



Demand Side Analytics
DATA DRIVEN RESEARCH AND INSIGHTS

EVALUATION PLAN FINAL

2020 SDG&E Residential AC Saver DA and Small Commercial Demand Response



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Electric
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TABLE OF CONTENTS

1	Introduction.....	2
1.1	EVALUATION CONSIDERATIONS: TOU.....	6
1.2	EVALUATION CONSIDERATIONS: CPP-TOU.....	6
1.3	EVALUATION CONSIDERATIONS: CPP-TD.....	7
1.4	EVALUATION CONSIDERATIONS: NON-RESIDENTIAL AC SAVER DA.....	9
1.5	EVALUATION CONSIDERATIONS: RESIDENTIAL AC SAVER DA.....	11
2	Methods.....	13
3	Evaluation Planning Protocol.....	15
4	Data Needed.....	16
5	Timeline.....	17

Tables

Table 1:	Program History.....	3
Table 2:	Deliverables Specifications.....	4
Table 3:	Baseline Definitions.....	9
Table 4:	Baseline Definitions.....	10
Table 5:	Residential Baseline Definitions.....	12
Table 6:	Key Research Questions.....	13
Table 7:	Evaluation Methods.....	14
Table 8:	Study Questionnaire.....	15
Table 9:	Evaluation Timeline and Deliverables.....	17

1 INTRODUCTION

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

- Non-residential: CPP-TOU, CPP-TD, ACSDA
- Residential: ACSDA.

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 energy savings and 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 to explicitly address the 12 questions in the planning protocol.

Table 1 summarizes the history, populations, and evaluation objectives for each program.

Table 1: Program History

Program Element	CPP-TOU	CPP-TD	AC Saver DA
Year introduced	<ul style="list-style-type: none"> January 2014 	<ul style="list-style-type: none"> Thermostats: 2012 	<ul style="list-style-type: none"> Thermostats: 2012 AC Saver Day Ahead: 2018
Year Defaulted	<ul style="list-style-type: none"> 2016 for small commercial 	<ul style="list-style-type: none"> NA 	<ul style="list-style-type: none"> NA
# of Participants	<ul style="list-style-type: none"> ~115k Small Comm participants ~11 Ag participants 	<ul style="list-style-type: none"> 11k devices (1.8k sites) on commercial dispatchable rates 	<ul style="list-style-type: none"> Commercial: ~7k devices (1.6k sites) on non-dispatchable Residential: 17k accounts including Nest (BYOT only) and ecobee (BYOT and free)
Historical events (last 3 years)	<ul style="list-style-type: none"> 2016 – 1 2017 – 3 2018 – 6 2019 – 0 2020 – 4 	<ul style="list-style-type: none"> 2015 – 5 2016 – 1 2017 – 3 2018 – 6 2019 – 0 2020 – 4 	<ul style="list-style-type: none"> 2015 – 5 2016 – 1 2017 – 3 2018 – 16 non-res, 18 res 2019 – 19 non-res, 20 res 2020 – 17 non-res, 17 res
2019 Evaluation Dispatchable Ex-post and Ex-ante	PY2018: <ul style="list-style-type: none"> Ex-post (2-6pm) – 2.7 MW Ex-ante portfolio (1-6pm) – 4.8 MW PY2019: <ul style="list-style-type: none"> No Events 	PY2018: <ul style="list-style-type: none"> Ex-post (2-6pm) – 3.3 MW Ex-ante (1-6pm) – 1.4 MW PY2019: <ul style="list-style-type: none"> No Events 	<ul style="list-style-type: none"> Non & quasi res <ul style="list-style-type: none"> Ex-post (6-8pm) – 0.52 MW Ex-ante (4-9pm) – 0.74 MW Residential <ul style="list-style-type: none"> Ex-post (6-8pm) – 3.76 MW Ex-ante (4-9pm) – 5.92 MW
Dual participation (2018 Peak day)	<ul style="list-style-type: none"> Overlaps with AC Saver Day Of and CBP (~2k accounts) 	<ul style="list-style-type: none"> Limited 	<ul style="list-style-type: none"> NA: ACSDA devices are not dispatched on CPP event days and participants cannot be dual enrolled in Summer Saver (Res) or AC Saver DO (Non-Res)
Enabling tech	<ul style="list-style-type: none"> AC Saver switches 	<ul style="list-style-type: none"> Ecobee thermostats 	<ul style="list-style-type: none"> Ecobee & Nest thermostats

