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2023 AC Saver Day Of Load Impact Evaluation Plan

Submitted to San Diego Gas & Electric Co. (SDG&E)

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Contents

1 Introduction and Key Issues

This document summarizes the 2023 load impact evaluation plan for the San Diego Gas & Electric Co. (SDG&E) AC Saver Day Of program. The plan addresses the research objectives of developing ex post and ex ante load impact estimates that conform to the timing and requirements of the Demand Response (DR) Load Impact Protocols[1].

Resource Innovations held a project kickoff meeting on August 28, 2023, with the SDG&E project manager and other key SDG&E staff to obtain feedback on the overall evaluation approach and to discuss any new or emerging areas of interest that should be addressed in the evaluation. The following key issues for the 2023 ex post and ex ante load impact analyses were discussed:

- The 2023 ex post load impacts will be estimated using a matched control group research design for both the residential and small and medium business (SMB) customer segments.

- Load impacts will be estimated separately for each customer class segment (residential and SMB) and by cycling strategy (50% and 100% cycling for residential, 30% and 50% for SMB), climate zone, net energy metering (NEM) status, and dual-enrollment status with other DR programs. Small commercial impacts will also be segmented by industry group and demand category;

- Ex ante reference load and load impacts will be estimated by modeling ex post load impacts across multiple program years as a function of temperature. We will test various model specifications, which may take into account variables such as month, whether the event is in the inner or outer summer, humidity, and temperature metrics other than “mean 17”;

- Estimates of hourly program load impacts for each of the 2023 AC Saver Day Of events using CAISO baselines will be compared with the evaluation, measurement and verification (EM&V) load impacts. The CAISO baseline methodologies are already documented, but Resource Innovations will review these with SDG&E prior to conducting the analysis. SDG&E will provide Resource Innovations with a timeline for when this analysis needs to be completed;

- In previous years, the RA hours window fell from 4 PM to 9 PM for all months. However, starting in the 2023 Compliance Year the RA hours will be adjusted to the window of 5 PM-10 PM for the months of March and April;

- A time-temperature matrix (TTM) that estimates the load impacts for both the residential and SMB customer segments at various temperatures, event start times, and event durations will be produced.

[1] California Public Utilities Commission Decision 08-04-050 issued on April 28, 2008 with Attachment A.

The remainder of this document proceeds as follows: Section 2 presents a summary of the methodology for estimating ex post load impacts for residential and SMB AC Saver Day Of participants. Section 3 contains a summary of the methodology for developing and reporting ex ante estimates. Section 4 presents a table of information to satisfy Protocol 3 of the DR Load Impact Protocols. Section 5 presents the data request sent to the SDG&E project manager on September 11, 2023. Section 6 provides an overview of each work plan task and subtask and describes the deliverables for each task of this evaluation. Finally, this evaluation plan concludes with a schedule of deliverables and due dates in Section 7.

2 Ex Post Load Impact Estimation

The residential 2023 ex post load impacts will be estimated using a matched control group research design. To conduct the residential matching, Resource Innovations will request characteristics information and interval data for approximately 200,000 SDG&E residential non-participants, proportional to the number of non-NEM and NEM program participants in each zip code. The control matches will be selected based on the candidate with load patterns most similar to each treatment customer. This approach was successfully used in the PY 2022 AC Saver Day Of load impact evaluation.

Control customers will be chosen using a dissimilarity statistic that determines the closest match for each participant. The dissimilarity statistic measures how similar each match candidate is to any given participant customer based on how well (or not) their energy usage characteristics match those of the participant on both the event day and other hot non-event days in 2023, called proxy days. The proxy days are selected to match the weather patterns of the event days. The characteristics used in the dissimilarity statistic are:

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

A matched control group framework will also be used for the SMB customer segment. Due to the smaller population count in this segment, Resource Innovations will request interval data for the entire customer population. This approach was successfully used in the PY 2015 through PY 2022 AC Saver Day Of load impact evaluations. The control matches will be selected based on industry, climate zone, NEM status, and load patterns most similar to each treatment customer. Individual non-participants may be selected more than once as a matched control customer.

