



# 2020 Default TOU Pilot Evaluation Plan

Prepared for:  
San Diego Gas and Electric Co. (SDG&E)

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# 1 Introduction and Key Issues

This document summarizes the evaluation plan for the San Diego Gas & Electric Company's (SDG&E's) Residential Default Time-of-Use (TOU) Program Year 2020 (PY2020). 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.<sup>1</sup>

Nexant held a project kickoff meeting on January 6, 2021 with SDG&E staff to obtain feedback on the overall evaluation approach, review the work schedule, and to discuss any new or emerging issues that should be addressed in the evaluation. The following key issues were discussed:

- The ex post methodology will apply a weather-normalized pre- and post-treatment analysis instead of a difference-in-differences approach used in prior evaluations since there are not enough customers for a control group.
- Load impacts will be estimated separately for each rate option, customer segment (Non-CARE/FERA and CARE/FERA) and by climate region. Load impacts will be estimated for each time period (hourly, rate period-specific, and daily), and aggregation level (per premise, aggregate). Uncertainty ranges of impacts will also be provided at these levels.
- Net Energy Metering (NEM) customers will be examined as a separate ex post analysis segment to see if there are any insights to be gained from those that have switched from a tiered rate to a TOU rate.
- Ex ante forecasts will require re-estimation of ex post impacts at a finer level of granularity in order to establish a relationship between impacts and weather. Nexant will examine impacts at the weekly level to allow for greater variation in load impacts and weather for use in estimation of the ex ante forecasts.
- SDG&E will develop a customer enrollment and COVID-19 effect forecast for the ex ante forecast.
- Analysis will be performed to investigate whether impacts for customers on TOU rates have changed significantly due to COVID-19 by comparing weather-normalized usage before and after the start of the pandemic.

The remainder of this document proceeds as follows: Section 2 presents a summary of the methodology for estimating ex post load impacts for Default TOU 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 discusses the data request. 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. Appendix A presents Nexant's budget by task for this project.

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<sup>1</sup> California Public Utilities Commission Decision 08-04-050 issued on April 28, 2008 with Attachment A.

## 2 Ex Post Load Impact Estimation

The estimation of load impacts by rate period and changes in annual and seasonal energy use for each pilot rate are key pilot objectives. Also of interest is how load impacts vary across climate regions and customer segments (e.g., Non-CARE/FERA customers and CARE/FERA customers) for two of the three climate regions, since CARE/FERA customers could not be defaulted in the hot climate region. The approach that will be used to estimate load impacts are summarized below and is consistent with the approach applied in the prior evaluations.

### 2.1 Weather-Normalized Pre- and Post-Treatment Analysis

In the previous Default TOU evaluations, a combination of matched control group and randomized encouragement design methodologies were used to evaluate SDG&E's TOU Rate 1 and Rate 2, respectively. By the summer of 2020, the majority of SDG&E's residential customers have been defaulted onto a TOU rate or have chosen to opt out. Due to this, there are not enough customers remaining that have not been exposed to the TOU rates from which to create a comparison group. To circumvent this challenge, Nexant will perform a comparison of participants' energy usage prior to being defaulted onto the TOU rate with their energy usage after being defaulted onto the TOU rate. The comparison will be weather-normalized in order to remove the impacts of varying weather characteristics in each year. This approach will allow for a meaningful estimation of load impacts in the absence of a proper comparison group while being able to utilize the vast majority of the data that has already been processed from the previous evaluations.

The general steps for this approach are: generating statistical estimates of usage as a function of weather, applying the resulting regression coefficients to average weather conditions, and calculating the difference between pre-treatment and post-treatment normalized usage values. The difference represents the change in consumption under normal weather conditions.

