VOLTUS - LOAD IMPACT PROTOCOLS

Third Party DRP LIP Workshop – May 10th, 2023
Confidential Information Excluded

VERDANT

AGENDA

Voltus Load Impact Protocols Workshop

- Voltus Background
- Portfolio and Program Descriptions
- Ex Post Methodology
- Ex Post Load Impacts
- Ex Ante Methodology
- Ex Ante Load Impacts

VOLTUS BACKGROUND

BACKGROUND

Voltus History

- Demand Response Provider across North America since 2016
- Track record of successful DR programs
- Entered PG&E CBP and PG&E BIP in 2019
- Awarded DRAM 2020 capacity in PG&E and SCE territory
- Became scheduling coordinator in 2020 and is currently providing RA to CCAs in California.
- Limited portfolio and event history in California prior to 2020
- Actively engaged in the 2023 PG&E and SCE DRAM, PG&E and SDG&E CBP, and PG&E and SCE BIP

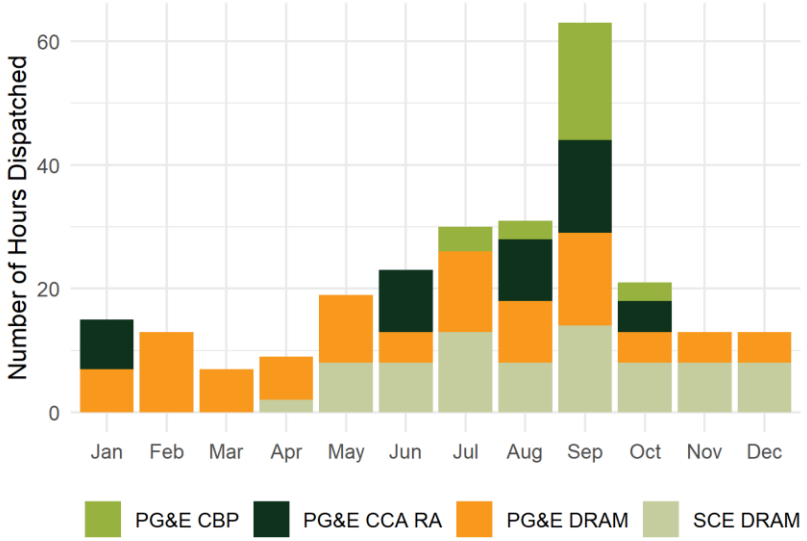
VOLTUS AND PROGRAM DESCRIPTIONS

CALIFORNIA DR PARTICIPATION

PY 2022 Programs and Dispatches

	PG&E DRAM	PG&E CBP	PG&E CCA RA	SCE DRAM
Event Season	Full Year	May - October	Full Year	Full Year
Num. of Voltus Event Days	34 days (58 dispatches)	7	11	15
Num. of 1 to 2 Hour Dispatches	37	3	3	9
Num. of Dispatches 3 Hours or Longer	21	4	8	10
2022 Enrolled Facilities by IOU	341 (All PG&E)			652 (All SCE)

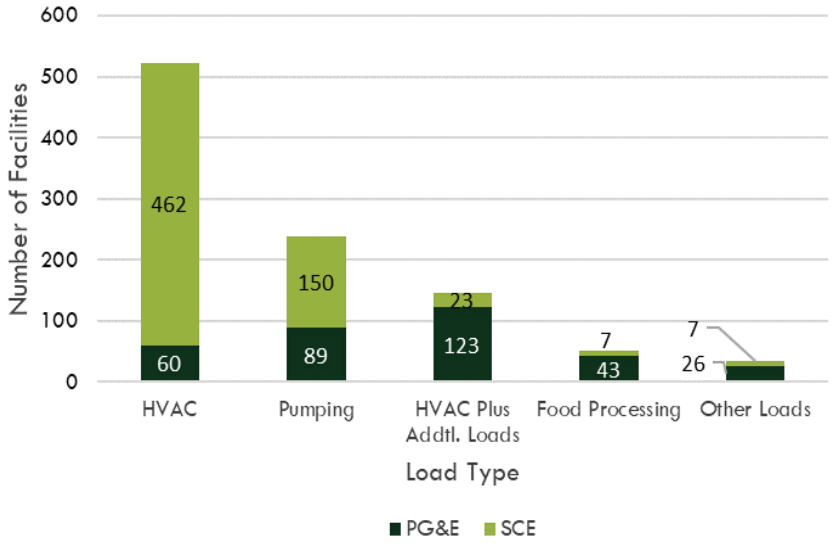
Program	Participant Event Hours				
	HE 17	HE 18	HE 19	HE 20	HE 21
PG&E CBP	5	337	566	639	409
PG&E DRAM	386	80	217	182	10
PG&E CCA RA	35	252	257	177	177
SCE DRAM	4,034	4,001	1,530	1,521	70

