



# 2025 Load Impact Evaluation of Southern California Edison’s Demand Response Aggregator Contracts

## CALMAC Study ID SCE0502

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Confidential information is redacted and denoted with black highlighting: [REDACTED]



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**ABSTRACT**

This report documents the ex-post and ex-ante load impact evaluation of Southern California Edison’s (“SCE’s”) third-party Demand Response Aggregator (“DRA”) contracts. The report provides estimates of ex-post load impacts that occurred during events dispatched from October 2024 through September 2025 and an ex-ante forecast of load impacts for 2026 through 2036 that is based on the DRA contract requirements and the ex-post load impacts estimated for the PY 2025 events.

Two DRAs had active contracts during the analysis period: Hybrid Electric Building Technologies (Hybrid) and Stem Energy (Stem). Hybrid and Stem enrolled commercial and industrial customers within SCE’s service territory to provide demand response. The DRAs nominated customers on a monthly basis, SCE dispatched the contracts, and the DRAs were responsible for dispatching their DR resources and ensuring they met their contracted capacity amount.

We conduct the ex-post load impact analysis at the customer level, using each customer’s available hourly interval load data from October 2024 through September 2025. We estimate customer-specific regression models applied to the hourly data, which are designed to simulate reference loads for event days accounting for typical monthly, day-of-week, and hourly usage patterns, along with weather conditions. The resulting load impacts are estimated by subtracting the observed loads from the simulated reference loads.

Developing ex-ante load impacts involves combining analyses of ex-post load impacts with expected contract terms over the forecast period. [REDACTED]

[REDACTED] The forecast contract quantities match those in place during our ex-post events so no adjustment for changes in contract terms is required. Therefore, the ex-ante forecast is based on an application of each contract’s most relevant historical performance.

Ex-post impacts relative to contract quantities varied across DRAs. [REDACTED]

## **EXECUTIVE SUMMARY**

This report documents the ex-post and ex-ante load impact evaluation of Southern California Edison's ("SCE's") third-party Demand Response Aggregator ("DRA") contracts. The report provides estimates of ex-post load impacts that occurred during events dispatched from October 2024 through September 2025 and an ex-ante forecast of load impacts for 2026 through 2036 that is based on the DRA contract requirements and the ex-post load impacts estimated for the PY 2025 events.

The primary goals of this evaluation are the following:

1. Estimate ex-post load impacts for October 2024 through September 2025, as described below, using methods that conform to the Load Impact Protocols;
2. Develop ex-ante load impact forecasts for the period 2026 through 2036; and
3. Provide transparency in the process of developing ex-ante load impacts from historical ex-post load impacts.

### **ES.1 Resources Covered**

Two DRAs had active contracts during the analysis period: Hybrid Electric Building Technologies (Hybrid) and Stem Energy (Stem). Hybrid and Stem enrolled commercial and industrial customers within SCE's service territory to provide demand response. The DRAs nominated customers on a monthly basis, SCE dispatched the contracts, and the DRAs were responsible for dispatching their DR resources and ensuring they met their contracted capacity amount. [REDACTED]

Tables ES-1a and ES-1b summarize the events dispatched by DRA contract during the analysis period, with ES-1a showing weekday events and ES-1b showing weekend events. The tables include the number of event days, number of dispatchable resources within each contract, the average number of those resources called during events, the average number of customers dispatched, the most common event window, and the average event duration. Contracts are most commonly dispatched for four-hour events from 5 to 9 p.m.

**Table ES-1a: Weekday Event Summary by DRA Contract**

Contract	# Event Days	Total Dispatchable Resources	Avg. Called Resources per Event	Avg. Customers per Event	Most Common Event Window	Average Event Duration (Hours)

**Table ES-1b: Weekend Event Summary by DRA Contract**

Contract	# Event Days	Total Dispatchable Resources	Avg. Called Resources per Event	Avg. Customers per Event	Most Common Event Window	Average Event Duration (Hours)

## ES.2 Evaluation Methodology

We conduct the ex-post load impact analysis at the customer level, using each customer’s available hourly interval load data from October 2024 through September 2025. We estimate two separate sets of customer-specific regression models: one for weekday events and another for weekend events. These distinct models account for structural differences in load profiles between weekday and weekend day types, ensuring that variations in consumption patterns and behavioral responses are appropriately captured. The models are designed to simulate reference loads for event days accounting for typical monthly, day-of-week, and hourly usage patterns, along with weather conditions. The resulting load impacts are estimated by subtracting the observed loads from the simulated reference loads. This approach allows us to summarize customer-level results by contract and overall to address all the evaluation objectives listed above.

Developing ex-ante load impacts involves combining analyses of ex-post load impacts with expected contract terms over the forecast period.

The forecast contract quantities match those in place during our ex-post events, so no adjustment for changes in contract terms is required. Therefore, the ex-ante forecast is based on an application of each contract’s most relevant historical performance.

### ES.3 Ex-post Load Impacts

Tables ES-2a through ES-2d summarize the average load impact for four-hour events for Hybrid events starting in HE17, HE18, HE19, and weekend HE18 events. Each of these event windows is provided separately due to differences in contract quantities at the hour intervals.

The associated contract achievement percentage (i.e., the load impact divided by the contract quantity) is in parentheses.



**Table ES-2a: Hybrid Weekday Hourly Load Impacts During HE17 Four-Hour Events (MW), Contract Achievement Percentage in Parentheses**

Contract	Hour of Event				Average Event Window
	Hour 1	Hour 2	Hour 3	Hour 4	
All Hybrid					

**Table ES-2b: Hybrid Weekday Hourly Load Impacts During HE18 Four-Hour Events (MW), Contract Achievement Percentage in Parentheses**

Contract	Hour of Event				Average Event Window
	Hour 1	Hour 2	Hour 3	Hour 4	
All Hybrid					

**Table ES-2c: Hybrid Weekday Hourly Load Impacts During HE19 Four-Hour Events (MW), Contract Achievement Percentage in Parentheses**

Contract	Hour of Event				Average Event Window
	Hour 1	Hour 2	Hour 3	Hour 4	
All Hybrid					

**Table ES-2d: Hybrid Weekend Hourly Load Impacts During HE18 Four-Hour Events (MW), Contract Achievement Percentage in Parentheses**

Contract	Hour of Event				Average Event Window
	Hour 1	Hour 2	Hour 3	Hour 4	
All Hybrid					

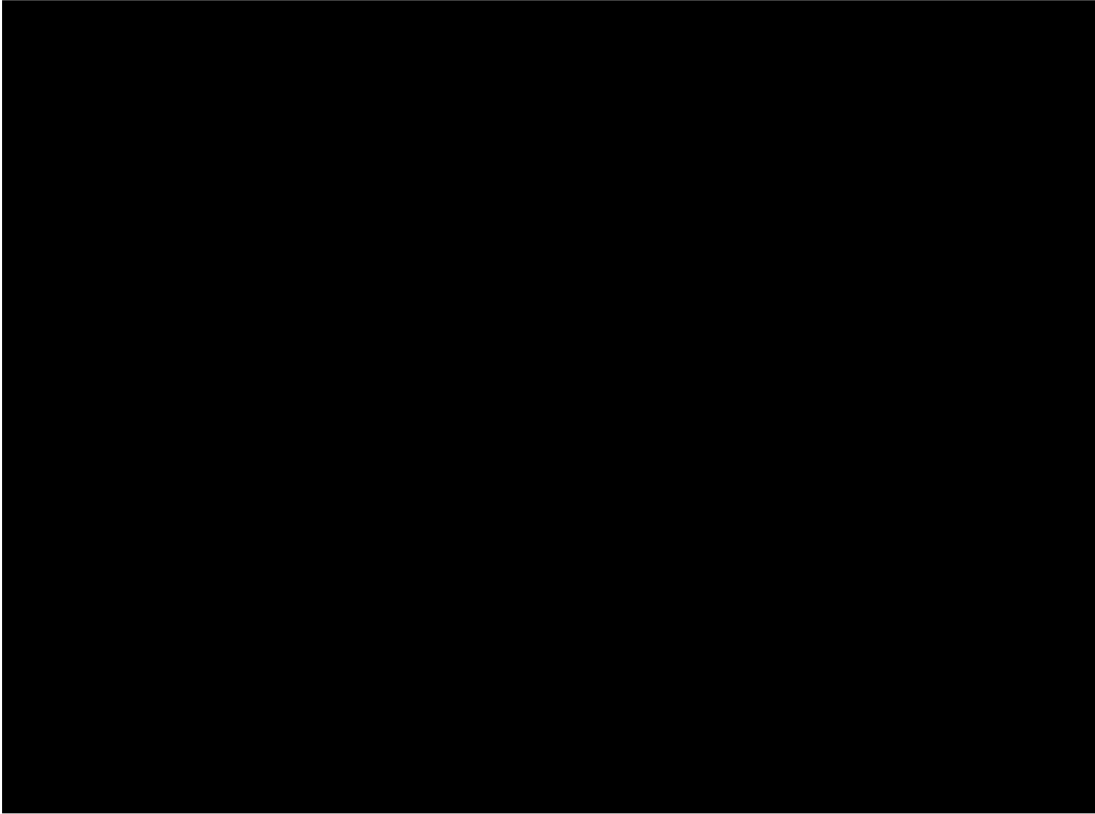
**Table ES-2e: Stem Weekday Hourly Load Impacts (MW), Contract Achievement Percentage in Parentheses**

Event Duration	Hour of Event			Avg. Event Window	# of Events
	HE18	HE19	HE20		

### ES.4 Ex-ante Load Impacts

Figure ES-1 shows the average RA-window load impact totaled across all contracts. We show August monthly peak day impacts for the two 1-in-2 weather scenarios in each year. Notice that the load impacts do not vary across weather scenarios, which is a direct result of the methodology we applied (as discussed in Section 5.1). The total load impact is at its highest in 2026 (at 56 MW, which is 91 percent of the total contract quantity) and declines beginning in 2027 as some of the contracts begin to expire.