Resource Innovations will estimate hourly load impacts through a difference-in-differences approach. Hourly load for the control group will be adjusted to reflect any differences observed between the treatment and control groups during the morning hours of the event day and during proxy days. This adjustment is typically small and is necessary to correct for small sampling biases that can occur with limited sample sizes. The treatment group load is then simply subtracted from the adjusted control group load to arrive at hourly estimates of load impacts.

Ex post load impact estimates will be reported for residential and SMB customers separately and for each cycling strategy, climate zone, NEM status, and dual-enrollment status with other DR programs, on the basis of per central air conditioning (CAC) ton, per CAC unit, per premise (kW), and in aggregate (MW). Small commercial impacts will also be segmented by industry group and demand category.

Ex post load impacts will be summarized and reported in MS Excel-based load impact table generators as in prior evaluations of the program. These tables will conform to the CPUC Load Impact

Protocols. Because the entire residential and SMB populations will be included in the analysis this year, we will not need to use sampling weights to produce these tables as used in previous years.

In addition to the ex post load impact estimates, Resource Innovations will perform an analysis of the distribution of load impacts across customers based on deciles of average customer usage.

3 Ex Ante Load Impact Estimation

The ex ante analysis for both residential and SMB customers uses the estimated ex post impacts as the dependent variable in a regression model, where ex post impacts are modeled as a function of temperature and potentially other variables to predict load impacts under weather conditions intended to simulate normal peaks (SDG&E and CAISO 1-in-2), extreme peaks (SDG&E and CAISO 1-in-10), and typical event day weather[2]. In other words, rather than show what the load impacts are under conditions specific to 2023 or any other specific program year, ex post load impacts are used to derive coefficients that will be applied to ex ante weather conditions to project what the program should be expected to deliver under a series of conditions that reflect the weather conditions that the CPUC has specified (1-in-2 is considered a normal peak condition, and 1-in-10 is considered to be an extreme peak condition). The ex ante estimates are used by the CPUC to provide the RA credits that are awarded to SDG&E annually.

SDG&E will provide Resource Innovations with enrollment forecasts that we will combine with average per-customer impacts to produce aggregate impact forecasts. Based on these forecasts, we will use population weights to ensure that load impact predictions represent the projected program population.

Hourly ex ante load impacts will be calculated using the ratios-based method used in previous evaluations. This method first directly estimates the relationship between impacts and temperature for an average load impact value from a particular window of time, for example 6 PM to 8 PM. The impact-temperature relationship is then extrapolated to individual hours in the RA window by applying a set of shaping ratios that represent how each hourly ex post impact relates to the average ex post load impact. The window of time used to develop an average load impact, which is then used to model the relationship of impacts with weather, changes from evaluation to evaluation based on when SDG&E dispatches the program in a given evaluation year.

The 2023 ex ante analysis will be conducted using two sets of ex ante weather conditions: The first set of weather conditions will reflect days on which SDG&E's load is likely to peak for each month; The second set of weather conditions will reflect days on which the CAISO system is expected to peak. Both sets of ex ante load impacts will be summarized and documented in the final report.

AC Saver Day Of Ex Ante Load Impact Reporting Requirements

The ex ante load impact estimates produced by this evaluation will be used for forecasting AC Saver Day Of load impacts as a demand response resource for RA. RA forecasting requires that load impacts are estimated for certain hours of the year. Specifically, the load impacts from this evaluation that will be put forward for RA forecasting require reporting of aggregate (portfolio-adjusted) monthly estimates of load impacts under 1-in-2 peak weather conditions expected to

[2] "SDG&E" and "CAISO" identify the system that is peaking, while 1-in-2 and 1-in-10 refer to the extremity of weather conditions (i.e., 1-in-2 means that the modeled weather conditions are representative of those that would be seen once in two years, and are considered "typical" peaking conditions).

accompany CAISO system peaking days. The RA hours window are from 5 PM to 10 PM for March, April, and May, and 4 PM to 9 PM for all other months.

