Demand Side Analytics
DATA DRIVEN RESEARCH AND INSIGHTS

EVALUATION PLAN

FINAL

Prepared for San Diego Gas & Electric

By Demand Side Analytics, LLC

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ACKNOWLEDGEMENTS

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1 INTRODUCTION

This evaluation plan lays out the analysis approach and requirements for evaluating impacts for SDG&E's small commercial and agricultural CPP-TOU rates, including the technology deployments (TD) for non-residential customers (CPP-TD). Throughout this document these will be referred to as three distinct groups of non-residential populations:

- Small Commercial accounts on CPP-TOU rates[1]
- Small Agricultural accounts on CPP-TOU rates

The primary goal of the evaluation is to measure CPP event impacts for these groups. This consists of estimating hourly ex post load impacts for PY 2024 and ex ante load impacts through 2035. The evaluation will also include a supplementary analysis to assess customer awareness and understanding of CPP event windows and notifications.

There are two main objectives for this evaluation plan. The primary objective is to engage in science and avoid after-the-fact analysis and decisions where there is a temptation to modify models to find the desired results. This requires documenting the hypothesis, specifying the intervention, establishing the sample size and the ability to detect a meaningful effect, identifying the data that will be collected and analyzed, identifying the outcomes that will be analyzed and segments of interest, and documenting in advance the statistical techniques and models that will be used to estimate demand reductions. The goal is to leave little to no ambiguity regarding what data will be collected or how the data will be analyzed. The secondary objective is to comply with the California Load Impact Evaluation Planning Protocols (Protocol #2). As a result, the evaluation plan is customized the explicitly address the 12 questions in the planning protocol.

1.1 EVALUATION OF CPP IMPACTS

Table 1 and Table 2 summarize the history, populations, and evaluation objectives for each CPP population.

[1] The CPP-TD smart thermostat program ended in December 2023. Past participants in this program not dual enrolled in CPP would not have received event notifications in PY 2024 and were not included int the analysis.

Table 1: Program History

Program Element	CPP-TOU (Commercial)	CPP-TOU (Agricultural)	CPP-TD (Peak Shift at Work)
Year introduced	▪ January 2014	▪ January 2014	▪ Thermostats: 2012
Year Defaulted	▪ 2016 for small commercial	▪ 2016 for small commercial	▪ NA
# of Participants (PY 2023)	▪ 23k	▪ ~56	▪ 95 sites, 144 devices, 141 devices connected (98%)
Historical events (last 3 years)	▪ 2020 – 9 ▪ 2021 – 0 ▪ 2022 – 5 ▪ 2023 – 3	▪ 2020 – 9 ▪ 2021 – 0 ▪ 2022 – 5 ▪ 2023 – 3	▪ 2020 – 9 ▪ 2021 – 0 ▪ 2022 – 5 ▪ 2023 – 3
Historical Evaluation Dispatchable Ex-post (last 3 years)	PY2021 (2-6pm): ▪ No Events PY2022 (4-9pm): ▪ 1.4 MW PY2023 (4-9pm): ▪ 0 MW		PY2021 (2-6pm): ▪ No Events PY2022 (4-9pm): ▪ 0.04 MW PY2023 (4-9pm): ▪ 0.04 MW
Historical Evaluation Dispatchable Ex-ante (last 3 years)	PY2021 (4-9pm): ▪ 0.18 MW PY2022 (4-9pm): ▪ 2.57 MW PY2022 (4-9pm): ▪ 0.58 MW		PY2021 (4-9pm): ▪ 0.06 MW PY2022 (4-9pm): ▪ 0.05 MW PY2023 (4-9pm): ▪ 0.05 MW
Dual participation	▪ Overlaps with CPP-TD and CBP	▪ Overlaps with CPP-TD and CBP	▪ Subset of CPP-TOU ▪ Otherwise limited
Enabling tech			▪ Smart thermostats, Mostly Ecobee (also includes other vendors)

Table 2: Deliverables Specifications

Program Element	CPP-TOU	CPP-TD
Ex-post	▪ 2023	
Ex-ante	▪ Updated 12-year RA window: ○ 5-10 pm March through May	

Program Element	CPP-TOU	CPP-TD
	○ 4-9pm all other months ▪ Time-Temperature matrix ▪ Slice of Day Table	
Comments	▪ Commercial and Ag reported separately	▪ Included in the same Table Generators as accounts not on TD
Analysis segments	▪ Notification ▪ Class (Commercial vs Ag) ▪ Climate zone (coastal vs inland) ▪ Dual enrollment (CPP-TD, CBP)	(may not be split by climate zone due to small sample)
Recent changes to consider	▪ New potential reporting requirements, including capability profiles	