**Figure ES-1: Average August RA Window Load Impacts by Weather Scenario and Year, Total for All Contracts**



## 1. INTRODUCTION AND PURPOSE OF THE STUDY

This report documents the ex-post and ex-ante load impact evaluation of Southern California Edison's ("SCE's") third-party Demand Response Aggregator ("DRA") contracts. The report provides estimates of ex-post load impacts that occurred during events dispatched from October 2024 through September 2025 (referred to as "Program Year 2025" or "PY2025") and an ex-ante forecast of load impacts for 2026 through 2036 that is based on the DRA contract requirements and the ex-post load impacts estimated for the PY2025 events.

The evaluation is conducted under the guidance of the Demand Response Measurement & Evaluation Committee (DRMEC), which consists of representatives of the Joint Utilities (SCE, PG&E, and SDG&E), the California Public Utilities Commission (CPUC), and the California Energy Commission (CEC). The evaluation conforms to the Load Impact Protocols adopted by the CPUC in D-04-08-050.

The primary goals of this evaluation are the following:

1. Estimate ex-post load impacts for PY2025, as described below, using methods that conform to the Load Impact Protocols;<sup>1</sup>
2. Develop ex-ante load impact forecasts for the period 2026 through 2036; and
3. Provide transparency in the process of developing ex-ante load impacts from historical ex-post load impacts.

The ex-post analysis estimates hourly *load impacts* for every event dispatched for each DRA contract. We summarize estimated load impacts for each hour of every event day by DRA contract and across all contracts, for the *average* event day, for the average customer, for all customers in aggregate, and for customers in each local capacity area (LCA).<sup>2</sup>

Developing ex-ante load impacts involves combining analyses of ex-post load impacts with expected contract terms over the forecast period. The ex-ante forecast is based on an application of each contract's most relevant historical performance, adjusted for expected changes in contract terms as needed. An important component of the development of ex-ante load impacts involves clearly explaining the process by which ex-post load impacts are translated into ex-ante load impacts and discussing and quantifying factors that affect differences between per-customer ex-post and ex-ante load impacts. Ex-ante load impacts from this evaluation will also be compared to those of the previous evaluation.

The report is organized as follows. Section 2 contains a description of the DRA contracts, the enrolled customers, and the events called; Section 3 describes the methods used in the study; Section 4 contains the detailed ex-post load impact results; Section 5 describes the ex-ante load impact forecast; and Section 6 contains descriptions of

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<sup>1</sup> Methods for estimating ex-post load impacts that conform to the Load Impact Protocols differ from methods used to determine DRA settlements after events. Settlement calculations vary by DRA.

<sup>2</sup> While summaries by LCA are required by the Protocols, all customers in this evaluation reside in a single LCA (LA Basin).

differences in various scenarios of ex-post and ex-ante load impacts. Appendix A contains an assessment of the validity of the study.

## 2. DESCRIPTION OF RESOURCES COVERED IN THE STUDY

This section provides details on the current DRA contracts, including summaries of contract characteristics and a summary of the events called from October 2024 through September 2025.

### 2.1 Contract Descriptions

Two DRAs had active contracts during the analysis period: Hybrid Electric Building Technologies (Hybrid) and Stem Energy (Stem), which enrolled commercial and industrial customers within SCE’s service territory to provide demand response. The DRAs nominated customers on a monthly basis, SCE dispatched the contracts, and the DRAs were responsible for dispatching their DR resources and ensuring they met their contracted capacity amount. [REDACTED]

The bilateral contracts between SCE and the DRAs define the effective dates, contract commitments, allowed timing of events, and how settlements are determined for each DRA contract. There are a number of similarities between the contracts that each DRA has negotiated with SCE. [REDACTED]

[REDACTED] A description of each DRA contract is provided below.

#### *Hybrid Contracts*

[REDACTED]

[REDACTED]

**Table 2-1: Hybrid Contract Capacities and End Months**

Contract	Regular Hours Contract Capacity (MW)	Extended Hours Contract Capacity (MW)	Additional Hours Contract Capacity (MW)	Contract End Month

*Stem Contracts*

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**2.2 Event Summary**

Table 2-2 summarizes the maximum contract capacity across the hours of the day for each DRA contract included in the ex-post study.

**Table 2-2: Maximum Capacity by Hour and DRA Contract**

Day Type	Hours	Total Contract Capacity (MW)		
		Hybrid	Stem	Total

Tables 2-3a and 2-3b show a summary of the number of events and dispatchable resources by DRA contract, with Table 2-3a showing weekday events and Table 2-3b showing weekend events. [REDACTED]

[REDACTED] However, not all resources are called during a particular event, as reflected in the "Avg. Called Resources per Event" column. The tables show the most common event window by contract as well as the average event duration. Variations in event hours and called resources across events complicate the summaries of load impacts.

**Table 2-3a: Weekday Event Summary by DRA Contract**

Contract	# Event Days	Total Dispatchable Resources	Avg. Called Resources per Event	Avg. Customers per Event	Most Common Event Window	Average Event Duration (Hours)
[REDACTED]						

**Table 2-3b: Weekend Event Summary by DRA Contract**

Contract	# Event Days	Total Dispatchable Resources	Avg. Called Resources per Event	Avg. Customers per Event	Most Common Event Window	Average Event Duration (Hours)
[REDACTED]						

### 3. STUDY METHODOLOGY

#### 3.1 Overview

For the DRA evaluation, two key factors are of interest in the ex-post analysis:

1. the estimated load reductions during events, which is important for assessing the resource value of the resources during emergencies, and
2. the extent to which DRAs successfully reduce load to meet their contract requirements during events.

We conduct the ex-post load impact analysis at the customer level, using each customer's available hourly interval load data from October 2024 through September 2025. We estimate two separate customer-specific regression models: one for weekday events and another for weekend events. These distinct models account for structural differences in load profiles between weekday and weekend day types, ensuring that variations in consumption patterns and behavioral responses are appropriately captured. The models are designed to simulate reference loads for event days accounting for typical monthly, day-of-week, and hourly usage patterns, along with weather conditions. The resulting load impacts are estimated by subtracting the observed loads from the simulated reference loads.

One potential challenge with estimating load impacts for DRAs is the high frequency of events for some DRA contracts. For example, [REDACTED] This leaves relatively few non-event weekdays to use as a counterfactual for event-day load profiles to estimate load impacts. As a result, we use all available pre-event hours on event days in addition to the non-event day data to develop the reference load models for each enrolled customer.

Our estimation process proceeds as follows: we apply a common specification to each customer, withholding approximately 15 percent of the customer's data from the estimated model. Each customer's model quality is then assessed by comparing its predicted values to the observed loads on the withheld days. We also examine and summarize the R-squared values for each customer, which represents the proportion of the customer's usage variability that is explained by the model's parameters. We summarize results from our model validation in Appendix A. For customers whose loads are not well-predicted using the standard model, we explore variations that may improve the predictions. The standard model was adapted from the models employed in the previous evaluation and is presented in the next sub-section.

Our validation process revealed load impact estimation issues for two Hybrid customers. For these customers, the statistical models estimated load impacts that were significantly lower than the corresponding MGO settlement data. (In general, the correspondence between MGO settlements and the estimated load impacts is quite good.) Because MGO settlement data is derived from a meter on the battery, it is expected to be highly correlated with customer-level interval data and be a direct comparison to our estimated results. In these two cases, we replaced our estimated load impacts with MGO-based impacts.

In addition, SCE reported an interval data issue that resulted in the data being shifted by one hour. However, SCE does not have comprehensive data on which customers/dates experienced the problem, which led us to apply an algorithmic correction to the data. For Hybrid customers, we shifted an event's hourly load impacts back one hour if it resulted in an estimated load impact that was closer to the MGO settlement value. For Stem customers, the shift was implemented if it resulted in a higher load impact. (There is no MGO settlement data for Stem customers.) Applying this algorithm resulted in shifting approximately 10 percent of customer-event load impacts by one hour.