Resource Innovations will additionally estimate ex ante load impacts for all hours that the AC Saver Day Of program can be dispatched, which extend beyond the RA hours: AC Saver Day Of can be dispatched during the hours 12 PM to 9 PM. These ex ante load impacts for all available program hours will be delivered to SDG&E in an MS Excel workbook separate from the evaluation report and associated table generators. Specifically, this RA all-hours workbook will contain 1-in-2 peak (portfolio-adjusted) ex ante load impacts for years 2023 through 2034.

Ex ante load impact estimates will be reported for residential and SMB customers separately, for each cycling strategy and each climate zone, on the bases of per CAC ton, per CAC unit, per premise, and in aggregate. The reporting will comply with the DR Load Impact Protocols.

In addition to complete ex post and ex ante databases, Resource Innovations will also produce a database, separate from the load impact table generator that provides program load impacts by busbar using average per-ton load impacts grossed up to the busbar level using the number of total enrolled tons on each busbar.

Resource Innovations will also report ex ante load impact estimates on an aggregate basis for all AC Saver Day Of customers, residential and SMB combined, as one group. Resource Innovations will check all reporting segments for any violations of the 15/15 rule and will notify SDG&E. SDG&E's AC Saver Day-of evaluation team will verify with SDG&E legal staff and the SDG&E Customer Privacy group if any redactions are necessary for 15/15 rule violations. If deemed necessary, Resource Innovations will produce both public and private versions of the report and table generator.

The DR Load Impact Protocols also require ex ante load impacts to be reported on both a program-specific and portfolio-adjusted basis; for AC Saver Day Of, portfolio-adjusted load impacts are the same as program-specific load impacts. Additionally, Slice-of-Day framework will be utilized to display impacts by month. The Slice-of-Day requirements cover all 24 hours in the day. They necessitate that SDG&E have enough capacity to satisfy its specific gross load profile in all 24 hours on the "worst day" in that month.

4 Demand Response Load Impact Protocol 3

Table 4-1 outlines this evaluation's approach to addressing 13 specific issues that must be addressed by this evaluation plan, per Protocol 3 of the DR Load Impact Protocols.

Table 4-1: Summary of Protocol 3 Issues for the 2023 AC Saver Day Of Load Impact Evaluation

Issue	Plan
What is the target level of confidence and precision?	10% precision with 90% confidence at the aggregate/average customer level ("90/10").
Ex ante estimation in addition to ex post?	Both ex ante and ex post load impact estimates will be developed in this evaluation.
If ex ante estimates are provided, are changes anticipated in program and/or customer characteristics?	No, AC Saver Day Of participant and program characteristics are not expected to change over the forecast horizon.
Will impact persistence be addressed?	No, a formal analysis of impact persistence across program years is not in scope for this evaluation.
Are M&V activities needed?	No, the only data to be used by this evaluation is already collected by SDG&E and the program implementer in the course of providing electric service and implementing the program.
Will estimates be developed for geographic sub-regions?	Yes, both ex ante and ex post load impacts will be developed for SDG&E climate zones.
Will estimates be developed for sub-hourly intervals?	No.
Will estimates be developed for customer segments?	Load impact estimates will be developed for residential and SMB customers, and separately for customers subject to different cycling strategies, located in different climate zones, and with different dual-enrollment statuses with other DR programs. Load impact estimates will also be calculated across usage deciles.
Will estimates be developed for day-types other than those required by subsequent protocols?	No.