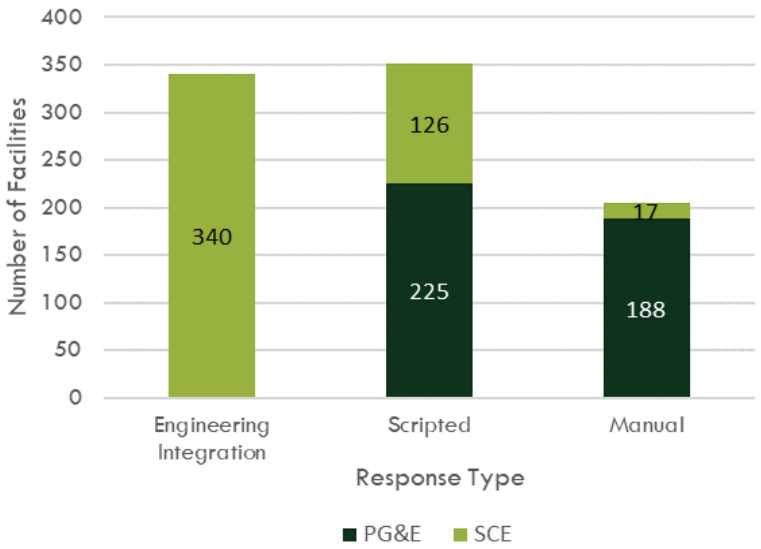


Note: PG&E and SCE ELRP Participation is included in the LIP Filing, but is not included in this presentation.