Using the standard and refined models, we estimate regression models applied to hourly data at the individual customer number level for all DRA contract customer accounts nominated during the analysis period. This approach allows us to summarize results

across various characteristics that may be associated with a given contract number to address all the evaluation objectives listed above. For example, to produce total impacts across all contracts, we can add estimated load impacts across all contract numbers. At a more detailed level, we can add estimated load impacts for the customers of a specific DRA contract, or for those that are located within a particular location.

## 3.2 Description of Methods

### *Regression Model*

In this section we describe the standard model that we estimate for each DRA customer for weekday and weekend events. The regression models only include data for non-event days and pre-event hours on event days.<sup>3</sup> The standard specification includes variables that account for typical customer usage patterns and weather conditions. The models exclude data prior to the first month in which we observe the customer being nominated by its DRA. This helps ensure that the estimates don't include load data that precedes the storage installation, which may also be used on non-event days to manage customer bills. The weekday and weekend models are largely similar in how the data is created, with the only difference being that weekday events are constructed using weekday data and weekend events use weekend and holiday data. The explanatory variables are also largely the same, with the main differences being day-type variables.

The general form of our weekday regression model is as follows:

$$Q_{i,t} = a + b^{Temp} \times Temp_{i,t} + b^{AvgT} \times Avg\_temp_t + b^{PeakT} \times Peak\_temp_t + b^{AvgT\_T} \times Temp_{i,t} \times Avg\_temp_{i,t} + b^{PeakT\_T} \times Temp_{i,t} \times Peak\_temp_{i,t} + b^{Irrad} \times Irrad_{i,t} + b^{MornLoad} \times MornLoad_t + \sum_{i=DOW} (b_i^{DOW} \times DOW_{i,t}) + \sum_{i=Months} (b_i^{MONTH} \times MONTH_{i,t}) + \sum_{i=hours} (b_i^h \times h_{i,t}) + \sum_{i=hours} (b_i^{MON} \times h_{i,t} \times MON_t) + \sum_{i=hours} (b_i^{FRI} \times h_{i,t} \times FRI_t) + e_{i,t}$$

The general form of our weekend regression model is as follows:

$$Q_{i,t} = a + b^{Temp} \times Temp_{i,t} + b^{AvgT} \times Avg\_temp_t + b^{PeakT} \times Peak\_temp_t + b^{AvgT\_T} \times Temp_{i,t} \times Avg\_temp_{i,t} + b^{PeakT\_T} \times Temp_{i,t} \times Peak\_temp_{i,t} + b^{Irrad} \times Irrad_{i,t} + b^{MornLoad} \times MornLoad_t + \sum_{i=DTYPE} (b_i^{DTYPE} \times DTYPE_{i,t}) + \sum_{i=Months} (b_i^{MONTH} \times MONTH_{i,t}) + \sum_{i=hours} (b_i^h \times h_{i,t}) + \sum_{i=hours} (b_i^{SUN} \times h_{i,t} \times SUN_t) + \sum_{i=hours} (b_i^{HOL} \times h_{i,t} \times HOL_t) + \sum_{i=hours} (b_i^{NEAR} \times h_{i,t} \times NEAR_t) + e_{i,t}$$

The variables are explained in Table 3-1.

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<sup>3</sup> For events that end earlier than hour-ending 18, only the event hours and the three hours following the event are excluded from estimation.

**Table 3-1: Descriptions of Variables included in the Ex-Post Regression Equation**

Variable Name / Term	Variable / Term Description
$Q_{i,t}$	The customer's usage in hour $i$ of day $t$
$a$ and the various $b$ 's	The estimated parameters
$h_i$	A dummy variable for hour $i$
$Temp_{i,t}$	Temperature during hour $i$ and/or day $t$
$Avg\_temp_t$	Average daily temperature on day $t$
$Peak\_temp_t$	Average temperature from HE 17-21 on day $t$
$Irrad_{i,t}$	Irradiance at the customer's weather station during hour $i$ of day $t$
$MornLoad_t$	A variable equal to the average of the day's load in HE 1-10
$MON_t$	A dummy variable for Monday
$FRI_t$	A dummy variable for Friday
$SUN_t$	A dummy variable for Sunday
$HOL_t$	A dummy variable for holiday
$NEAR_t$	A dummy variable for near holidays
$DOW_{i,t}$	A series of dummy variables for each day of the week
$DTYPE_{i,t}$	A series of dummy variables for Sunday, holidays, and near holidays
$MONTH_{i,t}$	A series of dummy variables for each month
$e_{i,t}$	The error term

The "morning load" variable is used in the same spirit as the optional day-of adjustment to the 10-in-10 baseline method currently used in some DR programs (e.g., Capacity Bidding Program). That is, it is intended to adjust the reference load (the regression-based estimate of the loads that would have occurred in the absence of the event day) for unobserved exogenous factors that may affect a customer's load on a given day. The use of the morning load variable assumes that variations in the morning load are related to variations in reference loads later in the day; but that the changes in the morning load are not part of the customer's response to the event itself.

The remaining terms in the equation are designed to control for weather and other periodic variation in a customer's load profile (e.g., hour of the day, day of the week, and month of the year). The interaction of the Monday and Friday indicators with the hourly indicators is designed to account for the typically different hourly load profiles of commercial and industrial customers on the first and last days of the workweek.

For each customer we use the estimates from the specification to produce predicted loads for every hour of every event day for which the customer is dispatched. We calculate the estimated load impacts by subtracting the customer's actual observed loads from the predicted reference loads.

### *Development of Uncertainty-Adjusted Load Impacts*

The Load Impact Protocols require the estimation of uncertainty-adjusted load impacts. In the case of ex-post load impacts, the parameters used to predict the customer's reference loads are not estimated with certainty. We base the uncertainty-adjusted load impacts on the variances from the reference load predictions.

Specifically, the uncertainty is based on the standard error of the predicted reference load for each customer. We arrive at the aggregate standard error by summing the variances of each customer's reference load predictions across the customers who are dispatched for each event. These aggregations are performed at either the all-contract level or by DRA contract, as appropriate. The uncertainty-adjusted scenarios are then simulated under the assumption that each hour's load impact is normally distributed with the mean equal to the sum of the estimated load impacts and the standard deviation equal to the square root of the sum of the variances of the errors around the estimates of the load impacts. Results for the 5<sup>th</sup> and 95<sup>th</sup> percentile scenarios are generated from these distributions.

In order to develop the uncertainty-adjusted load impacts associated with the average event hour (i.e., the bottom rows in the tables produced by the ex-post table generator), we assume that load impacts are independent across event hours.

## **4. DETAILED STUDY FINDINGS**

The primary objective of the ex-post evaluation is to estimate the aggregate and per-customer event-day load impacts for each DRA contract. In this section we first summarize the aggregate estimated load impacts for each DRA using a metric of estimated *average hourly load impacts* by event and for the average event. We limit the summarized results to four-hour events beginning in HE 17, 18, or 19, which are the majority of the events for each contract and are the most relevant events when developing the ex-ante forecast. The averages are first calculated at the customer level and then added up across customers within a contract. This approach ensures that load impacts are not diluted by averaging across resources dispatched for different event hours or different event days.<sup>4</sup> We use the percentage contract achievement as a measure of contract performance, which is defined as the estimated ex-post load impact divided by the contract amount.

We then present tables of *hourly* load impacts for a representative event day where all resources are dispatched (there is no typical event day due to the variability in resources dispatched as well as the event hours), in the format required by the Load Impact Protocols adopted by the California Public Utilities Commission (CPUC) in Decision (D.) 08-04-050 ("the Protocols"). These results include risk-adjusted load impacts at different

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<sup>4</sup> Note that it may be difficult to compare the ex-post summaries contained in this report to the results contained in the Excel-based table generator appendix. The focus of the Excel-based table generator is to present the load impacts for every day that had an event, regardless of the extent of the dispatch. (Monthly summaries are included as well, showing the average outcome across the events as they were called.)

probability levels, and figures that illustrate the reference loads, observed loads and estimated load impacts compared to aggregate contract commitments.

### 4.1 Ex-Post Load Impacts by DRA

Summarizing ex-post impacts is complicated because it is uncommon for all dispatch IDs to be called at the same time and event hours can vary across dates and dispatch IDs. We simplify the summary of ex-post load impacts in two ways. First, we summarize only the most common event windows: four-hour events beginning in hour-ending 17, 18, or 19. The HE17 and HE18 events are the most relevant for the ex-ante study because they occur during the Resource Adequacy (RA) window and thus serve as the basis for our forecasts. Second, we reflect the full capability of each contract by calculating the average load impact at the customer level and summing across the customers within a contract. Therefore, average load impacts reflect what would happen when all dispatch IDs are called during the same hours, even though that rarely (if ever) happens in practice.