SDG&E defaulted over 120,000 small non-residential customers onto CPP-TOU rates between November 2015 and April 2016. Roughly 5% of these customers opted-out and were placed on TOU rates without a critical peak component. For all small commercial rates, the TOU peak period and the CPP event period (if applicable) historically ran from 11am to 6pm. However, these periods were narrowed to 2pm to 6pm in PY2018. Beginning in PY 2022, the CPP peak period was shifted to 4pm to 9pm to align with the Resource Adequacy window. Beginning in PY 2022 SDG&E customers were defaulted onto local Community Choice Aggregations (CCAs): City of San Diego residents in 2021 and other customers onto the Clean Energy Alliance CCA in 2023. These CCAs do not offer CPP rates and therefore customers served by these CCAs were removed from the dispatchable CPP rates, resulting in a substantial decline in the Small CPP-TOU population from about 108,000 accounts in 2020 to about 24,000 accounts in PY 2023.

The commercial TD program historically provided ecobee connected thermostats free of charge to commercial customers. The program has been in operation since 2014. Beginning in 2017, customers were required to be on a CPP-TOU rate (either CPP-D (large commercial), TOU-A-P (small commercial) or CPP-D-Ag (agricultural). Because the requirement to be on a CPP-TOU rate was not in place before, a significant number of participants are not enrolled in a CPP-TOU rate. In 2018, the program changed from the free thermostat to a rebate model and was broadened to include additional thermostat models. The devices on dispatchable rates (PSW and CPP-D) are curtailed on the CPP event days Devices on CPP rates (collectively CPP-TD) were dispatched from 2pm to 6pm. Beginning in PY 2022, the CPP peak was shifted to 4pm to 9pm to align with the Resource Adequacy window and the CPP-TD event window was shifted to 4pm to 8pm, due to the four-hour device dispatch limit. The number of Small Commercial accounts with smart thermostats on dispatchable rates dropped from 773 sites (and 2,299 devices) in PY 2020 to 95 sites (and 144 devices) in PY 2023. The defaulting of customers onto CCAs explains some of this reduction in participation, but the remainder is due to active management of device connectivity by SDG&E. Over the same period as the CCA rollouts, SDG&E implemented a

policy of periodically unenrolling thermostats disconnected for at least 12 months (at first) then for at least 3 months. Disconnected devices cannot receive dispatch signals or deliver load reductions therefore this narrowed participating devices to those capable of delivering load reductions, increasing connectivity rates from 58% in PY 2020 to 98% in PY 2023. In prior years device connectivity rates were carefully tracked and incorporated into the analysis given the effect on impacts and signal to noise ratios. However, given the small remaining population, the continuation of the SDG&E device management implementation, and the consistently high and improving device connectivity rate over the last two years (94% in PY 2022 and 98% in PY 2023) this is no longer needed.

Four CPP events were called in PY 2023 across the full Small CPP-TOU population. Given the substantial shifts in population since PY 2022 and the small number of events in PY 2023 (only one). We plan to only include ex post impacts from PY 2024 in the estimation of ex ante impacts for PY 2024.

Reference loads will be prepared for seven different segments to be able to fully leverage the segmented ex-post impacts from PY 2024. The PY 2024 impacts for each segment will be applied to the PY 2024 reference loads developed for each segment before aggregating loads and impacts to the system level ex-ante impacts. The main segment categories are building blocks. They are designed to ensure segment level results add up to the total and to enable production of ex-ante impacts, including busbar level results. Note that this analysis will exclude small commercial thermostat participants as they will be evaluated as part of the TD analysis. The six main small commercial CPP analysis segments will be:

- ✓ Commercial[2]
  - Notified & Coastal
  - Notified & Inland
  - Not notified & Coastal
  - Not notified & Inland
- ✓ Dual enrolled (CBP)
- ✓ Dual enrolled (CPP-TD)
- ✓ Agricultural

DSA will conduct CPP analysis net of ELRP impacts since all load reduction during ELRP events is counted toward ELRP performance. We will check for and remove any ELRP A1-A5 participants from the analysis on CPP event days. Similar to PY2022 and PY 2023, CCA customers will also be excluded