PARTICIPANT CHARACTERISTICS

Load and Response Types





EX POST METHODOLOGY AND IMPACTS

EX POST METHODOLOGY

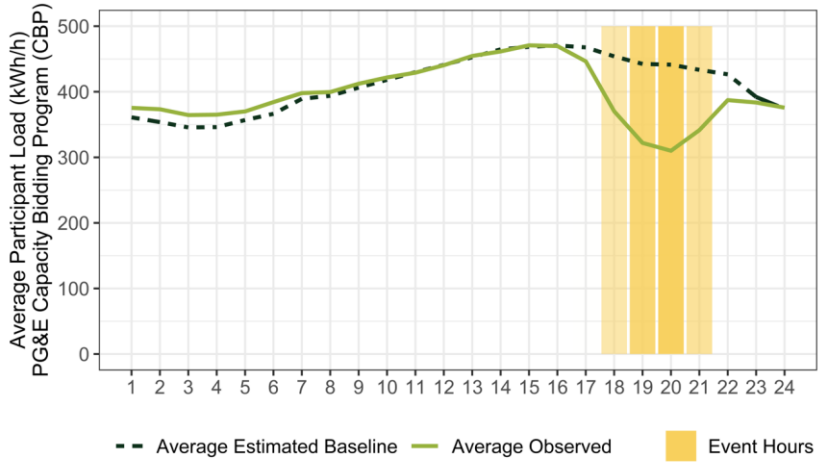
Overview

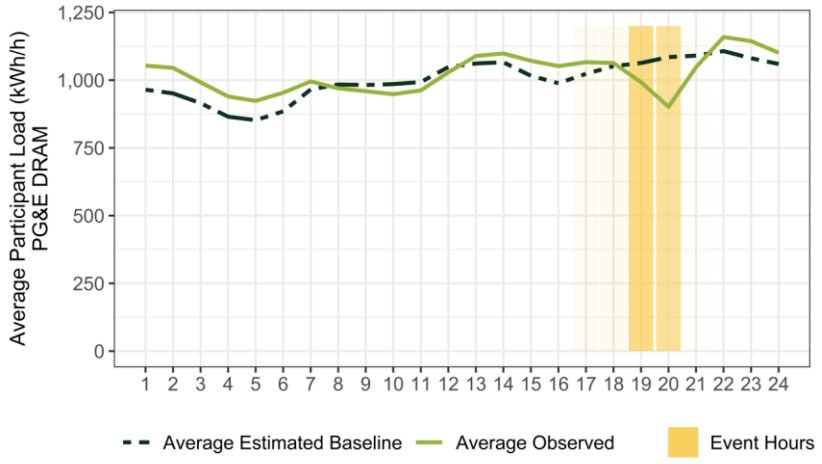
- Individual regression models were used to estimate ex post impacts.

- Individual models were selected for several reasons which include:
  - Data Availability
  - Event Variability
  - Participant Load Variability
  - Reporting Granularity
- Individual customers received their best fitting model specification for several applicable scenarios which include:
  - Summer Weekday Models
  - Winter Weekday Models
- Model fits (MAPE and CV RMSE) were examined on a set of event like holdout days. The model with the best out-of-sample predictions for each facility was chosen as the final model.