Table 4-1a through 4-1d summarize the average load impact for four-hour events for Hybrid events starting in HE17, HE18, HE19, and weekend HE18 events. Each of these event windows is provided separately due to differences in contract quantities at the hour intervals.

The associated contract achievement percentage (i.e., the load impact divided by the contract quantity) is in parentheses.

[Redacted Table Content]

**Table 4-1a: Hybrid Weekday Hourly Load Impacts During HE17 Four-Hour Events (MW), Contract Achievement Percentage in Parentheses**

Contract	Hour of Event				Average Event Window
	Hour 1	Hour 2	Hour 3	Hour 4	
All Hybrid	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]

**Table 4-1b: Hybrid Weekday Hourly Load Impacts During HE18 Four-Hour Events (MW), Contract Achievement Percentage in Parentheses**

Contract	Hour of Event				Average Event Window
	Hour 1	Hour 2	Hour 3	Hour 4	
All Hybrid					

**Table 4-1c: Hybrid Weekday Hourly Load Impacts During HE19 Four-Hour Events (MW), Contract Achievement Percentage in Parentheses**

Contract	Hour of Event				Average Event Window
	Hour 1	Hour 2	Hour 3	Hour 4	
All Hybrid					

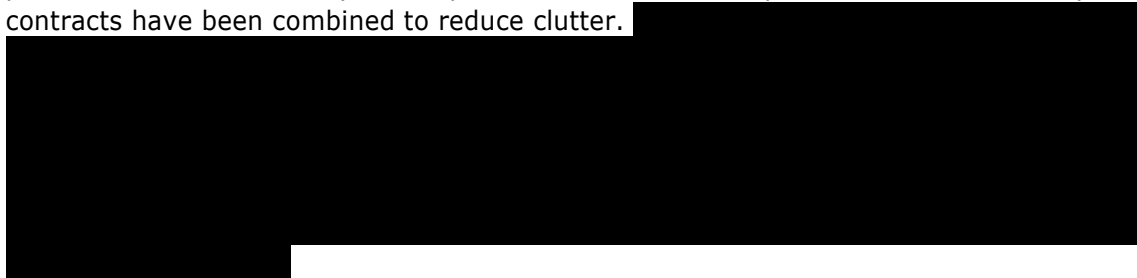
**Table 4-1d: Hybrid Weekend Hourly Load Impacts During HE18 Four-Hour Events (MW), Contract Achievement Percentage in Parentheses**

Contract	Hour of Event				Average Event Window
	Hour 1	Hour 2	Hour 3	Hour 4	
All Hybrid					

**Table 4-1e: Stem Weekday Hourly Load Impacts (MW), Contract Achievement Percentage in Parentheses**

Event Duration	Hour of Event			Avg. Event Window	# of Events
	HE18	HE19	HE20		
[Redacted Data]					

Figure 4-1a contains the same event data as shown in Tables 4-1a through 4-1d, but provides a more direct way to compare the scale of load impacts. In addition, the Hybrid contracts have been combined to reduce clutter.



**Figure 4-1a: Hybrid Average Hourly Load Impacts for Four-Hour Events**

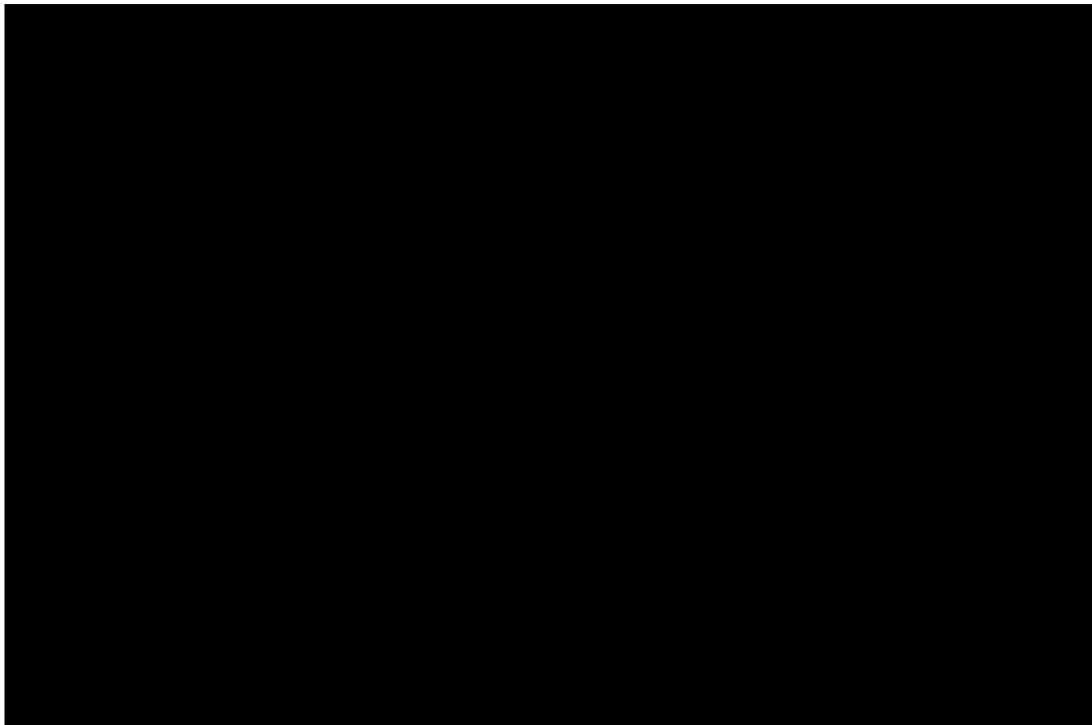
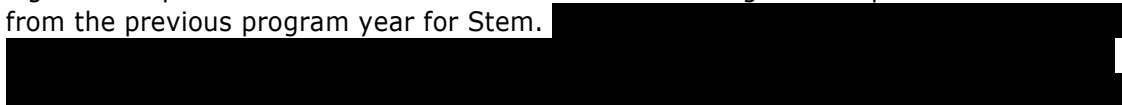
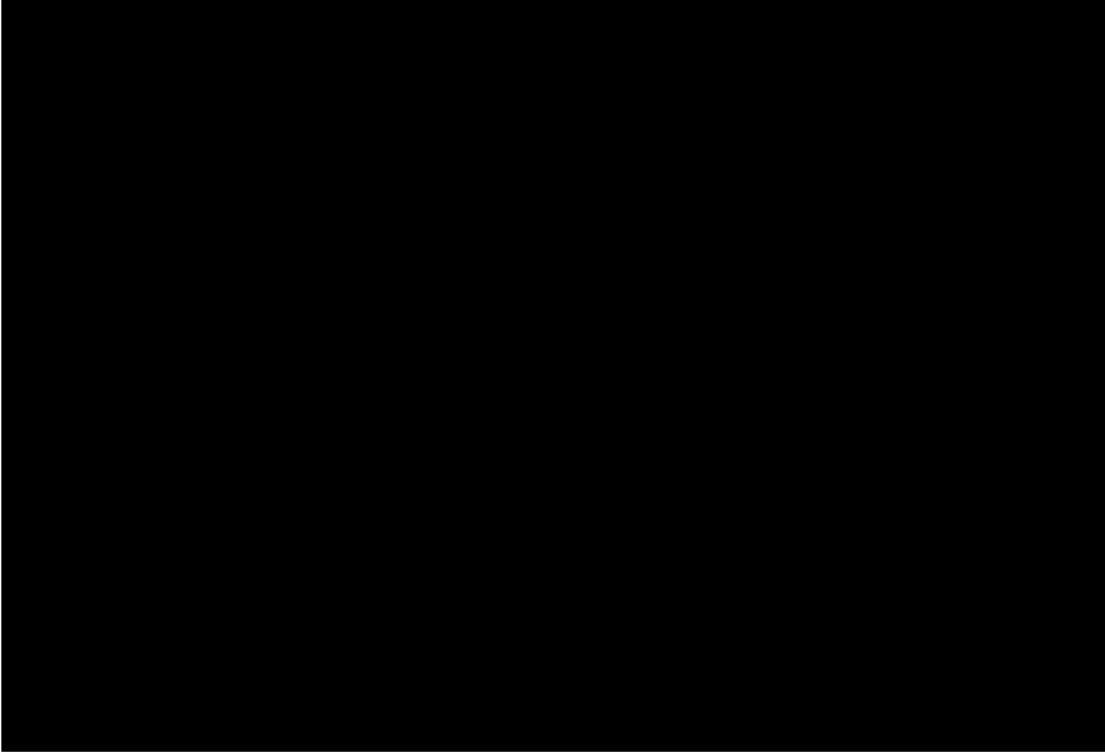


Figure 4-1b presents the event data from Table 4-1e alongside comparable event hours from the previous program year for Stem.



[Redacted]

**Figure 4-1b: Stem Average Hourly Load Impacts**



*Hybrid Load Impacts*

[Redacted]

5

[Redacted]

6

A

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<sup>5</sup> The selection criteria for a representative ex-post date were twofold: first, ensuring that most, if not all, contracts were called on the selected day; and second, event hours were largely similar across the contracts.