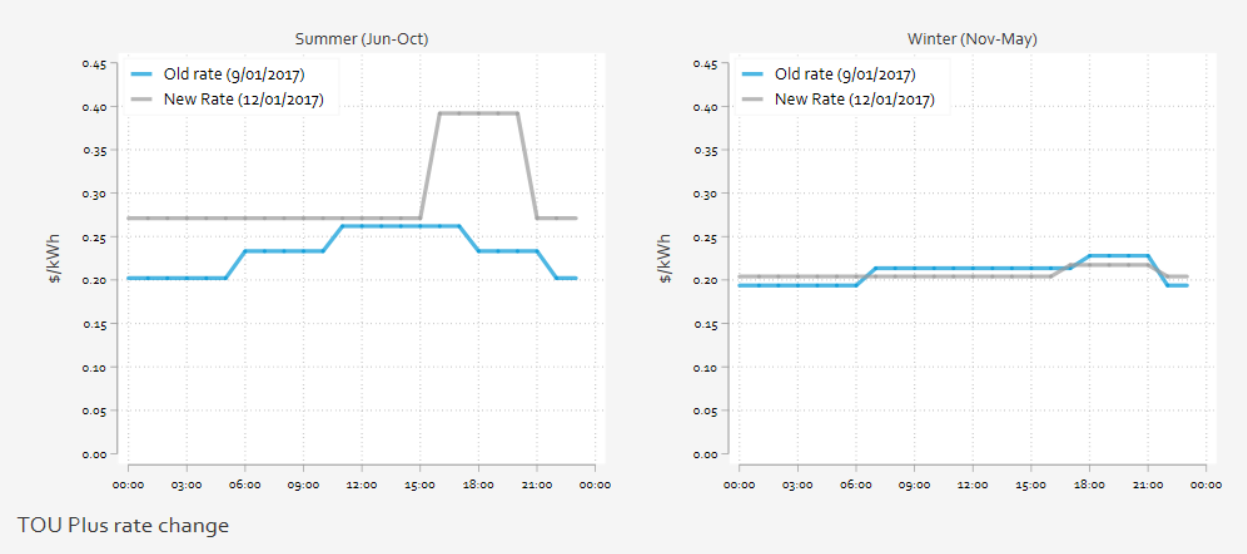
[2] In PY 2023 notification rates were about 94%, as defined by accounts belonging to customers receiving any notification. Depending on the size on population sizes in PY 2024, this segmentation may need to be revisited.

from the control pool because they were found to be systematically different from customers not on the San Diego CCA.

1.2 EVALUATION OF TOU IMPACTS

In 2016 SDG&E transitioned small commercial customers onto CPP-TOU rates, with the option of a TOU only rate. Agriculture customers were transitioned on TOU rates with the option of a CPP-TOU rate. The following year, in December 2017, the TOU window was adjusted from 11am to 6pm to 4pm to 9 pm in the summer and 5 to 8pm in the winter. The window remained at 11 am to 6 pm for agricultural customers and for commercial customers with pre-existing on-site generation. Figure 1 illustrates the change in rates[3] immediately before and after the transition, which occurred in the month of December 2017. The change in rate structure was more pronounced in the summer months when peak to off peak price ratio is highest and prices are higher than the old rate across all hours.

Figure 1: TOU Peak Windows for Non-Residential Customers



TOU Plus rate change

Measurement of TOU impacts requires the following:

- **12 months of pre-treatment data**: in order to assess the impact of the TOU usage in each month it is necessary to compare usage observed when enrolled customers are on TOU rates to usage in each month before the same enrolled customers were on TOU rates

[3] The exact rates have since been updated but the general structural and relative magnitude of peak to off-peak ratios remains similar

- **Comparison groups**: in order to distinguish between impacts due to the TOU rate and changes in usage explainable by other factors there must be a comparison group of similar customers which did not experience treatment, e.g. which were not on TOU rates during the pretreatment or during the post-treatment period. The comparison groups would ideally be equivalent, e.g. from the same population with the only difference being that the rate change was not experienced. However, this is not a requirement. If equivalent controls are not available synthetic controls can be constructed from other populations that did not experience a rate change during the pre-treatment or treatment period. [4]

SDG&E defaults new accounts onto TOU rates upon the opening of the new account. Therefore, pre-treatment data is not available and direct measurement of impacts of the TOU rate on load patterns is not possible. Therefore the PY 2024 evaluation will not include estimation of TOU impacts.

1.3 EVALUATION OF CPP EVENT AND NOTIFICATION AWARENESS

Percent impacts for customers on small CPP rates were below 1% in PY 2022 and were not statistically significant in PY 2023, despite the majority of customers being sent event notifications. A survey of Small Commercial customers on CPP rates will be conducted to identify customer awareness of the CPP event window and of event notifications.