Table 2: Deliverables Specifications

Program Element	CPP-TOU	CPP-TD	ACSDA
Ex-post	<ul style="list-style-type: none"> NA (no events) 	<ul style="list-style-type: none"> NA (no events) 	<ul style="list-style-type: none"> 2019
Ex-ante	<ul style="list-style-type: none"> 12-year, 4-9pm RA window only 	<ul style="list-style-type: none"> 12-year, 4-9pm RA window only 	<ul style="list-style-type: none"> 12-year, 4-9pm RA window only Time temp matrix
Comments	<ul style="list-style-type: none"> Small commercial only Excludes all TD accounts 	<ul style="list-style-type: none"> To emulate discontinuation of auto-enroll, only count first account as enrolled (assume disenrollment thereafter). Previous analyses assumed continuous enrollment, in alignment with auto-enroll. Report impacts per customer, per thermostat, as % of cooling load Ex ante impacts estimated on per connected thermostat basis Update connectivity decay analysis to inform ex ante forecasts. Address discontinuation of auto-enroll, as described above and include devices purged pre 2020 to ensure complete device enrollment picture. 	
Analysis segments	<ul style="list-style-type: none"> Notification Climate zone (coastal vs inland) Dual enrollment (AC Saver DO, CBP) Solar 	<ul style="list-style-type: none"> Rate (PSW vs CPP-D) Rate size (Small, Med, Large) Climate zone (coastal vs inland) 	<ul style="list-style-type: none"> Both: Climate zone (coastal vs inland) Non-residential: <ul style="list-style-type: none"> Rate (Non-res, Quasi-res) Rate size (Small, Med, Large) Residential: <ul style="list-style-type: none"> Rate (TOU vs flat) Tech (Free ecobee vs BYOT ecobee vs BYOT Nest)
Recent changes to consider			<ul style="list-style-type: none"> 2020: Purge of disconnected devices 2020: Discontinuation of auto-enrollment of subsequent accounts at an existing site

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 in PY2018 to 2pm to 6pm.

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 or and devices on non-dispatchable rates are curtailed on AC Saver DA days. The AC Saver DA events can be dispatched at any time between 12 pm to 9 pm (on-peak hours) for a maximum of 4 consecutive hours and nearly all events in 2018 and 2019 were called from 6-8pm. In previous years, devices now on AC Saver DA and CPP-TD had been dispatched from 2-6 pm during SCTD events.

These recent changes introduce two additional considerations beyond the standard evaluation objectives of developing ex-post and ex-ante impacts. First, there was a purge of disconnected devices in 2020. We can create a full list of past participants using past data and have a clearer insight to the connectivity of devices in 2020. Second, there has been a discontinuation by SDG&E of their auto-enrollment process. New accounts moving into previously enrolled sites will no longer be automatically enrolled into the programs. These adjustments are expected to modify the results of the survival analysis and isolate thermostat disconnectivity from customer churn. We will assume that enrollment ends upon move-out of the first account enrolled at a given site. We will apply this rule retroactivity to enrollment in previous program years to ensure an appropriate comparison when updating survival rate estimations. To support SDG&E's enrollment forecasting efforts we will derive a participant churn rate in addition to updating the survival analysis.

SDG&E communicated during the Kickoff meeting that it might be possible to obtain and use end use device data for supplemental evaluation purposes related to TD programs, specifically residential ecobee devices enrolled in eco+. As described, DSA is currently evaluating eco+ deployments across the US and Canada¹. We have provided utility specific reporting for client utilities and would be well positioned to provide this for SDG&E if data permissions were granted.

All enrolled participants in these demand response programs experienced multi-day dispatch concurrent with CAISO system emergencies in mid-August and early September. These emergencies were driven by extreme heat across the region coupled with supply shortages, culminating in rolling outages on several occasions. For all programs, we will remove non-event days that experienced an outage. Because in some cases outages were concurrent with demand response events, attention will need to be paid to the correct per-customer impacts that get incorporated into ex ante estimates. That is, while ex post performance may include some effect dilution due to outages, this should not affect ex ante modeling.