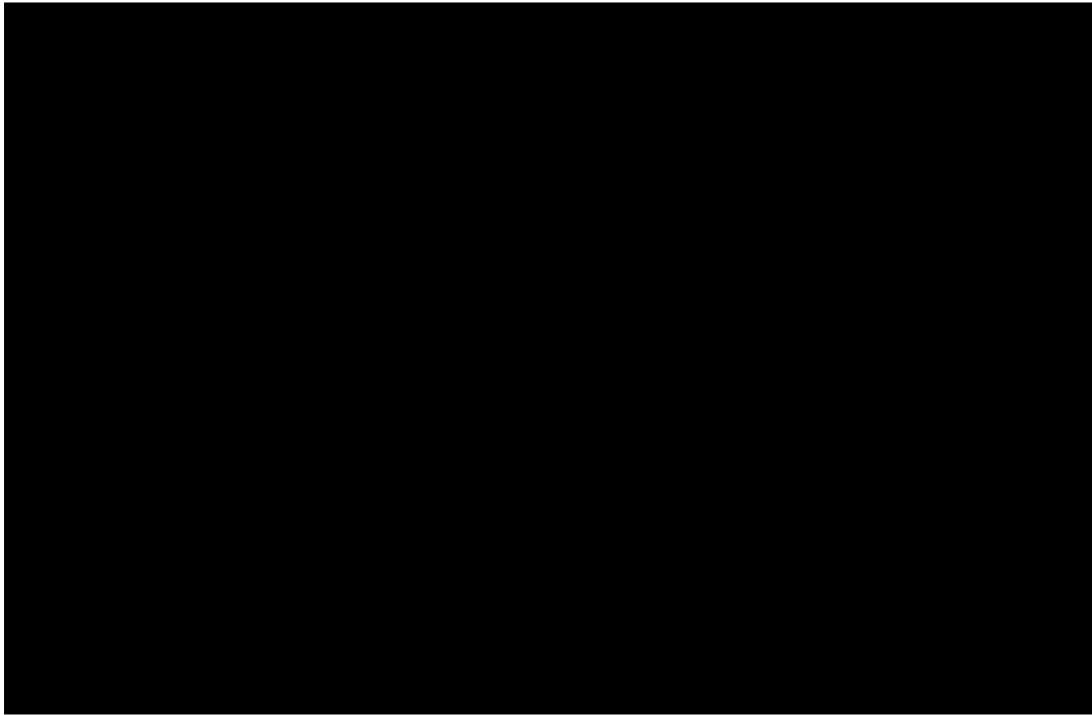
<sup>6</sup> [Redacted]

summary of Hybrid’s load impacts during each event is presented in the Excel-based table generator designated as Appendix B.

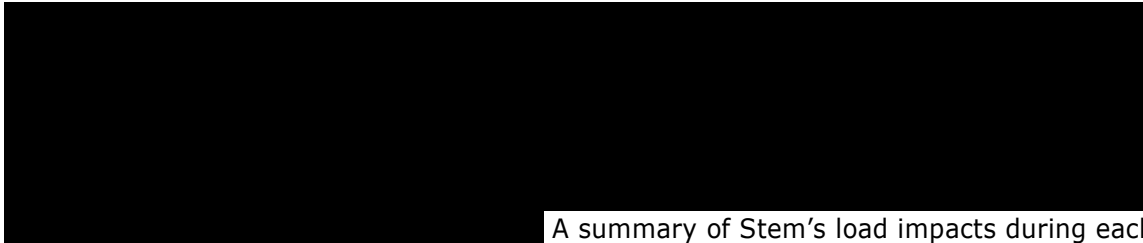
**Table 4-2: Hourly Load Impacts for All Hybrid Contracts on September 10, 2025**

Hour-Ending	Estimated Reference Load (MWh/hr)	Observed Event Day Load (MWh/hr)	Estimated Load Impact (MWh/hr)	Average Temperature (°F)	Uncertainty Adjusted Impact (MWh/hr) - Percentiles			Standard Error
					5th%ile	50th%ile	95th%ile	
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
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21								
22								
23								
24								
By Period:	Estimated Reference Energy Use (MWh/hr)	Observed Event Day Energy Use (MWh/hr)	Estimated Change in Energy Use (MWh/hr)	Average Temperature (°F)	Uncertainty Adjusted Impact (MWh/hr) - Percentiles			Standard Error
Average Event Hour								

**Figure 4-2: Hourly Load Impacts for All Hybrid Contracts on September 10, 2025**



*Stem Load Impacts*

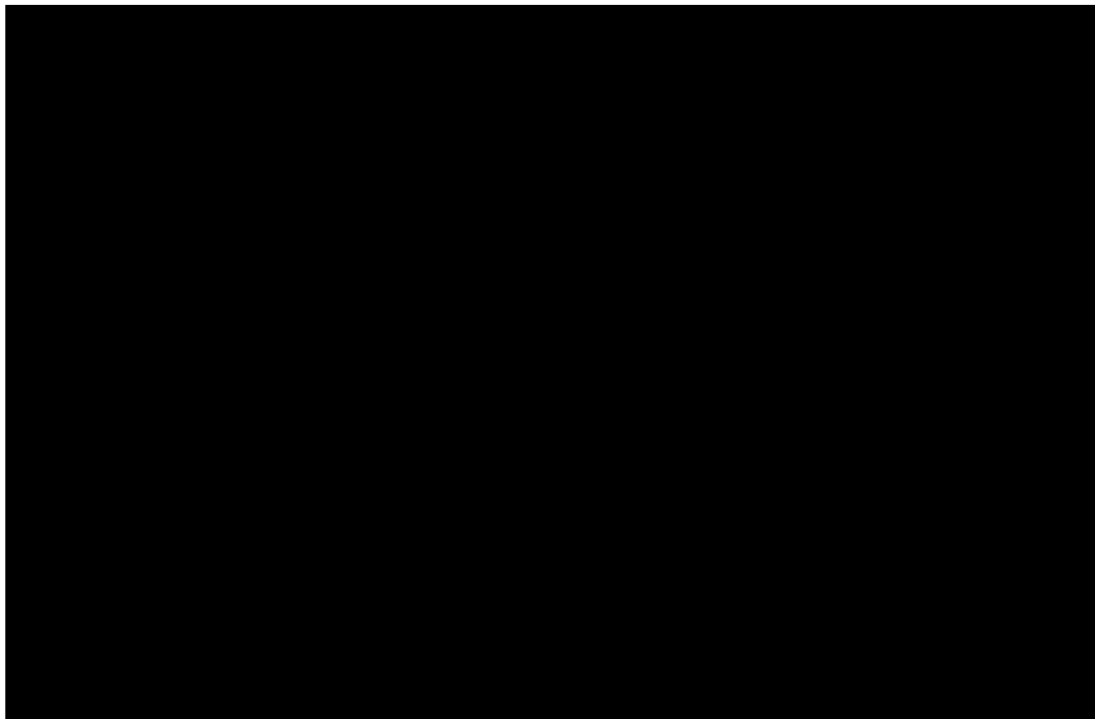


A summary of Stem's load impacts during each event is presented in the Excel-based table generator designated as Appendix B.

**Table 4-3: Hourly Load Impacts for the Stem Contract on October 7, 2024**

Hour-Ending	Estimated Reference Load (MWh/hr)	Observed Event Day Load (MWh/hr)	Estimated Load Impact (MWh/hr)	Average Temperature (°F)	Uncertainty Adjusted Impact (MWh/hr) - Percentiles			Standard Error
					5th%ile	50th%ile	95th%ile	
1								
2								
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4								
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24								
By Period:	Estimated Reference Energy Use (MWh/hr)	Observed Event Day Energy Use (MWh/hr)	Estimated Change in Energy Use (MWh/hr)	Average Temperature (°F)	Uncertainty Adjusted Impact (MWh/hr) - Percentiles			Standard Error
Average Event Hour								

**Figure 4-3: Hourly Load Impacts for the Stem Contract on October 7, 2024**



## 5. EX-ANTE LOAD IMPACT FORECAST

### 5.1 Description of Methods

The objectives of the ex-ante portion of the evaluation are to develop ex-ante DRA load impacts for the RA window<sup>7</sup> for the period 2026 through 2036, where the forecasts are provided:

- For a typical event day and for the monthly system worst day for each month;
- For the average customer and all customers in aggregate, and by LCA<sup>8</sup>; and
- For 1-in-2 weather year under both SCE and CAISO-coincident peak conditions.

In this process, three elements are required to develop the ex-ante load impact forecasts:

1. Contract capacity forecasts (e.g., MW commitment by contract, year, and month);
2. Contract-specific reference load profiles; and
3. Estimates of average load impacts by contract.