EX POST IMPACTS

PG&E Average Event Day



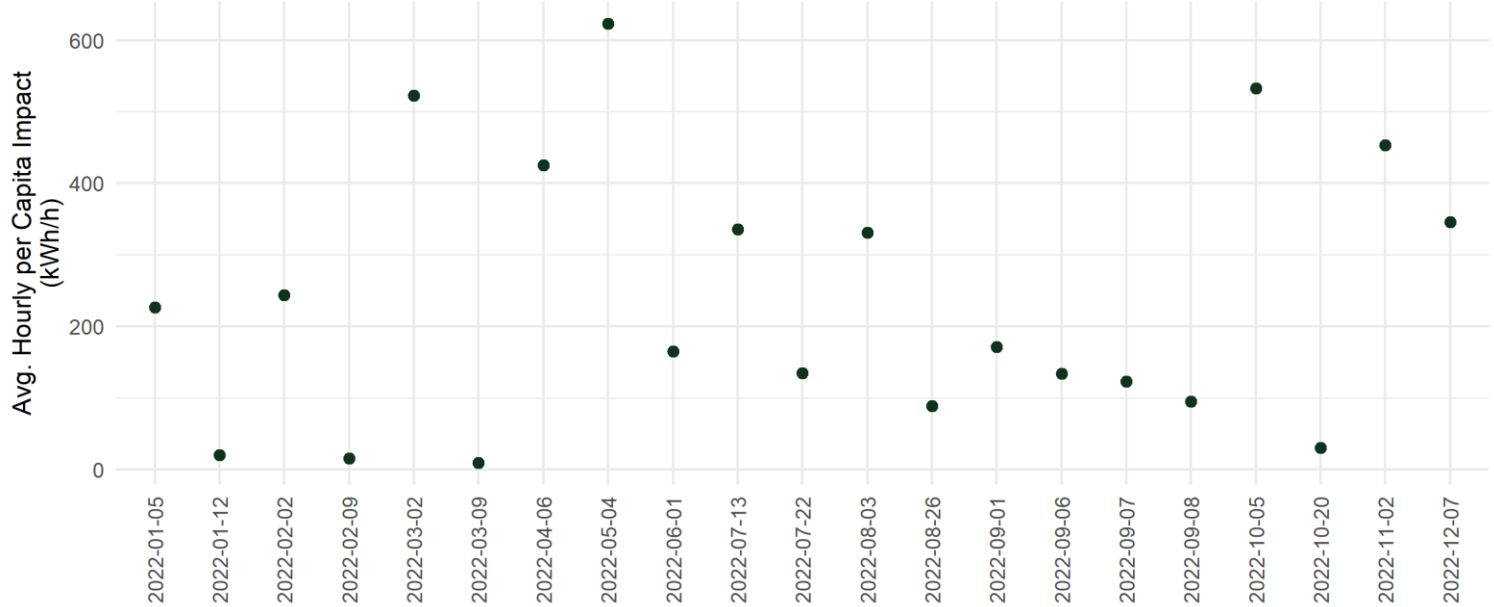


Program	Avg. Number of Facilities	Mean Reference Load (kWh/h)	Avg. Facility Impact (kWh/h)	Pct. Load Reduction	Avg. Total Reduction MWh/h	Avg. Event Temperature (F)
PG&E CBP	66	367.8	125.0	34.0%	8.2	82.8
PG&E DRAM	21	1,082.9	274.7	25.4%	3.8	72.0

Note: Event dispatches occur for varying times and durations. To minimize the dilution of impacts, only dispatches with hours HE 19 and HE 20 as event hours are included in the average event day load shapes for PG&E programs. Average event day load shapes may vary from impacts reported in the table due to the inclusion of different events and exclusive inclusion of only event hours in the average impacts.

EX POST IMPACTS

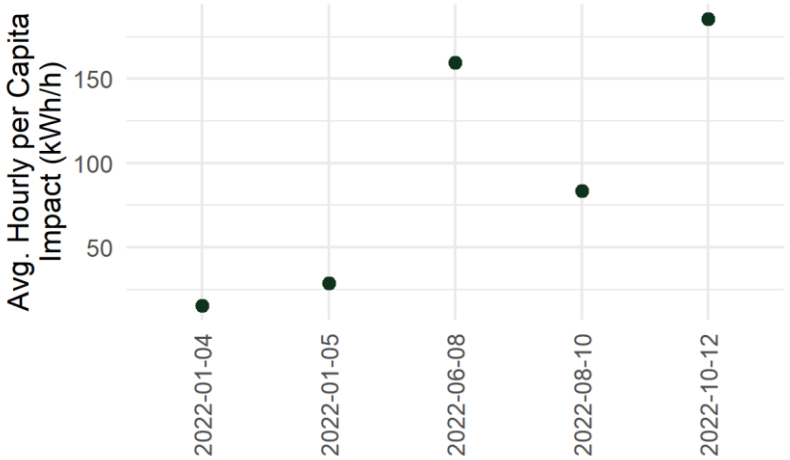
PG&E Average Event Impact

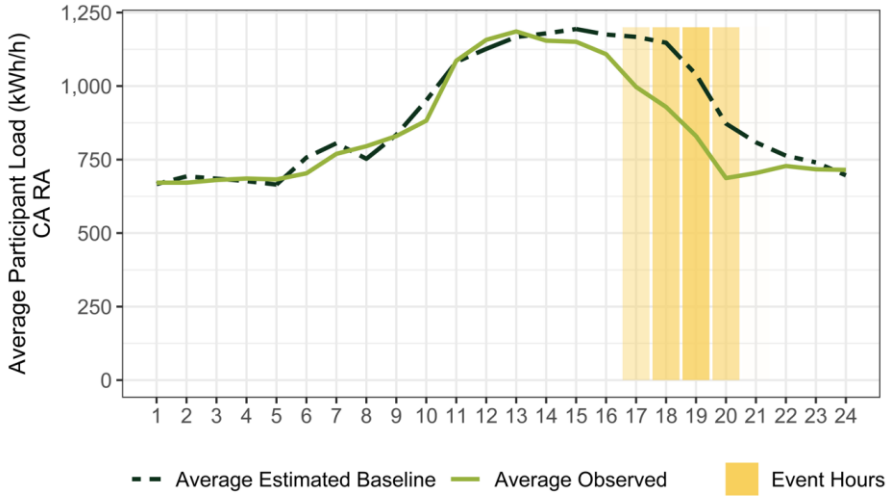


Average per facility impacts by PG&E event day. Event days not meeting 15/15 reporting rules are excluded.