¹ <https://www.ecobee.com/assets/static/eco-EMV-Executive-Summary-20e4e62c30a41ae00d7c430c24335532.pdf>

There are also considerations specific to evaluating each program. These considerations stem from a variety of factors including historical weather patterns and the availability and quality of treatment and control populations for analysis. The considerations for each program are described below.

1.1 EVALUATION CONSIDERATIONS: TOU

The small commercial TOU program will no longer be evaluated. The intervention began in 2014 and small commercial and small agricultural customers were defaulted onto TOU in 2016. We recommend against evaluating the persistence of customer response to the small commercial TOU structural changes. Due to the lack of RCT design, the small effect size, the time elapsed since the initial intervention, and the ongoing default transition of residential customers to TOU rate (leading to a lack of a control group), we cannot confidently attribute changes in energy use to SMB TOU rates. For these reasons, the TOU evaluation was omitted in PY2019 and similarly will no longer be evaluated in PY2020.

1.2 EVALUATION CONSIDERATIONS: CPP-TOU

For the small commercial CPP-TOU population (whose rates also include a TOU component), there are multiple considerations relevant to the evaluation, including

The only available control group candidates are customers who opted out of default CPP-TOU. All small customers were defaulted to CPP-TOU and roughly 5.5% (6,639) customers opted out. Because they opted out the CPP-TOU, they are not the ideal candidate pool, but are the only available controls.

Developing a matched control group requires more care.

- ✓ Matching needs to account of the key driver of opt-outs to mitigate self-selection. The structural bill impacts were not available for the PY2016 evaluation. Our recommendation to either include the structural bill impacts in the propensity score model or include a proxy such as the percentage of annual consumption occurring during CPP like hours.
- ✓ Matching for all customers cannot be done on a one-to-one basis. The matching must be done with replacement, meaning that the same control group candidate may be used as a control multiple-times.
- ✓ Matching needs to pay careful attention to both consumption levels and load shapes. We recommend a two-stage matching process. First, identify customers with similar energy consumption patterns. Then, identify customers with similar load patterns.

The notification data will need to be analyzed early and thoroughly. Because of limited success with event notifications in 2016, one of the first tasks needs to be a thorough analysis of notification data. What share of customers has been provided notification information? Of the customers who provided notification information, was the notification sent for each event? Was it

opened? Are there specific steps that increase the share of successful event notifications? Customer who signed up for notification will be segmented from customer were not receiving notifications. We expect customers who receive notification to be more responsive to event dispatch and plan to avoid mixing them up with customers who were did not sign up for notification to avoid diluting their impacts.

The number of events and the event conditions play a significant role in the ability to evaluate impacts. The treatment effect is easier to detect if there are multiple events. SDG&E called a total of one event in 2016, three events in 2017, and six events in 2018, and no events in 2019.

A time-temperature matrix will also be provided in addition to the standard weather year ex post impact tables. A time temperature matrix shows the expected change in hourly use as a function of the temperature conditions and the event start and the end hour.

Customers who elected to be notified or adopted enabling technology will be analyzed separately from customers without notification. Pooling the data of customers who did and did not provide notification can dilute real impacts. Our recommendation is to analyze these groups separately from the start and aggregate results. If impacts for customers without notification cannot be distinguished from zero, we recommend setting them aside – there is no expectation of price response when customers are unaware of CPP events. However, this means load impacts for customers who are actively participating are not diluted. Implementing the analysis for each of the key segments also makes it simpler to net out dual enrollments and estimate portfolio impacts.

Results need to be segmented by four different dimensions. 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. We also plan to produce results for additional categories, such as industry type. Note that this analysis will exclude small commercial thermostat participants as they will be evaluated as part of the SCTD analysis. The four main small commercial CPP analysis dimensions will be:

- ✓ Class (Commercial vs Agricultural)
- ✓ Enrollment in event notification (Y/N)
- ✓ Dual enrollment (by program)
- ✓ Net metering status (Y/N)

1.3 EVALUATION CONSIDERATIONS: CPP-TD

- **Use of matched control group.** SDG&E has confirmed that no sizable randomly assigned control group was withheld from event dispatch for the 2019 events. Because a control group was not withheld, we will rely on a matched control group. As with the PY2017 and PY2018 evaluations, we may need to employ a synthetic control group approach for the quasi-

residential population given the unique and highly correlated load patterns among this population.