The survey will be fielding in early October to maximize the salience and recall of the four PY 2024 CPP events called in early September.

Given the goal of identifying any changes that can be made to increase load reductions, the survey will target two test cells, corresponding to customers among the top 25th percentile of customers and those among the bottom 75th percentile. Customers among the top 25th percentile have tend to have more sites and more load, and therefore load reduction potential, across those sites. A $50 incentive per complete is planned for both test cells. The survey will be fielded online via email invitation.

[4] Non-comparable groups (e.g., large residential, medium commercial) could be used to construct a synthetic control group to estimate load impacts. However, this approach poses challenges given the default transition of residential customers to TOU rates beginning in 2019. For example, it would be necessary to constrain synthetic controls to customers that opted out of TOU rates, though even this group may have been influenced by general customer outreach related to the transition.

2 METHODS

Different evaluation methods will be applied to each program, given the research questions and considerations unique to each. Table 3 summarizes the key research questions pertinent to the evaluation of each program. The non-dispatchable load impacts for customers on CPP-TOU rates will not be re-evaluated as they were previously incorporated in the PY 2018 TOU evaluation and pre-treatment data is no longer available.

Table 3: Key Research Questions

	Research Question	CPP-TOU
1	What were the demand reductions due to program operations and interventions in 2024 – for each event day and hour?	✓
2	How do load impacts differ for customers who have enabling technology and/or are dually enrolled in other programs?[5]	
3	How does weather influence the magnitude of demand response?	✓
4	How do load impacts vary for different customer sizes, locations, and customer segments?	✓
5	What is the ex-ante load reduction capability for 1-in-2 and 1-in-10 weather conditions? And how well does it align with ex-post results and prior ex-ante forecasts?	✓
6	What concrete steps or experimental tests can be undertaken to improve program performance?	✓

Table 4 summarizes the data sources, segmentation and estimation methods to be used for each program. The segmentation is of particular importance because the evaluation will use a bottom-up approach to estimate impacts for each segment and ensure that aggregate impacts across segments add up to the sum of the parts. This will be done to address discrepancies between segment and aggregate impacts in past evaluations which took a top-down approach for aggregate impacts. Because impacts for each segment will be added together it is important that segmentation be

[5] There is no dual enrollment in CPP among technology enabled programs since the CPP-TD program ended in December 2023.

structured to be mutually exclusive and completely exhaustive. In other words, every customer needs to be assigned to exactly one segment. The segmentation approaches for each program are detailed below. By design, the segmentation differentiates customers who are expected deliver demand reductions– such as customers who sign up for event notification or technology to automate response – from customers who are expected to deliver little or no demand reductions.

Table 4: Evaluation Methods

	CPP-TOU (including CPP-TD
Data sources / samples	▪ All event season data for PY 2024 for: ✓ ~18k Small Commercial participants ✓ ~22k CPP-TOU opt outs (to be used for match control group) ✓ < 100 Ag participants ✓ < 100 participants in the CPP-TD smart thermostat enabled program
Segments	▪ Notification ▪ Climate zone (coastal vs inland) ▪ Dual enrollment (TD, CBP) ▪ Class (Ag vs Commercial)
Estimation method: Ex-post	▪ Matched control groups analyzed using diff-in-diff calculation for each segment. ▪ For small segments (N<70) individual customer regressions with synthetic control groups may be used
Estimation method: Ex-ante	▪ Weather normalized customer regressions by segment for reference loads ▪ Regression of historical event percent impacts versus weather for percent reductions ✓ If no clear weather – percent impact relationship is found weather will not be included in the ex ante impact model. Hour may be included for the technology enable TD segment

3 EVALUATION PLANNING PROTOCOL

Table 5 lists the study design question in the California Load Impact Protocols and details how the evaluation plan addresses each study design issue for each program.