First, Nexant will fit a degree-hour regression model separately for each premise and time period. A typical regression specification of this nature is as follows:

$$kW_{i,t} = \alpha_i + \beta_{Cool} \times CDH_{i,t} + \beta_{Heat} \times HDH_{i,t} + \varepsilon_{i,t}$$

In the above equation, the variable  $kW_{i,t}$  equals electricity usage during the time period of interest, which might be each hour of the day, peak or off-peak periods, daily usage or some other period. The index  $i$  refers to customers and the index  $t$  refers to the time period of interest. The estimating database would contain electricity usage data during both the pretreatment and post-treatment periods for all participants. The terms  $CDH_{i,t}$  and  $HDH_{i,t}$  refer to the calculated cooling degree-hours or heating degree-hours at given base temperatures during the time period. Cooling or heating degree-hours are calculated as the difference between the mean temperature of the hour and a base temperature, usually 65°F. Cooling degree-hours are used if the actual temperature is above the base temperature, while heating degree-hours are used if the actual temperature is below the base temperature. Nexant will test a variety of base temperatures, whether to use a fixed or variable degree-hour approach, and alternative temperature measurements to determine which specification performs best. Lastly, the  $\beta_{Cool}$  and  $\beta_{Heat}$  terms represent the estimated coefficients from the temperature terms.

After the optimal model is selected, the coefficients are applied to average-year weather conditions. For this purpose, the 1-in-2 SDG&E or CAISO weather scenarios typically used for ex ante forecasts can be applied. Also, the National Oceanic and Atmospheric Administration (NOAA) produces 30-year normal weather series that could also be used. However, this data may not capture more recent trends in climate change. Lastly, load impacts for each segment will be estimated by taking the difference between the pre-treatment and post-treatment weather-normalized usage values.

PY2020 is unique in that from approximately March onwards, the COVID-19 pandemic led to stay-at-home orders and commercial shutdowns. This has led to noticeable changes in residential load patterns that fall outside the explanation of seasonality. Nexant will explore the possibility of including a term in the regression model that attempts to capture the increase in home occupancy and other effects of the pandemic. For example, Google and Apple have regularly published mobility trend data going back to February 2020. These databases show how much more or less people are going to specific places, such as residences and workplaces. They are specific down to the city level and can potentially be used to adjust for the pandemic's effects on residential load.

## 2.2 COVID-19 Assessment

It will be important to investigate whether reference loads and impacts for customers on TOU rates have significantly changed between 2019 and 2020 due to COVID-19. When analyzing the COVID-19 effect, it is important to compare reference loads and impacts for the same group of customers over time. A comparison of customers enrolled in one year with those enrolled in the following year is not a valid estimate of COVID-19 since any observed difference might be due in large part to changes in the participant population rather than changes in behavior of customers that participated in both years.

As such, reference loads and load impacts for the COVID-19 analysis will pertain to the populations of customers that remained enrolled on TOU rates over the same time periods. Pilot participants who were enrolled starting in April 2018 will be analyzed for changes in loads and impacts in spring and summer periods between PY2018, PY2019, and PY2020. Participants who were defaulted before the beginning of summer 2019 will be analyzed for changes to loads and impacts in summer periods for PY2019 and PY2020.

The outcomes of this analysis will help to inform the potential COVID-19 influence that is observed from the differences in load between 2018, 2019, and 2020 for the general population defaulted onto the TOU rates who are experiencing TOU and COVID-19 influences at the same time.

# 3 Ex Ante Load Impact Estimation

The goal of the ex ante analysis is to produce load impact estimates on average weekdays and monthly system peak days for each month under four distinct sets of system peaking conditions: SDG&E 1-in-2; SDG&E 1-in-10; CAISO 1-in-2; and CAISO 1-in-10. That is, rather than showing what the load impacts were under the conditions specific to the first few seasons of the pilot, the ex ante estimates project what the TOU rates should be expected to deliver under a series of conditions in the future. Towards that end, we must model how default TOU load impacts vary as a function of important variables like temperature.