- **Results need to be segmented by different dimensions.** 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. The three main analysis dimensions for the updated Ex Ante impacts will be:
 - ✓ Class (Small, Medium, Large)
 - ✓ Rate (PSW, CPP-D)
 - ✓ Climate zone (coastal vs inland)
- **Effect sizes should be larger and easier to detect.** Because of automation, the percent load reductions from TD customers should be larger than from customers without technology. However, air conditioner loads are a smaller share of small and medium customer loads. As a result, care needs to be taken to produce well matched and precise control groups.
- **Device connectivity and trends will be incorporated.** As for PY2018 and PY2019, we will determine device connectivity and trends using thermostat first / last online and program enrollment dates, taking into account the classification rule changes we'll implement to incorporate the auto-enroll discontinuation. Importantly, some sites previously classified as disconnected will now no longer be counted as enrolled. Ex ante impacts will be provided for connected, disconnected, and all thermostats.
- **Ex ante impacts will be reported for the average customer and for the average thermostat**
- **The non-residential CPP-TD analysis will also be conducted using the CAISO baseline protocols.** These baseline results should be compared with the evaluation results and include Day matching and Weather matching. The baselines used for each will align with the recommendations in the California ISO Baseline Accuracy Assessment Report, summarized in Table 3.

Table 3: Baseline Definitions

Customer Segment ²	Weekday	Baselines Recommended ³	Adjustment Caps
Residential	Weekday	4 day weather matching using maximum temperature	+1.4 / -1/1.4
		Highest 5 of 10 day matching	+1.4 / -1/1.4
	Weekend	4 day weather matching using maximum temperature	+1.4 / -1/1.4
		Highest 3 of 5 weighted day matching	+2 / -1/2
Non-residential	Weekday	4 day weather matching using maximum temperature	+1.4 / -1/1.4
		10 of 10 day matching	+1.2 / -1/1.2
	Weekend	4 day weather matching using maximum temperature	+1.4 / -1/1.4
		4 of 4 day matching	+1.2 / -1/1.2

1.4 EVALUATION CONSIDERATIONS: NON-RESIDENTIAL AC SAVER DA

- **Use of matched control group.** SDG&E has confirmed that no sizable randomly assigned control group was withheld from event dispatch for the 2018, 2019, or 2020 events. Because a control group was not withheld, we will rely on a matched control group. As with the PY2017 evaluation, we may need to employ a synthetic control group approach for the quasi-residential population given the unique and highly correlated load patterns among this population.
- **Results need to be segmented by two different dimensions.** 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. We also plan to produce results for additional categories, such as industry type. The main analysis dimensions will be:
 - ✓ Class (Small, Medium, Large, Quasi-residential⁴)
 - ✓ Climate zone (coastal vs inland)
- **The data regarding thermostat opt-out rates should be analyzed.** Opt-outs tend to occur gradually over time and SDG&E has been undertaking an effort to lower event opt out by TD customers. We have ample experience with Nest and Ecobee data.

² Residential and non-residential designations are based on customer rate class from that customer’s local distribution company. That is, if a customer is served under a non-residential rate from its LDC, that customer is classified as a non-residential customer.

³ All baselines will include a 2 hour pre and post period buffer and a 45-day look back limit. Ineligible days will include ISO holidays (excludes President’s, Columbus, and Veterans Days), weekends and ACSDA event and award days. Participants in other DR programs will be excluded.

⁴ Post-purge enrollment analysis conducted over the summer indicated there are only about a dozen quasi-residential sites which remain enrolled after removal of about a thousand long disconnected sites.