EX POST IMPACTS

PG&E CCA RA per Capita Event Impacts and Average Event Day



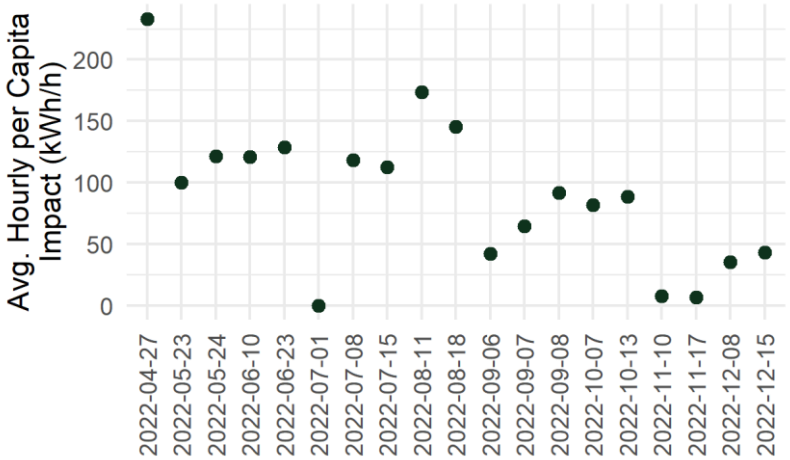


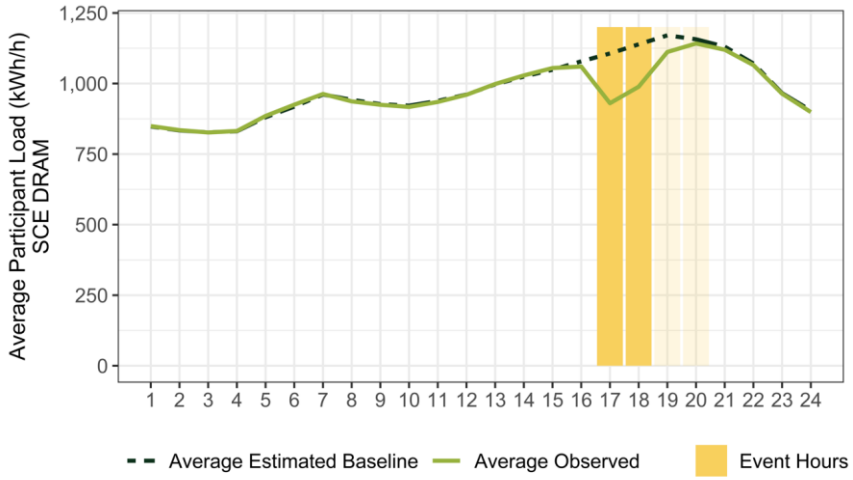
Program	Avg. Number of Facilities	Mean Reference Load (kWh/h)	Avg. Facility Impact (kWh/h)	Pct. Load Reduction	Avg. Total Reduction MWh/h	Avg. Event Temperature (F)
PG&E CCA RA	12	2,191.6	664	30.3%	7.9	82.8

Note: Event dispatches occur for varying times and durations. To minimize the dilution of impacts, only dispatches with hours HE 19 and HE 20 as event hours are included in the average event day Load Shape for PG&E programs. Average event day load shapes may vary from impacts reported in the table due to the inclusion of different events and exclusive inclusion of only event hours in the average impacts. Event days not meeting 15/15 reporting rules are excluded from event specific hourly per capita impacts.