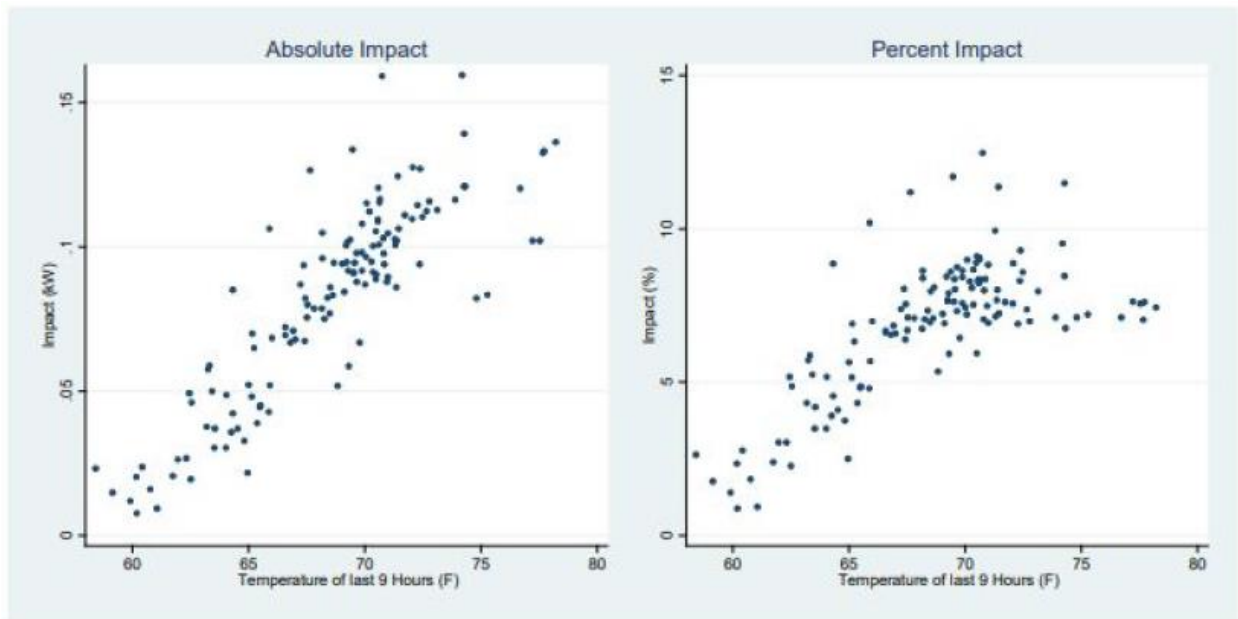
The estimates will be developed through the following four steps:



1. Assess how TOU impacts in each hour vary, by segment, as a function of weather conditions using regression.
2. Assess how reference load in each hour varies, by segment, as a function of weather conditions using regression.
3. Predict the reference loads and load impacts as a function of ex ante weather conditions for both SDG&E and CAISO peak scenarios.
4. Combine the reference loads and load impacts to fulfill the requirements of the CPUC Load Impact Protocols showing load with and without TOU rates in effect.

Figure 3-1 shows scatter plots of absolute (kW) and relative (percentage) TOU impacts during the peak period by temperature for summer weekdays in a previous TOU evaluation conducted by Nexant. As seen, there is a very strong relationship between temperature and TOU demand reductions, although there is also a fair amount of variation across different days with similar weather conditions.

**Figure 3-1: Example of Relationship between TOU Impacts and Weather**



The ex post impacts for the D-TOU pilot to date have been estimated at a monthly level. In order to establish a relationship between load impacts and weather variables as shown in the graph above, it will be necessary to re-estimate the ex post load impacts at a more granular level. For the PY2019 evaluation, the impacts used to build the ex ante model were estimated at the weekly level. Separate regression models will be estimated for each hour using hourly impacts (or loads for the reference load modeling) for each weekday or the average impacts (or reference load) across a week. A similar model will be used to predict impacts for the monthly system peak day. For monthly system peak days, a non-linear specification might be considered or, alternatively, a separate model could be estimated using data from weekdays with temperatures exceeding a certain temperature threshold or using only the top five highest load days from each month, for example.