Issue	Plan
Will the evaluation try to understand why the impact estimates are what they are?	Yes, the report will present a discussion of the relationship between ex post and ex ante load impacts and a comparison of 2023 load impacts to those in previous years.
Will estimates of the number or percentage of free riders or structural benefiters be developed?	No. Sufficient end-use data to facilitate this analysis is not available for this evaluation.
Is a control group being used in the analysis and, if so, how will you address potential bias?	Yes, a matched control group methodology will be used to estimate ex post load impacts. We will assess bias by examining load differences between groups during non-event hours.
For programs common across multiple utilities, will you conduct a joint evaluation?	The characteristics of the SDG&E AC Saver Day Of program are different enough from air conditioning load control programs at Southern California Edison Co. (SCE) and Pacific Gas and Electric Co. (PG&E) that a joint evaluation is not appropriate.

5 Data Sources

Resource Innovations sent a detailed data request to the SDG&E program team on September 11, 2023. The data request was provided in MS Word (.docx) format and is embedded here as Attachment 5-1. The primary components of the data request are the following:

1. IntelliSOURCE-sourced enrollment lists for each event day in 2023
2. Customer characteristics for all 2023 AC Saver Day Of participants
3. Customer characteristics for the full SDG&E population of residential customers
4. Customer characteristics for the full SDG&E population of SMB customers
5. Whole-house, hourly interval load data from Oct 2022 through Sept 2023 for all 2023 residential AC Saver Day Of participants
6. Whole-premise, hourly interval load data from Oct 2022 through Sept 2023 for the full SDG&E population of SMB customers
7. Enrollment information for other programs for all AC Saver Day Of participants
8. Event notification list
9. Program event information
10. Weather data for all weather stations from Oct 2022 through Sept 2023
11. Whole-house, hourly interval load data for Oct 2023 for all 2023 residential AC Saver Day Of participants
12. Whole-house, hourly interval load data for from Oct 2022 through Oct 2023 for the residential control group customers
13. Whole-premise, hourly interval load data for Oct 2023 for the full SDG&E population of SMB population
14. Weather data for all weather stations for Oct 2023
15. SDG&E system load data
16. DR and time-differentiated rates event and notification data
17. 2023 Blackouts information

Resource Innovations requests that items 1-10 be fulfilled by October 9, 2023, and items 11-17 be fulfilled by November 6, 2023.

Attachment 5-1: 2023 AC Saver Day Of Data Request

2023 ACSDO - Data Request.docx

In addition to the data request, SDG&E will need to provide a forecast of monthly program enrollment for years 2024 through 2034. The enrollment forecast will need to be segmented by customer class, cycling strategy, climate zone, and dual-enrollment status with other DR programs. Resource Innovations requests that the enrollment forecast be delivered to Resource Innovations by January 15, 2024.

6 Detailed Work Plan

This section outlines the specific tasks and deliverables that Resource Innovations will complete and deliver during the course of this evaluation. The first task was to conduct a project kickoff meeting, which was completed on August 28, 2023. Delivery of the final evaluation plan will constitute the completion of Task 2. The work plan below begins with Task 3.

6.1 Task 3: Evaluation Design

Task 3.1: Data Collection and Validation

Resource Innovations has requested key customer-level and other relevant data from SDG&E to support this evaluation; a detailed data request was submitted to the SDG&E project manager on September 11, 2023. The data request is attached in Section 5; it includes, but is not limited to:

- Participant program information including participation start and end dates, air conditioning tonnage, number of air conditioners enrolled in the program, etc.;
- Interval data for all residential customers in the AC Saver Day Of program;
- Interval data for all SMB participants and non-participants
- Customer characteristics (e.g., customer class, NAICS code, climate zone, closest weather station, notification choices, electric rate, max demand, average annual demand, average summer demand);
- Event notification data, including customer overrides (if applicable);
- Weather data;
- Program event data (e.g., dates of events, trigger information); and
- System load data.

This data request is composed of two parts, with the first set of items requested by October 9, 2023 or earlier, and the second set of items requested by November 6, 2023 or earlier.