EX POST IMPACTS

SCE DRAM per Capita Event Impacts and Average Event Day



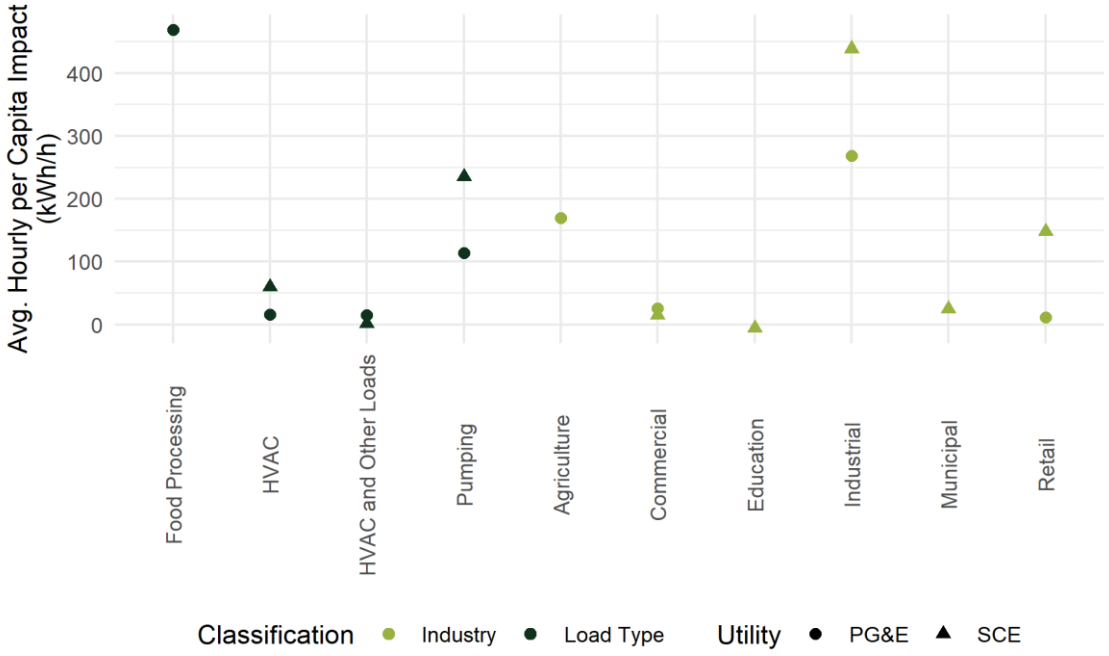


Program	Avg. Number of Facilities	Mean Reference Load (kWh/h)	Avg. Facility Impact (kWh/h)	Pct. Load Reduction	Avg. Total Reduction MWh/h	Avg. Event Temperature (F)
SCE DRAM	176	1,159.3	251.9	21.7%	44.4	76.8

Note: Event dispatches occur for varying times and durations. To minimize the dilution of impacts, only dispatches with hours HE 17 as event hours are included in the average event day for SCE DRAM . Average event day load shapes may vary from impacts reported in the table due to the inclusion of different events and exclusive inclusion of only event hours in the average impacts. Event days not meeting 15/15 reporting rules are excluded from event specific hourly per capita impacts.

EX POST IMPACTS

Average Impacts By Segments



Note:. Segments not meeting 15/15 reporting rules are excluded.

- Avg per capita impact across all event hours in 2022 is 60.1 kWh/h per event hour
- Industrial loads provided largest impacts across industries
- Food Processing Loads provided the largest impacts in specific load types

EX ANTE METHODOLOGY AND IMPACTS

EX ANTE METHODOLOGY

Overview

The ex ante methodology used adjusted ex post customer-specific regressions.

- The ex post $\beta_{1e,h} EventDay_e Hour_h$ impact estimator is altered to:
  - $\beta_1 EventHour * nth\_HOUR$ for non-weather sensitive;
  - $\beta_1 WeatherVar * EventHour + \beta_{2,h} EventHour * nth\_HOUR$ for cooling and winter sensitive customers.
- **Step 1:** Predicted per-customer weather-adjusted reference loads and impacts
- **Step 2:** Derate hourly impacts for customers without long duration events in specific seasons. Derate factors are based typical fatigue by season and load types seen in PY 2022
- **Step 3:** SubLAP and Load Type hourly per capita impacts are applied to the participant enrollment forecast to calculate total ex ante MW