- **Effect sizes may be smaller and more difficult to detect that CPP-TD impacts.** Although load response is automated, the percent load reductions from ACSDA customers were lower than CPP-TD impacts in PY2018, in part due to the late typical event window (6-8pm), the typically low non-residential loads at this time of day, and the tendency of CAISO to dispatch ACSDA on days that are cool in the SDG&E territory and may not have meaningful AC load to curtail. In addition, air conditioner loads are a smaller share of small and medium customer loads. As a result, care needs to be taken to produce well matched and precise control groups.
- **Device connectivity and trends will be incorporated.** As in PY2018 and PY2019, we will determine device connectivity and trends using thermostat first / last online and program enrollment dates, taking into account the classification rule changes we'll implement to incorporate the auto-enroll discontinuation. Importantly, some sites previously classified as disconnected will now no longer be counted as enrolled. Ex post and ex ante impacts will be provided for connected, disconnected, and all thermostats.
- **A time-temperature matrix will also be provided in addition to the standard weather year ex post impact tables.** A time temperature matrix shows the expected change in hourly use as a function of the temperature conditions and the event start and the end hour.
- **Ex post and ex ante impacts will be reported for the average customer and for the average thermostat**
- **The non-residential ACSDA analysis will also be conducted using the CAISO baseline protocols.** These baseline results should be compared with the evaluation results and include Day matching and Weather matching. The baselines used for each will align with the recommendations in the California ISO Baseline Accuracy Assessment Report, summarized in the table below. Note that the Residential baseline will be used for Quasi-residential customers.

Table 4: Baseline Definitions

Customer Segment ⁵	Weekday	Baselines Recommended ⁶	Adjustment Caps
Residential	Weekday	4 day weather matching using maximum temperature	+1.4 / -1/1.4
		Highest 5 of 10 day matching	+1.4 / -1/1.4
	Weekend	4 day weather matching using maximum temperature	+1.4 / -1/1.4
		Highest 3 of 5 weighted day matching	+2 / -1/2
Non-residential	Weekday	4 day weather matching using maximum temperature	+1.4 / -1/1.4

⁵ Residential and non-residential designations are based on customer rate class from that customer's local distribution company. That is, if a customer is served under a non-residential rate from its LDC, that customer is classified as a non-residential customer.

⁶ All baselines will include a 2 hour pre and post period buffer and a 45-day look back limit. Ineligible days will include ISO holidays (excludes President's, Columbus, and Veterans Days), weekends and ACSDA event and award days. Participants in other DR programs will be excluded.

Customer Segment ⁵	Weekday	Baselines Recommended ⁶	Adjustment Caps
		10 of 10 day matching	+1.2 / -1/1.2
	Weekend	4 day weather matching using maximum temperature	+1.4 / -1/1.4
		4 of 4 day matching	+1.2 / -1/1.2

1.5 EVALUATION CONSIDERATIONS: RESIDENTIAL AC SAVER DA

- **Use of matched control group.** Because a control group was not withheld from the enrolled population during events, we will rely on a matched control group. Matches will be pulled from a sample of residential customers which was created in PY2019. We will use the same pool for the PY2020 matching. These customers have never been enrolled in demand response programs (ACSDA, CBP, Summer Saver, etc.).
- **Consideration of TOU default rate rollout in matching models.** Beginning in 2019, SDG&E began defaulting residential customers onto TOU rates, at a pace of about 75k per month. Because the switch to TOU rates can potentially affect underlying loads, TOU transition date will be included in the matching model as a predictor so that participants will be paired with a match that was transitioned to a TOU rate in the same time frame.
- **Results need to be segmented by five different dimensions.** 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. We also plan to produce results for additional categories, such as industry type. The main analysis dimensions will be:
 - ✓ Climate zone (coastal vs inland)
 - ✓ Technology / Channel (Free ecobee, BYOT ecobee, BYOT Nest)
 - ✓ Rate (TOU or not TOU, TBD based on the transition timing of the participants)
 - ✓ Solar/NEM status⁷
- **The data regarding thermostat connectivity rates should be analyzed.** Disconnections tend to occur gradually over time and SDG&E has been undertaking an effort to improve device connectivity. We have ample experience with Nest and Ecobee data to support this. As a separate project, DSA is working with SDG&E on an effort to reconnect thermostats.
- **Effect sizes may be smaller and more difficult to detect than CPP-TD impacts.** Although load response is automated, the percent load reductions from ACSDA customers were lower than CPP-TD impacts in PY2018, in part due to the late typical event window (6-8pm), the typically

⁷ Given SDG&E’s requests in PY2019 we will attempt to incorporate NEM status in the bottom up segmentation, as feasible given counts in individual research cells.

low non-residential loads at this time of day, and the tendency of CAISO to dispatch ACSDA on days that are cool in the SDG&E territory and may not have meaningful AC load to curtail. In addition, air conditioner loads are a smaller share of small and medium customer loads. As a result, care needs to be taken to produce well matched and precise control groups.