Separate regression models relating TOU load impacts and reference loads to weather will be estimated for each hour, month, and customer segment (based on CARE/FERA status and climate

region). Nexant's validity testing for ex ante estimation will include in-sample model testing by comparing goodness of fit, bias, and precision of different model specifications. A number of models will be tested to estimate how load impacts change in response to weather and calendar. Our ex ante models tend to be fairly simple to make the models easy to explain (and illustrate) to stakeholders and make the linkage between ex post and ex ante models as straightforward as possible.

To provide aggregate (MW) load impacts, it will be necessary to develop an enrollment forecast. This has historically been provided by the utility for DR evaluations. However, given Nexant's prior work with the pilot attrition analysis, we propose to work with SDG&E to develop the enrollment forecast based on our combined knowledge.

In keeping with the requirements of the CPUC Load Impact Protocols, ex ante impact estimates will be developed for the following customer segments and conditions:

- 24 day types in each year (i.e., the monthly system peak day and average weekday for each month);
- 5 customer segments (hot non-CARE/FERA, moderate non-CARE/FERA and CARE/FERA, cool non-CARE/FERA and CARE/FERA) plus the service territory as a whole;
- 2 weather years (i.e., with 1-in-10 and 1-in-2 year conditions);
- 2 peak operational conditions (SDG&E and CAISO); 11 forecast years (i.e., 2020 through 2031); and
- 2 customer groups (i.e., average and aggregate).

Hourly estimates for each combination of the above will be provided in an MS Excel table generator in which the user can select and view each scenario and customer segment.

In the PY2019 D-TOU ex ante forecast, ex post impacts from November 2018 through October 2019 were used as inputs to the model specification. Because customer load and impacts are likely to be significantly different in 2020 than in previous years due to the COVID-19 pandemic, there is uncertainty in how to apply the results from PY2020 to future years. Nexant will carefully review the relationship of the ex post impacts and reference loads to temperature in PY2020 and compare them to the previous evaluations. Then, in collaboration with SDG&E, Nexant will determine the appropriate amount of influence for the PY2020 results on future years and thoroughly document the decision process.

## 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 PY2020 Default TOU Impact Evaluation**

Issue	Plan
1. What is the target level of confidence and precision?	10% precision with 90% confidence at the aggregate/average customer level ("90/10").
2. Ex ante estimation in addition to ex post?	Both ex ante and ex post load impact estimates will be developed in this evaluation.
3. If ex ante estimates are provided, are changes anticipated in program and/or customer characteristics?	Yes, the TOU population will change in the forecast horizon as more customers are added to and drop off the TOU rate. The enrollment forecast will account for changes in the population for specific customer segments.
4. Will impact persistence be addressed?	Yes, due to the potential impact of COVID-19, impact persistence across program years will be examined in this evaluation.
5. Are M&V activities needed?	No, the only data to be used by this evaluation is already collected by SDG&E in the course of providing electric service and implementing the pilot.
6. Will estimates be developed for geographic sub-regions?	Yes, both ex ante and ex post load impacts will be developed for SDG&E climate regions.
7. Will estimates be developed for sub-hourly intervals?	No.
8. Will estimates be developed for customer segments?	Load impact estimates will be developed for residential customers by CARE/FERA status, located in different climate regions, and subject to different rate options.
9. Will estimates be developed for day-types other than those required by subsequent protocols?	No.
10. Will the evaluation try to understand why the impact estimates are what they are?	Yes, the report will present a discussion of the ex post impacts, the relationship between ex post and ex ante load impacts and an analysis on the persistence of load impacts across seasons for a constant set of customers.