Deliverables:	Due Dates:
• Data Request	Delivered September 11, 2023
• Data Request Response 1 (#1-10)	October 9, 2023 (or earlier)
• Data Request Response 2 (#11-17)	November 6, 2023 (or earlier)

Task 3.2: Ex Post Impact Analysis

Resource Innovations will estimate ex post load impacts using a matched control group research design. The ex post impact analysis will include but not be limited to:

- Estimating the hourly load impacts and average daily load impacts for the residential and SMB program segments, for each cycling strategy, climate zone, and dual enrollment status in other DR programs;
- Estimating the hourly load impacts and average daily load impacts for the SMB program segment for each industry group, demand category, and NEM status;
- Estimating the uncertainty-adjusted range of impacts, on an aggregate and per-customer basis, for each program segment;
- Estimating the distribution of hourly and average daily impacts provided by different customer segments across all events combined; and
- Producing a draft report summarizing ex post load impact estimates in addition to presenting ex post load impacts to SDG&E via teleconference.

Deliverables:	Due Dates:
• Ex Post Estimation – Draft results and report	January 8, 2024
• Ex Post Estimation – Final results and report	January 15, 2024

Task 3.3: Ex Ante Impact Analysis

Resource Innovations will develop ex ante load impact estimates for the AC Saver Day Of program for the years 2023 through 2034, including a base year 2023 forecast that assumes 2023 enrollment.

The load impact estimates, reported on both aggregate and average bases, will conform to the requirements of the DR Load Impact Protocols, and will be produced for the following weather conditions and day types:

- Monthly load impacts under 1-in-2 peak conditions (i.e., normal), 1-in-10 peak conditions (i.e., extreme), and typical event day weather conditions coincident with the SDG&E system peak; and
- Monthly load impacts under 1-in-2 peak conditions, 1-in-10 peak conditions, and typical event day weather conditions coincident with the CAISO system peak.

The methodology used for ex ante load impact estimation is summarized in Section 3.

The ex ante load impacts will incorporate SDG&E's enrollment forecasts for the AC Saver Day Of program for each month over the years 2023 through 2034.[3] If the enrollment forecast includes uncertainty estimates, we will incorporate them into the ex ante load impact estimates. Resource Innovations will include the forecasted AC Saver Day Of enrollments in the final report.

Deliverable:	Due Date:
• Enrollment Forecast from SDG&E	January 15, 2024
• Ex Ante Estimation – Draft results and report	February 19, 2024
• Ex Ante Estimation – Final results and report	March 4, 2024

6.2 Task 4: Prepare Reports

The first draft of the evaluation report that Resource Innovations will present to SDG&E for review and comment will be the ex post portion, which will be delivered shortly after the draft ex post load impacts are presented to SDG&E.

The final draft of the evaluation report will be prepared, which builds upon the first draft containing the ex post analysis, and adds in the ex ante load impact analysis, in order to produce a final draft containing both ex post and ex ante estimates. To facilitate the understanding and transparency of the relationship between ex post and ex ante load impacts, the final report will contain a section that explains, to the extent possible, how the following factors account for the differences between ex post and ex ante load impacts: operational conditions (such as temperature and month); program modifications; enrollment adjustments; regulatory uncertainty; fluctuations in the economy; changes

[3] The 10-year enrollment forecast is contingent on an upcoming decision regarding the program sunsetting. The enrollment forecast for the ex ante analysis will be adjusted according how many years the program expects to continue.

in load growth; demographic shifts; learnings from previous evaluations; and/or other pertinent exogenous or endogenous influences. To the extent possible, Resource Innovations will quantify the total percentage change between ex post and ex ante impacts associated with each of the potential factors outlined above.

The final report will also include the following:

- An explanation of differences between ex post and ex ante load impact estimates from the 2021 and 2022 program year evaluations and those estimated for the 2023 program year report and the factors underlying those differences;
- Detailed hourly results tables required by the DR Load Impact Protocols.

Resource Innovations will prepare an abstract that is less than 3,000 characters in length with no tables to be publicly posted on the California Measurement Advisory Council (CALMAC) website. Resource Innovations will also prepare a two-page written summary of the ex ante load impacts in MS Word (.docx) format.

