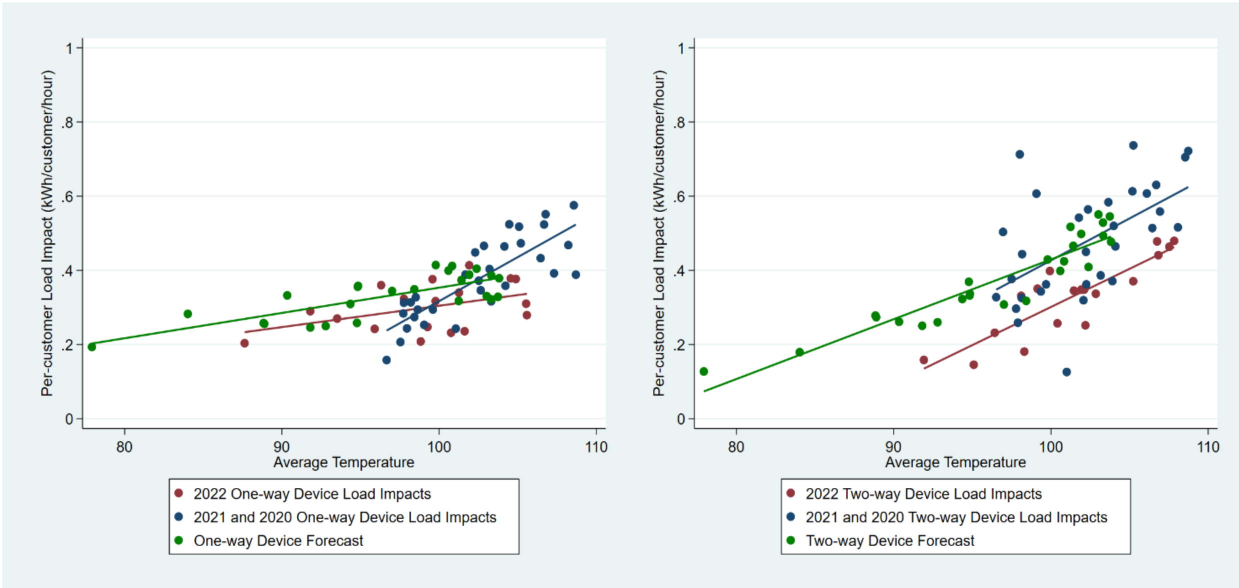


Figure D-12: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGST

Figure D-13: Scatterplot of Hourly Load Impacts vs. Average Temperature, PGZP