Issue	Plan
11. Will estimates of the number or percentage of free riders or structural benefiterers be developed?	No. Structural benefiterers were evaluated under the pilot evaluation and will not be revisited in this evaluation.
12. Is a control group being used in the analysis and, if so, how will you address potential bias?	No. Since the majority of residential SDG&E customers are expected to have been defaulted onto a TOU rate or have chosen to opt out, there are not enough customers remaining to create a control group.
13. For programs common across multiple utilities, will you conduct a joint evaluation?	The characteristics of the SDG&E Default TOU pilot are different enough from TOU pilots at Southern California Edison Co. (SCE) and Pacific Gas and Electric Co. (PG&E) that a joint evaluation is not appropriate.

## 5 Data Sources

All of the data required for this evaluation will be sourced from SDG&E. Nexant is currently discussing the approach to the data request and customers sampling with SDG&E. Table 5-1 presents data Nexant expects to request. Nexant may request additional information in subsequent data requests.

**Table 5-1: PY2020 Data Request 1**

Data Request	Detailed Description	Notes/Questions
<p><b>Customers who are currently enrolled on default TOU rates:</b> Demographics and pilot information</p>	<p>Please include the following data for all customers who are currently enrolled on a residential default TOU rate.</p> <ol style="list-style-type: none"> <li>1. Masked Utility ID Numbers tied to these customers.</li> <li>2. Customer account status</li> <li>3. Customer account start date (when the customer opened their account at their current premise)</li> <li>4. Current rate</li> <li>5. Current rate effective date</li> <li>6. Weather Station</li> <li>7. LPP sign-up indicator</li> <li>8. LPP sign-up date</li> <li>9. NEM indicator</li> <li>10. NEM start date</li> </ol>	<p><b>Use:</b> This data will be used to estimate load impacts</p> <p><b>Timeline:</b> ASAP</p>
<p><b>Interval Data:</b> for all customers specified in list provided by Nexant based on the forthcoming sample design</p>	<p>Please provide hourly electricity consumption data for the following:</p> <ul style="list-style-type: none"> <li>• All dates as described in forthcoming data request</li> <li>• All customers as specified in forthcoming data request</li> </ul> <p>Please note whether the interval data is provided in Pacific Daylight Time (PDT) or Pacific Standard Time (PST). If data is provided in sub-hourly intervals, please indicate whether the meter records kWh/hr (average hourly demand) or the kWh consumed over the time period. The following variables should be provided:</p> <ol style="list-style-type: none"> <li>1. Bill account number</li> <li>2. Premise ID</li> <li>3. Service Point ID</li> <li>4. Date</li> <li>5. Hour ending</li> <li>6. Average hourly kW or kWh</li> <li>7. Units of measurement</li> <li>8. Channel</li> </ol>	<p><b>Use:</b> This data will be used for load impact estimation</p> <p><b>Timeline:</b> TBD</p>

## 6 Detailed Work Plan

This section outlines the specific tasks and deliverables that Nexant will complete and deliver during the course of this evaluation. The first task was to conduct a project kickoff meeting, which was completed on January 6, 2021. Delivery of the final version of this evaluation plan will constitute the completion of Task 2. The work plan below begins with Task 3.

### 6.1 Task 3: Data Collection & Validation

Nexant is requesting key customer-level and other relevant data from the SDG&E Project Manager to support the project. This and subsequent data requests may include, but are not limited to, the following:

- Characteristics for all customers on default TOU rates, including (but not limited to) closest weather station, SDG&E-specific climate zone, and rate assignment
- Interval data for all customers specified via the sample design during the relevant period of interest
- Weather data

We will validate and clean the data provided and work closely with SDG&E to resolve any data issues.

#### Deliverables:

- Data Request
- Data Request Meeting
- Data Request Response

#### Due Dates:

In Progress  
TBD  
ASAP

### 6.2 Task 4: Ex Post Load Impacts

Nexant will use the data requested in Task 3 to estimate ex post load impacts for the second summer of the Residential Default TOU pilot, following the Load Impact Protocols. The ex post impact evaluations will include:

- Estimates of hourly, rate period-specific, and daily load impacts for residential customers on a per premise/customer (kW) and aggregate (MW) basis:
  - By pilot segment (Non-CARE/FERA and CARE/FERA by climate region)
- Estimates of the uncertainty-adjusted range of impacts based on a per premise/customer and aggregate basis
- COVID-19 analysis where ex post load impacts from the 2019 and 2020 spring and summer are estimated for the population of customers who remained on a TOU rate for the entirety of the seasons in both years.