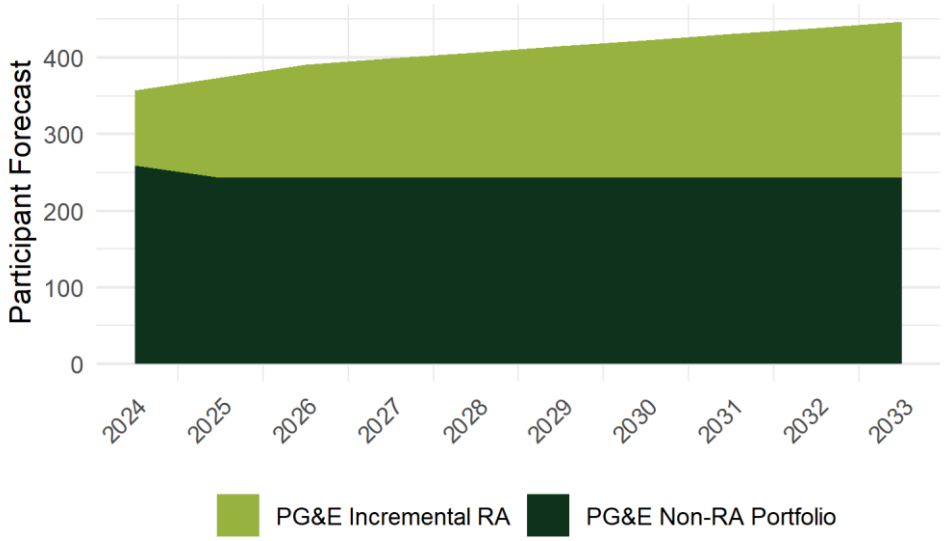
Total Participant Event Hours By IOU and Hour

Hour Ending	PG&E	SCE
HE 17	391	4,034
HE 18	417	4,001
HE 19	783	1,530
HE 20	821	1,521
HE 21	419	70

EX ANTE FORECASTS

Participant Forecasts 2024 through 2033

- Ex Ante forecasts were provided by Voltus by IOU, Incremental RA Status, and Load Type
- Voltus expects participant growth for the PG&E Portfolio of customers.
- Participants in PG&E RA are expected to total 98 in 2024 and grow to 204 by 2033
- SCE Portfolio remains at 484 Participants throughout whole forecast period



EX ANTE IMPACTS

PY 2024 Ex Ante Impact Estimates

Utility Territory	Year	Participants	Average Aggerate August System Peak Event Hour Reduction (MW) CAISO 1-in-10	CAISO 1-in-2	Utility 1-in-10	Utility 1-in-2
PG&E All	2024	357	65.3	63.5	67.1	63.6
	2033	447	79.8	77.5	82.0	77.7
PG&E RA Only	2024	98	22.5	22.1	23.0	22.0
	2033	204	39.6	38.6	40.6	38.6
SCE	2024	484	28.4	28.6	28.1	28.9
	2033	484	28.4	28.6	28.1	28.9

Incremental RA under Utility 1-in-2 is estimated to be 22.0 MW in PY 2024

Statewide, the Voltus Portfolio is anticipated to provide 93.7 MW in 2024

RECONCILIATION
PY 2022 EX ANTE VS. PY 2022 EX POST

RECONCILIATION

Causes for Difference in Prior Ex Ante Forecast for PY 2022 and PY 2022 Ex Post

- Reasons for Differences
  - Prior ex ante RA participant forecasts were based on larger share of Voltus participants due to the awaiting of DRAM awards
  - Awards were smaller than ex ante MW forecasts resulting in smaller ex ante participation
  - Ex Ante is based on full deployment of all participants. Actual dispatches and market awards fully dispatched all participants.
- Updates to Ex Ante
  - More explicit delineation between incremental RA participants and full portfolio forecast.
  - Incorporation of expected load types in the ex ante participant forecast to more accurately present forecasts

RECONCILIATION

PY 2022 Estimates Ex Post and Ex Ante Forecasts and Current RA Forecast – PG&E Only

Method	Programs/Method	Avg. Number of Facilities	Mean Reference Load (kWh/h)	Avg. Facility Impact (kWh/h)	Pct. Load Reduction	Avg. Total Reduction (MWh/h)	Avg. Event Temp (F)
PY 2022 Ex Post	CCA RA Average Event Day	12	2,191.6	664.0	30.3%	7.9	82.8
	Participant Weighted Programs PG&E Average Event Day Impacts	99	740.6	222.1	30.0%	22.0	80.5
Ex Ante Utility 1-in-2 August Peak	FY 2022 Estimate for 2022	304	249.5	80.0	24.3%	24.3	83.6
	FY 2023 Estimate for 2024	98	1,218,4	224.1	18.3%	22.0	88.2


THANK
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