- **Device connectivity and trends will be incorporated.** As in PY2018 and PY2019, we will determine device connectivity and trends using thermostat first / last online and program enrollment dates, taking into account the classification rule changes we'll implement to incorporate the auto-enroll discontinuation⁸. Importantly, some sites previously classified as disconnected will now no longer be counted as enrolled. Ex post and ex ante impacts will be provided for connected, disconnected, and all thermostats.
- **A time-temperature matrix will also be provided in addition to the standard weather year ex post impact tables.** A time temperature matrix shows the expected change in hourly use as a function of the temperature conditions and the event start and the end hour.
- **Ex post and ex ante impacts will be reported for the average customer and for the average thermostat.**
- **The residential ACSDA analysis will also be conducted using the CAISO baseline protocols.** These baseline results should be compared with the evaluation results and include Day matching and Weather matching. The baselines used for each will align with the recommendations in the California ISO Baseline Accuracy Assessment Report, summarized in the table below.

Table 5: Residential Baseline Definitions

Customer Segment	Weekday	Baselines Recommended ⁹	Adjustment Caps
Residential ¹⁰	Weekday	4 day weather matching using maximum temperature	+1.4 / -1/1.4
		Highest 5 of 10 day matching	+1.4 / -1/1.4
	Weekend	4 day weather matching using maximum temperature	+1.4 / -1/1.4
		Highest 3 of 5 weighted day matching	+2 / -1/2

⁸ Nest thermostats are missing last online date.

⁹ All baselines will include a 2 hour pre and post period buffer and a 45-day look back limit. Ineligible days will include ISO holidays (excludes President's, Columbus, and Veterans Days), weekends and ACSDA event and award days. Participants in other DR programs will be excluded.

¹⁰ Also includes quasi-residential sites

2 METHODS

Different evaluation methods will be applied to each program, given the research questions and considerations unique to each. Table 6 summarizes the key research questions pertinent to the evaluation of each program. Note that all research questions apply to TD programs because it includes both an assessment of energy savings and of load impacts. The non-dispatchable load impacts for customers on CPP-TOU rates will not be evaluated as they were previously incorporated in the TOU evaluation.

Table 6: Key Research Questions

	Research Question	CPP-TOU	CPP-TD, ACSDA Res, ACSDA Non-Res
1	What were the demand reductions due to program operations and interventions in 2020 – 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?		✓
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 3 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 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 and energy

savings – 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 and energy savings.

Table 7: Evaluation Methods

	CPP-TOU	TD Programs
Data sources / samples	<ul style="list-style-type: none"> ▪ All event season data over the past four program years (2016-2019) for: <ul style="list-style-type: none"> ✓ 130k Small Comm ✓ 22k CPP-TOU opt outs (to be used for match control group) ✓ 216 Ag participants ✓ 3,816 Ag participants (to be used for match control group) 	<ul style="list-style-type: none"> ▪ All event season data¹¹ over the past four program years (2016-2019) for: <ul style="list-style-type: none"> ✓ 3.3k CPP-TD and Non-residential ACSDA participants ✓ 17,000 residential ACSDA participants ✓ 10,800 residential customers – to serve as a control group which was pre-defined in 2019 analysis
Data sources / samples	<ul style="list-style-type: none"> ▪ Notification ▪ Climate zone (coastal vs inland) ▪ Dual enrollment (AC Saver DO, CBP) ▪ Solar 	<ul style="list-style-type: none"> ▪ Rate ▪ Size (Small, Med, Large) ▪ Climate zone (coastal vs inland) ▪ Tech / channel (Residential only) ▪ Solar (Residential only)
Estimation method: Ex-post	NA	<ul style="list-style-type: none"> ▪ CPP-TD: NA ▪ ACSDA: <ul style="list-style-type: none"> ○ Matched control groups analyzed using fixed effects diff-in-diff regression for each segment. ○ CAISO baselines will also be calculated.
Estimation method: Ex-ante	<ul style="list-style-type: none"> ▪ Weather normalized customer regressions by segment for reference loads ▪ Price elasticities interacted with weather 	<ul style="list-style-type: none"> ▪ Weather normalized customer regressions by segment for reference loads ▪ Regression of historical event percent impacts versus weather for percent reductions

¹¹ Given that ACSDA events are called under a variety of weather conditions we will use all relevant data to identify a set of proxy days similar to each event. This approach worked well for the PY 2019 evaluation.