Finally, Resource Innovations will prepare a comparison of ex post load impacts as estimated by this evaluation to ex post load impacts as estimated by the CAISO Baseline estimation process. Resource Innovations will calculate the ex post load impacts as prescribed by CAISO and prepare and deliver a presentation of the CAISO Baseline load impacts in comparison with the evaluation's ex post load impacts. Key drivers of differences in load impacts as estimated by the two methodologies will be identified. In addition, Resource Innovations will investigate and report any differences between estimating the CAISO baselines using aggregate versus individual loads.

Deliverables:	**Due Dates:**
• Final Hourly Ex Post and Ex Ante Load Impacts	March 4, 2024
• Executive Summary Write-Up	March 18, 2024
• Non-Technical CALMAC Abstract	April 15, 2024
• CAISO Baseline Comparison	To be determined (TBD)

6.3 Task 5: Presentation of Results

Resource Innovations will present the findings of this evaluation at a workshop at the CPUC in San Francisco, California, or via teleconference, upon request.

Deliverable:	**Due Date:**

- Workshop presentation — To be determined (TBD)

6.4 Task 6: Project Management and Progress Reporting

The Resource Innovations project manager will keep the SDG&E project manager informed of progress on all project deliverables. Teleconferences will be conducted by the Resource Innovations project manager upon completion of all major deliverables so that SDG&E stakeholders can review and discuss results with the evaluation team.

Deliverables:	Due Dates:
• Project Update Calls	Every other Monday

6.5 Task 7: Database Documentation

Resource Innovations will prepare and deliver an integrated project dataset with all the data collected and developed in the project.

Deliverables:	Due Dates:
• Final Load Impacts Database	March 4, 2024

6.6 Task 8: Time-Temperature Matrix

Resource Innovations will prepare and deliver a time-temperature matrix (TTM) for both the residential and SMB segments. Load impacts will be estimated for:

- All cycling options
- Event start times from 12 PM to 9 PM
- Event durations from 1 hour to 6 hours in increments of 1 hour
- Daily maximum temperatures from 70 °F to 100 °F in increments of 1 °F
- Weekday and weekend events

The files will be delivered as both interactive table generators and flat files.

Deliverables:	Due Dates:
• Residential TTM table generator	March 18, 2024
• SMB TTM table generator	March 18, 2024
• Residential TTM flat file	March 18, 2024

- SMB TTM flat file March 18, 2024

7 Deliverables and Due Dates

Table 7-1 summarizes the due dates for all deliverables described in the above work plan by task. Deadlines will only shift with the joint agreement of SDG&E and Resource Innovations.

Table 7-1: Deliverable Summary by Task

Task	Task Description	Deliverable	Due Date
1	Conduct Kickoff Meeting	Kickoff meeting	August 28, 2023
		Kickoff meeting memorandum	September 11, 2023
2	Develop Evaluation Plan	Draft evaluation plan	August 30, 2023
		Final evaluation plan	TBD (5 days following comments)
3.1	Data Collection	Data request	September 11, 2023
		Data request response 1	October 9, 2023 (or earlier)
		Data request response	November 6, 2023 (or earlier)
3.2	Ex Post Load Impact Analysis	Draft ex post results and report	January 8, 2024
		Final ex post results and report	January 15, 2024
3.3	Ex Ante Load Impact Analysis	Enrollment forecast from SDG&E	January 15, 2024
		Draft ex ante results and report	February 19, 2024
		Final ex ante results and report	March 4, 2024
4	Prepare Reports	Final hourly ex post and ex ante impacts	March 4, 2024
		Executive summary write-up	March 18, 2024
		CALMAC abstract	April 18, 2024
		CAISO Baseline comparison	TBD

Task	Task Description	Deliverable	Due Date
5	Load Impact Workshop Presentation	Workshop presentation	TBD
6	Project Management and Progress Reporting	Project update calls	Bi-weekly on Mondays
7	Database Documentation	Load impacts database	March 4, 2024
8	Time-Temperature Matrix	TTM table generators and flat files	March 18, 2024

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