SCE provided the forecast of monthly capacity commitments by contract, which is summarized in the next sub-section. In a typical demand response study, the utility provides a customer enrollment forecast. However, in this study the DRAs determine the enrollment required to meet their contract obligations. Therefore, the focus of the ex-ante forecast is on the contract obligations rather than customer enrollments, which are reverse engineered as necessary to obtain the forecast capacity values.

Contract-specific reference load profiles are based on simulations from regression models that match those used in the ex-post load impact analyses but removing the morning load variable.<sup>9</sup> Customer-specific models are estimated with the resulting reference loads added up to the contract level. Reference loads are simulated using the appropriate weather data (e.g., 1-in-2 weather-year conditions for SCE and CAISO-coincident peak conditions as provided by SCE) and event-day characteristics.

Ex-ante load impacts are developed from the ex-post load impact estimates. Because the contract capacities in our historical data match those of the forecast period (i.e., the contracts included in this year's evaluation do not have any forecast changes in their contract capacity values), we perform a straightforward adaptation of the ex-post impacts into the ex-ante forecast. There's no need to adjust for changes in the contract capacities.

Given the limited number of events for Stem this program year (and the absence of four-hour events), we rely on impacts from the prior program year to inform the ex-ante estimates. As shown in Figure 4-1b above, the impacts observed during the current

---

<sup>7</sup> The RA window is from 4 to 9 p.m. (HE 17 to 21) from June through October and 5 to 10 p.m. (HE 18 to 22) in the remaining months.

<sup>8</sup> All DRA contracts are limited to the LA Basin LCA.

<sup>9</sup> The presence of the morning load variable complicates the simulation of ex-ante reference loads because it requires a separate simulation of the morning load.

program year are generally comparable to those from last year, which supports the reasonableness of applying prior-year performance in developing the ex-ante estimates.

For Hybrid, the ex-ante load impacts are based on each contract's average performance during similar events in the PY2025 ex-post study, which are four-hour events beginning in HE 17 or 18. To ensure that we're forecasting load impacts when all resources are dispatched, ex-ante impacts are calculated at the customer level before being aggregated to the contract level. Because the contracts can be called for a maximum of four hours, we simulate a four-hour event from HE 17 through 20 during June through October and HE 18 through 21 for November through May. Ex-post impacts are averaged together by hour of day to derive the ex-ante forecast. For example, the HE 19 load impact is based on the ex-post estimates for HE 19, regardless of whether the start hour was HE 17 or 18.<sup>10</sup>

Snapback effects are included in the ex-ante forecast for the three hours following the event (HE 21 through 23, or HE 22 through 24 for November through May). They are based on the ex-post average load impacts for the three hours following four-hour events beginning in HE 17 or 18. The uncertainty-adjusted load impact scenarios are simulated using the standard deviations of the hour-specific average load impacts described above.

## 5.2 Contract Quantity Forecasts

In lieu of an enrollment forecast (which is what we receive in the typical DR resource evaluation), SCE provided us with the monthly contract capacity (MW) values for each contract during the forecast period. Customer enrollments are assumed to remain the same, as the contract capacity values do not change in the forecast period. Table 5-1 shows the totals across all contracts by month and year, averaged for the RA window<sup>11</sup>, which is HE 17 to 20 from June through October and HE 18 to 21 from November through May.

Pursuant to the Load Impact Protocol Process Guide (version 6.1, released by the Energy Division on March 5, 2026), large loads (e.g. data centers, EV fleet charging station load) should be reported as a distinct load type. In PY 2025, no data centers or charging stations of comparable size were enrolled in the program. We do not anticipate the DRAs adding large load customers during their current contract periods.

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<sup>10</sup> There are two exceptions: when simulating a HE 17 to 20 window, we include HE 21 impacts from HE 18 to 21 ex-post events with HE 20; and when simulating a HE 18 to 21 window, we include HE 17 impacts from HE 17 to 20 ex-post events with HE 18. This allows us to retain the estimates for those hours while applying them to forecast hours with the same contract quantity.

<sup>11</sup> As called for this program, in which events cannot exceed four hours in duration.

**Table 5-1: Average RA Window Forecast Contract Quantities for All Contracts (MW)**

Month	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Jan											
Feb											
Mar											
Apr											
May											
Jun											
Jul											
Aug											
Sep											
Oct											
Nov											
Dec											

The contract end dates are as follows:



### 5.3 Ex-Ante Load Impacts by DRA

#### *All Contracts Forecast*

Figure 5-1 shows the average RA-window load impact totaled across all contracts. We show August monthly worst day impacts by weather scenario for each year. Notice that the load impacts do not vary across weather scenarios, which is a direct result of the methodology discussed in Section 5.1.



**Figure 5-1: Average August RA Window Load Impacts by Weather Scenario and Year, Total for All Contracts**

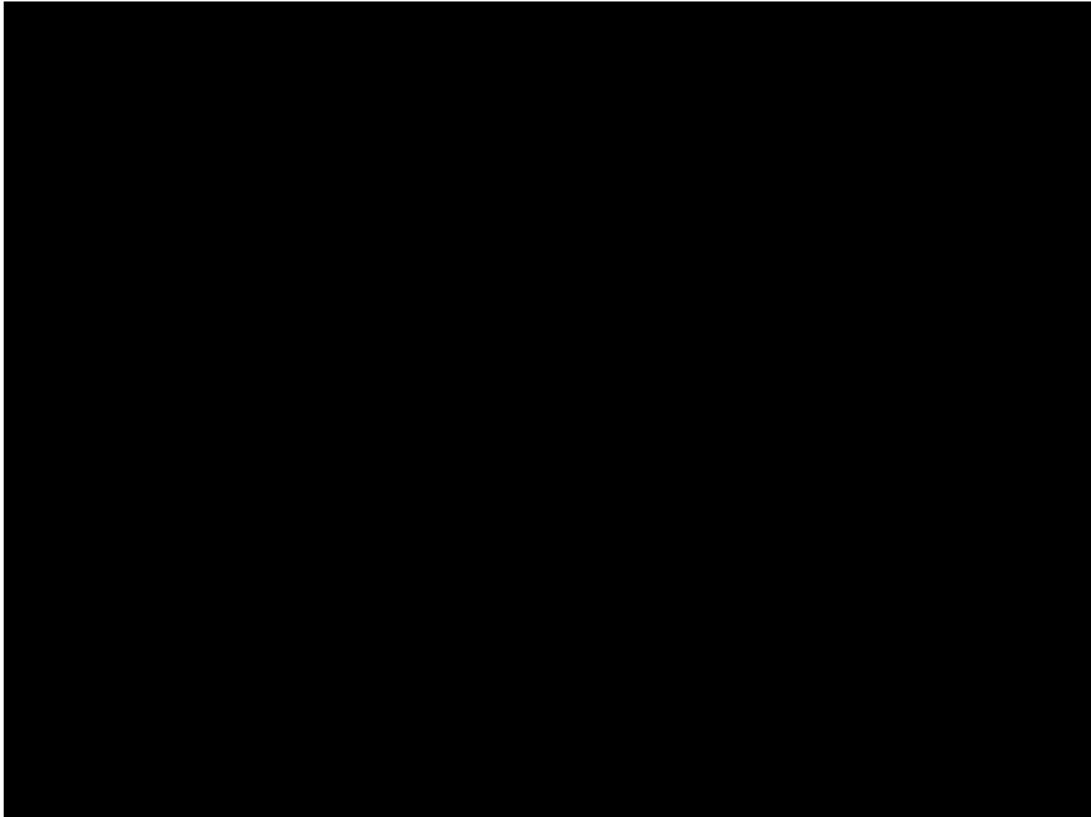


Table 5-2 shows the monthly average RA window load impact across all contracts for 2025. The average is calculated over the hours assumed to be called: HE 17 through HE 20 in June through October and HE 18 through 21 in all other months.