3 EVALUATION PLANNING PROTOCOL

Table 4 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 8: Study Questionnaire

#	Study design issue	CPP-TOU	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?	A matched control group will be developed for each segment from customers who opted out of CPP-TOU. The matching will be done with replacement.	A matched control group will be developed for each segment from non-TD customers
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?	To manage data volume, it may be necessary to select a 10% sample, stratified by segment	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: 115k Control: 6,639 Small Comm participants ¹² and 3,310 Ag participants	Non Res: 3k treatment and 3k control group customers Residential: 17k treat, 11k control pool
7	How will the evaluation address outliers?	Customers for whom a matched control group 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?	FE diff-in-diff regression using clustered (at premise level), robust standard errors	
10	Will estimates be developed for subcategories? If so, please define them.	Yes, please refer to segmentation in Table 3	
11	Will energy savings be estimated?	No. For customer in TOU, we will analyze whether customer changed when they use energy in response to the change in the TOU rate structure.	
12	Will overlap with energy efficiency programs be estimated?	No	No

¹² Estimate of small commercial sites never on CPP-TOU. Another roughly 7k sites opted out of CPP-TOU.

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 or 15-minute interval data for all non-residential customers from October 1, 2015 to September 30, 2020
3. Technology deployment thermostat information
4. Weather data for relevant stations from November 1, 2019 to September 30, 2020
5. Ex-ante weather dataset for SDG&E and CAISO
6. Event data for October 1, 2014 to through September 30, 2020 for all programs (full PY2020)
7. Event notification data from November 1, 2019 to September 30, 2020
8. SDG&E and CAISO system load data from 2019-2020
9. Enrollment forecasts: AC Saver Day Ahead Res and Non-res, CPP forecasts
10. Outage data
11. Customer characteristic file for all residential customers ever enrolled in ACSDA and the sample of 10,800 residential premises from November 1, 2019 to September 30, 2020
12. Hourly interval data 2014 to September 30, 2020 for all residential customers ever enrolled in ACSDA and the sample of 10,800 residential premises from November 1, 2019 to September 30, 2020

5 TIMELINE

The evaluation work has been scoped into seven tasks. All but Task 6 (Project Management) have corresponding deliverables, laid out in Table 5.

Table 9: Evaluation Timeline and Deliverables

Task	Deliverable PY 2020	Due Date	Completed
Task 1 Conduct Project Initiation Meeting	PI Meeting:	Mid-September 2020	9/3/2020
	PI Meeting Memorandum:	Five business days after the PI Meeting	9/10/2020
Task 2 Develop Measurement and Evaluation Plan	Draft EM&V Plan:	End of September	9/24/2020
	Final EM&V Plan:		
Task 3.1 Data Collection and Validation	Draft Data Request	Within 5 days of kickoff meeting	9/10/2020
	Final Data Request	Within 10 days of kickoff meeting	
Tasks 3 & 4 Impact Analysis & Reports	Draft Ex Post LI Estimates (table generators/report)	Due late December, 2020	
	Final Ex Post LI Estimates (table generators/report)	Due early January, 2021	
	Draft Ex Ante LI Estimates (table generators/report)	Due February 15th, 2021	
	Final Ex Ante LI Estimates (table generators/report)	Due March 1st, 2021	
	Final hourly and monthly Ex Post and Ex Ante datasets	Due March 1st, 2021	
	Executive Summary write-up for April 1st reports	Due March 15th, 2021	
	Non-technical abstract for CALMAC website	Due April 10th, 2021	
Task 5 Presentation of Results	Presentation	Date to be determined	
Task 7 Database documentation	2017 Integrated project database	March 1st, 2021	
	2017 Database specifications and documentation	March 1st, 2021	