Table 5: Study Questionnaire

#	Study design issue	CPP-TOU	CPP-TD
1	Will the evaluation rely on a control group? If so, how will it be developed and what comparisons between the treatment and control group will be made?	Yes: either through a site-specific regression model in which matched control hourly usage is used as a right-hand-side variable or a difference-in-differences model in which a matched control is selected with replacement on a stratified random sample of nonparticipants.	
2	Will the evaluation rely on pre-intervention data to establish a baseline?	Yes	
3	Will the study rely on a sample or include the full population receiving the intervention? If a sample is used, does it meet 90/10 precision requirements?	Full population	
4	Is the study designed to detect a specific effect size? And, if so, how was statistical power assessed?	NA	
5	What is the study's threshold for statistical significance?	90% confidence using a two-tailed test	
6	What is the size of the control and treatment groups, if applicable?	Treatment: ~18k including <100 Ag sites Control: ~6,639 Small Comm opt-outs[6] and ~3,310 Ag opt-outs	Non Res: <100 treatment and ~1k control group customers
7	How will the evaluation address outliers?	Customers for whom a matched control cannot be identified (due to score distance) will not be included. We expect it to be less than 1% of participants.	
8	How will the evaluation address attrition?	Analysis will be implemented using an intent to treat framework at the premise level. The treat-effect on the treated will adjust the changes in enrollment	
9	How will standard errors be calculated?	**Matched-Control Diff-in-Diff:** Standard errors produced by difference-in-differences **Individual site regressions:** Robust standard errors from regressions	
10	Will estimates be developed for subcategories? If so, please define them.	Yes, please refer to segmentation in Table 4	

[6] Estimate of small commercial sites never on CPP-TOU. Another roughly 7k sites opted out of CPP-TOU.

#	Study design issue	CPP-TOU	CPP-TD
11	Will energy savings be estimated?	No. For customer in TOU, we will apply historically measured point elasticities to estimate load impacts by season and time period on the TOU rate relative to a hypothetical non-TOU rate.	
12	Will overlap with energy efficiency programs be estimated?	No	No

4 DATA NEEDED

Demand Side Analytics delivered a data request in advance of the kickoff meeting, which is included as Attachment A. At a high level, the data request includes eight items:

1. A customer characteristic file for all SDG&E non-residential customers
2. Hourly interval data for all non-residential customers from October 1, 2023 to September 30, 2024
3. Technology deployment thermostat information
4. Weather data for relevant stations from October 1, 2023 to September 30, 2024
5. Ex-ante weather dataset for SDG&E and CAISO
6. Event data for October 1, 2023 to through September 30, 2024 for all programs (full PY2024)
7. Event notification data from October 1, 2023 through September 30, 2024
8. SDG&E and CAISO system load data from October 2022 to September 2024
9. Enrollment forecasts: Non-res Small CPP (ag and Commercial) and Small CPP-TD (PSW) forecasts
10. Outage data

5 TIMELINE

The evaluation work has been scoped into seven tasks. All but Task 6 (Project Management) have corresponding deliverables, laid out in Table 6. Key deliverables have been shaded in blue.

Table 6: Evaluation Timeline and Deliverables

Task	Item	Target Date
1.Conduct Project Initiation Meeting	Target Date for Contract Execution by SDG&E	7/9/2024
	Draft Project Schedule to SDG&E PM	9/11/2024
	Project Initiation Meeting Agenda to SDG&E PM	9/11/2024
	Project Initiation Meeting	9/16/2024
	Project Initiation Meeting Memo	9/18/2024
2. Develop Measurement and Evaluation Plan	Draft Evaluation Plan	9/20/2024
	Draft Data Request	9/20/2024
	SDG&E Review, Comments	9/27/2024
	Final Evaluation Plan	9/30/2024
	Final Data Request	9/30/2024
3.1. Data Collection and Validation	SDG&E Data Transfer & DSA Validation	9/30/2024-10/21/2024
3.2. Ex Post Impact Analysis	Present Draft Ex Post Load Impacts	12/7/2024
	SDG&E comments on Draft Load Impacts	12/15/2024
	Ex Post Load Impact Table Generators	12/22/2024
3.3. Ex Ante Impact Analysis	Deliver Draft Time Temperature Matrices	1/16/2025
	Present Draft Ex Ante Load Impacts	1/30/2025
	SDG&E comments on Draft Load Impacts	2/13/2025
	Ex Ante Load Impact Table Generators	2/13/2025
4. Prepare Reports	Draft Evaluation Report	2/17/2025
	SDG&E comments on Draft Evaluation Report	3/3/2025
	Final Evaluation Report	3/10/2025
5. Presentation of Results	Internal SDG&E Presentation	TBD - June 2025
	Draft M&E Workshop Slides	5/15/2025
	SDG&E comments on Draft M&E Workshop Slides	5/30/2025
	Final M&E Workshop Slides	6/23/2025
	Public M&E Workshop	TBD - July 2025
6. Project Management and Progress Reporting	Weekly or biweekly check-ins	Ongoing
7. Database Documentation	Produce database files	3/1/2025