**Table 5-2: Average RA Window Forecast Load Impacts for All Contracts by Month in 2026 (MW)**

Month	SCE 1-in-2 Worst Day RA Window Load Impacts
January	
February	
March	
April	
May	
June	
July	
August	
September	
October	
November	
December	

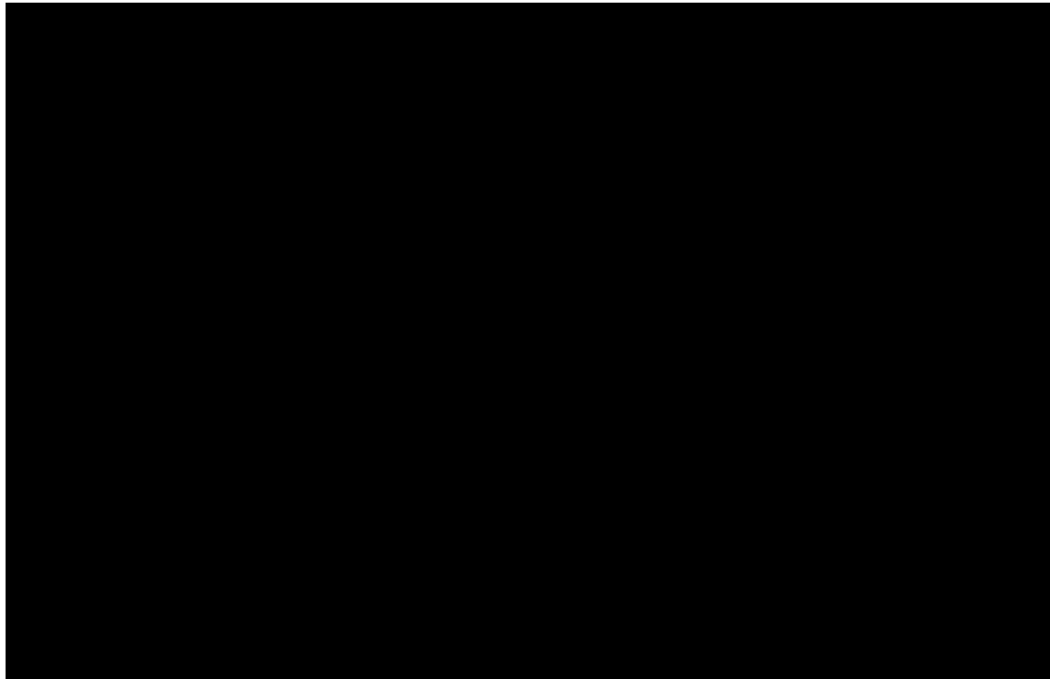
Table 5-3 and Figure 5-2 show the hourly load impacts in August 2026 for the utility-specific 1-in-2 weather scenario. The load impact declines somewhat during the RA window, which reflects two things:



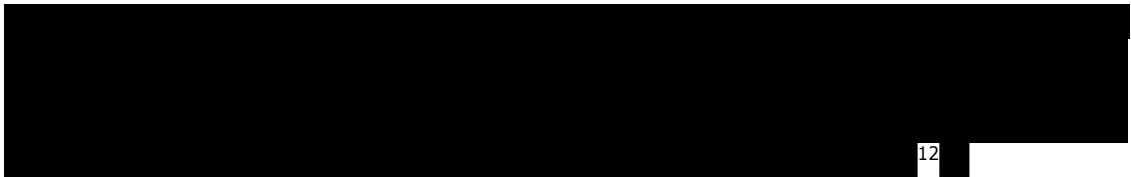
**Table 5-3: Hourly Reference Loads and Load Impacts for All LCR Contracts, August 2026 SCE 1-in-2 Weather**

	Estimated Reference Load (MWh/hr)	Estimated Event Day Load (MWh/hr)	Estimated Load Impact (MWh/hr)	Load Impact (%)	Average Temperature (°F)	Uncertainty Adjusted Impact (MWh/hr) - Percentiles			Standard Error
						5th %ile	50th %ile	95th %ile	
1									
2									
3									
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24									
By Period:	Estimated Reference Energy Use (MWh/hr)	Observed Event Day Energy Use (MWh/hr)	Estimated Change in Energy Use (MWh/hr)	Average Load Impact (%)	Average Temperature (°F)	Uncertainty Adjusted Impact (MWh/hr) - Percentiles			Standard Error
Average RA Window Called***						5th%ile	50th%ile	95th%ile	

**Figure 5-2: Hourly Reference Loads and Load Impacts for All LCR Contracts, August 2026 SCE 1-in-2 Weather**



*Hybrid Forecast*



12

12



**Table 5-4: Average RA-Window Load Impacts in August (MWh/hr), All Hybrid Contracts**

Year	CAISO 1-in-2	Utility 1-in-2	% Performance
2026			
2027			
2028			
2029			
2030			
2031			
2032			
2033			
2034			
2035			
2036			

*Stem Forecast*



**Table 5-5: Average RA-Window Load Impacts in August (MWh/hr), Stem**

Year	CAISO 1-in-2	Utility 1-in-2	% Performance
2026			
2027			
2028			
2029			
2030			
2031			
2032			
2033			
2034			
2035			
2036			

**6. COMPARISONS OF RESULTS**

In this section, we present several comparisons of load impacts for each contract:

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

Above, “current study” refers to this report, which is based on findings from PY2025; and “previous study” refers to the report that was developed for PY2024. Ex-ante reference

loads and load impacts are averaged over the hours assumed to be called within the Resource Adequacy (RA) window.

## 6.1 Previous versus current ex-post

It is difficult to construct an apples-to-apples comparison of ex-post impacts across evaluations because the contracts can be called over a range of hours and, [REDACTED]. To alleviate concerns about comparing results across years, we directly compare event windows and the hours within. For instance, HE 17 to 20 events in PY2025 will be directly compared to HE 17 to 20 events in PY2024.

Tables 6-1a, 6-1b, and 6-1c, use the load impact and contract MW values from Tables 4-1a and 4-1b and Figure 4-1b. These values reflect Hybrid events that were four hours in duration starting in HE 17 or 18, as well as Stem events from the current and prior program years. We recreated the same values for Hybrid for PY2024 to provide a direct comparison. [REDACTED]

[REDACTED]

**Table 6-1a: Hybrid Previous versus Current HE17 Ex-Post Impacts**

Event Hour	Current			Previous		
	Impact MW	Contract MW	% of Contract	Impact MW	Contract MW	% of Contract

**Table 6-1b: Hybrid Previous versus Current HE18 Ex-Post Impacts**

Event Hour	Current			Previous		
	Impact MW	Contract MW	% of Contract	Impact MW	Contract MW	% of Contract

**Table 6-1c: Stem Previous versus Current Ex-Post Impacts**

Event Length	Hour	Current			Previous		
		Impact MW	Contract MW	% of Contract	Impact MW	Contract MW	% of Contract

## 6.2 Previous versus current ex-ante

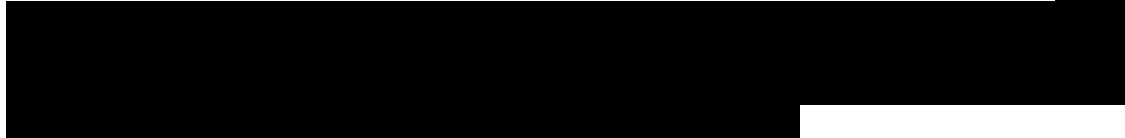
Table 6-2 compares the ex-ante impacts from the current and previous studies for August 2026 using the SCE-specific 1-in-2 weather conditions. [REDACTED]

**Table 6-2: Previous versus Current Ex-Ante Impacts**

DRA	Period	Current		Previous	
		Impact MW	Contract MW	Impact MW	Contract MW
All	All				

### 6.3 Previous ex-ante versus current ex-post

Table 6-3 compares the ex-post impacts from the current study to the August 2025 SCE 1-in-2 ex-ante forecast from the previous study. The ex-post impacts are calculated by taking an average of impacts during four-hour events that start in HE17 or HE18.

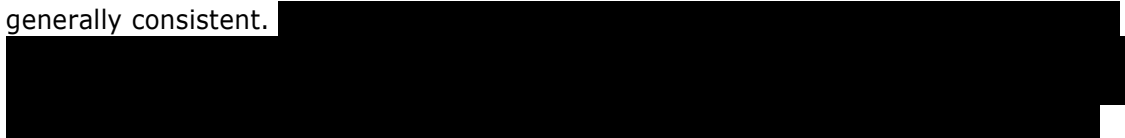


**Table 6-3: Previous Ex-Ante versus Current Ex-Post Impacts**

DRA	Period	Current Ex-Post		Previous Ex-Ante	
		Impact MW	Contract MW	Impact MW	Contract MW
All	All				

### 6.4 Current ex-post versus current ex-ante

Table 6-4 compares ex-post and ex-ante August 2026 load impacts from the current study. Both types of impacts are based on four-hour events starting in HE 17 or 18, though the hours are combined slightly differently in the two cases. Because the ex-ante impacts are derived from averages of ex-post results, we would expect the two to be generally consistent.



**Table 6-4: Current Ex-Post vs. Current Ex-Ante Impacts**

DRA	Period	Current Ex-Post		Current Ex-Ante	
		Impact MW	Contract MW	Impact MW	Contract MW
All	All				

## **APPENDICES**

The following Appendices accompany this report. Appendix A is the validity assessment associated with our ex-post load impact evaluation. The additional appendices are Excel files that can produce the tables required by the Protocols. The Excel file names are listed below.

DRA Study Appendix B:

PY2025\_SCE\_Third-Party DRA\_Ex\_Post\_Impacts\_FINAL\_CONFIDENTIAL.xlsx

DRA Study Appendix C:

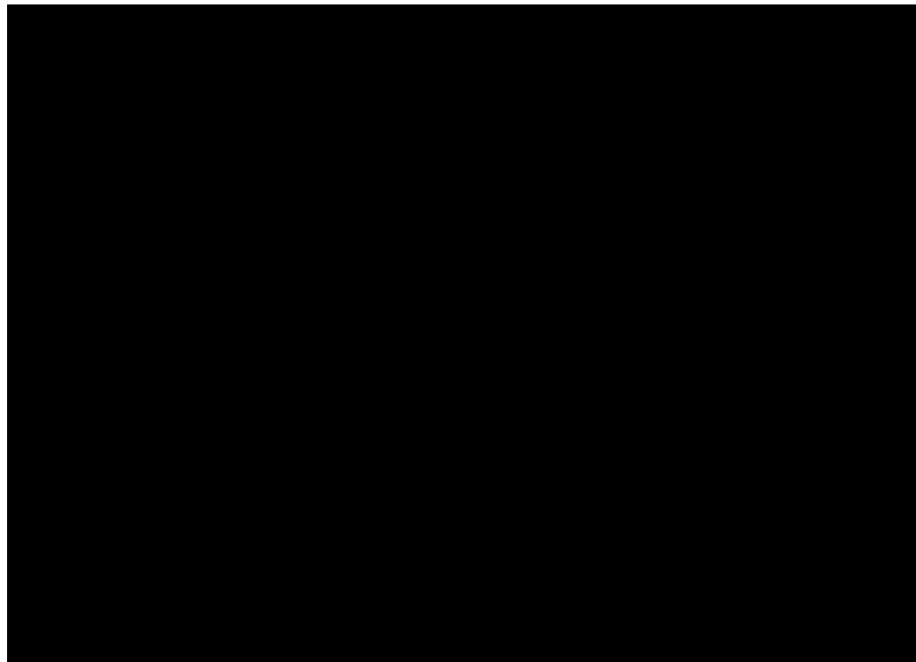
PY2025\_SCE\_Third-Party DRA\_Ex\_Ante\_Impacts\_FINAL\_CONFIDENTIAL.xlsx

## APPENDIX A. VALIDITY ASSESSMENT

Our primary method of validating our ex-post regression model is to see how well the model predicts loads for days that are withheld from the estimation (i.e., out-of-sample predictions). We first randomly selected 15 percent of the non-event days to withhold from the testing regression models, which are separately estimated for each customer number.



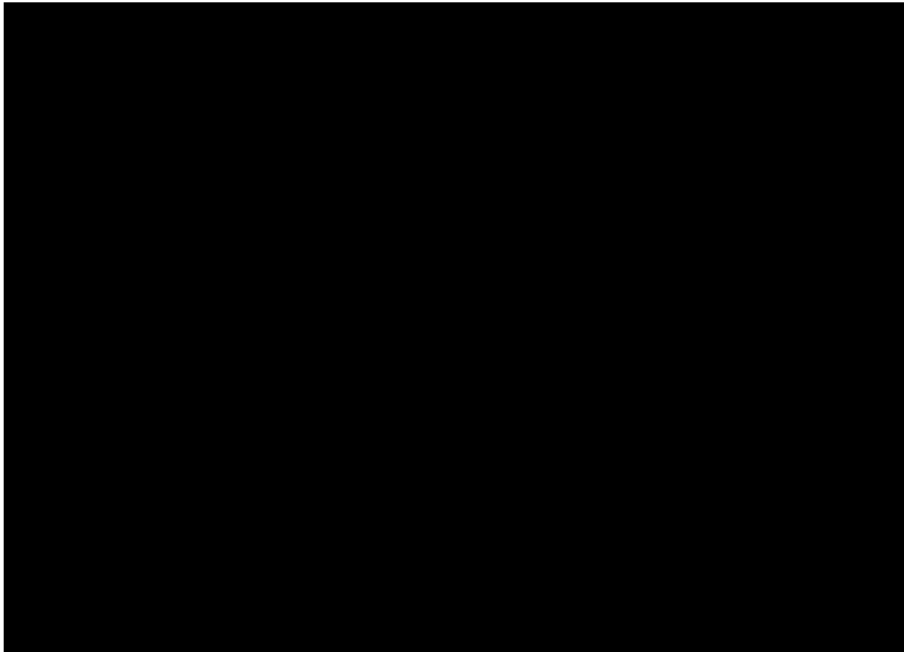
**Figure A-1a: Weekday Observed and Predicted Out-of-Sample Loads, Hybrid**



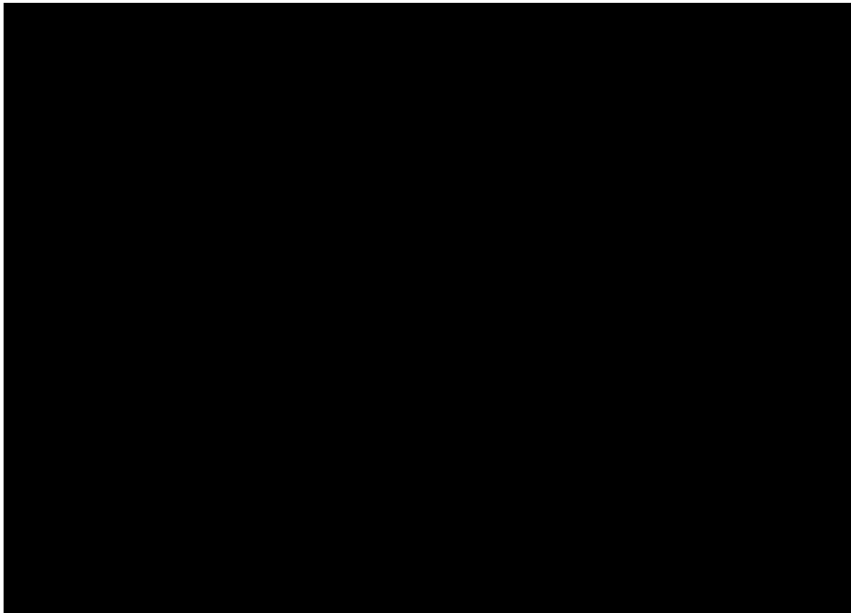
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<sup>13</sup> MPE provides an indication of bias while MAPE provides a measure of accuracy.

**Figure A-1b: Weekend Observed and Predicted Out-of-Sample Loads, Hybrid**

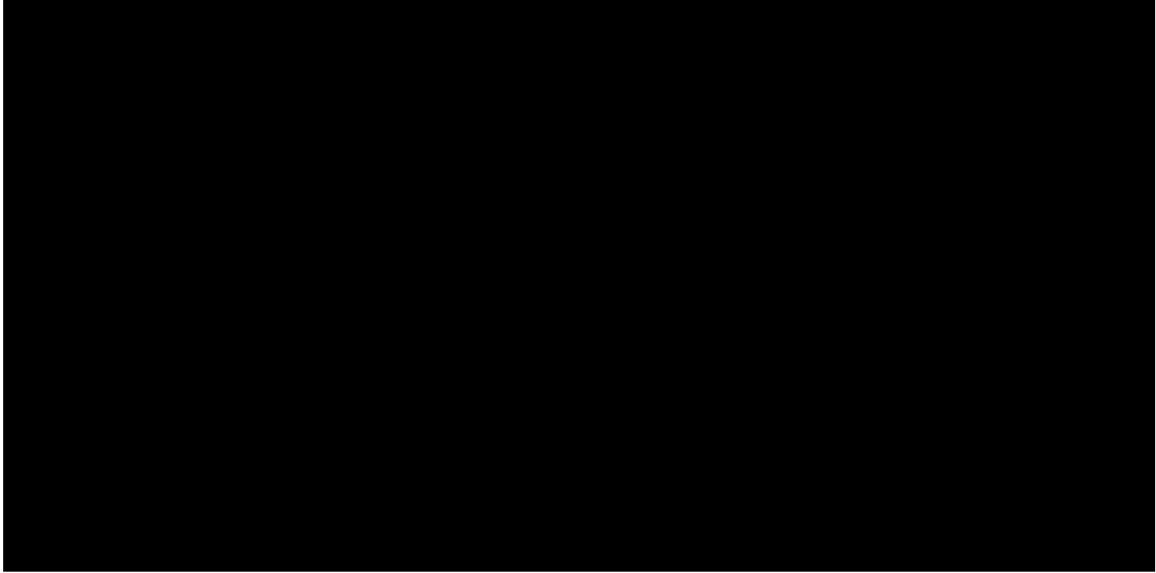


**Figure A-2: Weekday Observed and Predicted Out-of-Sample Loads, Stem**





**Figure A-3a: Weekday Histogram of Customer-Specific R<sup>2</sup> Values by DRA**



**Figure A-3b: Weekend Histogram of Customer-Specific R<sup>2</sup> Values by DRA**



Tables A-1a and A-1b summarize the average of the customer-specific R<sup>2</sup> values by DRA and model.

**Table A-1a: Weekday Average R<sup>2</sup> from Ex-Post Model by Demand Response Aggregator**

Aggregator	Average Customer-Level R <sup>2</sup>
[Redacted]	

**Table A-1b: Weekend Average R<sup>2</sup> from Ex-Post Model by Demand Response Aggregator**

Aggregator	Average Customer-Level R <sup>2</sup>
[Redacted]	