Ex post load impact tables will be reported in an MS Excel table generator that utilizes a standardized set of input selection fields. The Nexant Project Manager will work with the SDG&E Project Manager to determine which selection options will apply to this evaluation. The table generator will clearly display a short explanation for any options that are not applicable. A presentation summarizing the methods and findings from Task 4 will be produced as part of Task 6.

**Deliverables:**

- Draft Ex Post Load Impacts
- Final Ex Post Load Impacts

**Due Dates:**

February 10, 2021  
February 16, 2021

## 6.3 Task 5: Ex Ante Forecast

Nexant will estimate ex ante load impacts for 11 years based on the enrollment forecast co-developed with SDG&E and the ex post estimates obtained in Task 4, in addition to ex post load impact estimates from the prior Default TOU Pilot evaluation. Hourly ex ante impacts on a per-customer and aggregate basis will be estimated for:

- Each monthly average weekday
- Each monthly system peak load day
- Four weather scenarios: 1-in-2 on utility peak days, 1-in-2 on statewide peak days, 1-in-10 on utility peak days, and 1-in-10 on statewide peak days
- An uncertainty-adjusted range of impacts, on an aggregate and per-called customer basis

Ex ante impacts will also be estimated for the same customer segments as the ex post estimates obtained in Task 4. Ex ante load impact estimates will be presented in an MS Excel table generator that utilizes a standardized set of input selection fields. The Nexant Project Manager will work with the SDG&E project manager to determine which selection options will apply to this evaluation. The table generator will clearly display a short explanation for any options that are not applicable. A presentation summarizing the methods and load impact forecast from Task 5 will be produced as part of Task 6.

**Deliverables:**

- Enrollment Forecast
- Draft Ex Ante Load Impacts
- Final Ex Ante Load Impacts

**Due Dates:**

February 5, 2021  
March 1, 2021  
March 5, 2021

## 6.4 Task 6: Reporting

In this task, Nexant will communicate the ex post load impact evaluation to SDG&E via a presentation. Nexant will develop a second presentation to communicate the ex ante load impacts.

Finally, Nexant will produce a detailed report documenting all of the analysis completed in Tasks 4 and 5 and all relevant findings. The report will incorporate information on the methods for both data collection and analysis. Ex post load impacts from the winter season that was evaluated in the SDG&E D-TOU Pilot Evaluation Final Report will be reproduced in this evaluation report in order to present ex post load impact findings for a complete 12-month period. Draft and final versions of the report will be produced. The draft version will incorporate any comments or suggested changes

based on feedback from the preliminary results included in the presentations described above. The final report will reflect suggested changes based on feedback from the draft report.

**Deliverables:**

- Draft Ex Post Load Impacts Presentation
- Draft Ex Ante Load Impacts Presentation
- Draft Evaluation Report
- Final Evaluation Report

**Due Dates:**

February 19, 2021  
March 5, 2021  
March 10, 2021  
March 19, 2021



## 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 Nexant.

**Table 7-1: Deliverable Summary by Task**

Task	Task Description	Deliverable	Due Date
1	Project Initiation & Check-in Meetings	Kickoff meeting	January 6, 2021
		Check-in meetings	Forthcoming- Weekly
2	Develop Measurement and Evaluation Plan	Draft evaluation plan	January 8, 2021
		Final evaluation plan	Five business days after comments
3	Data Collection & Validation	Data request	In Progress
		Data request meeting	TBD
		Data request response	ASAP
4	Ex Post Load Impacts	Draft ex post load impacts	February 10, 2021
		Final ex post load impacts	February 16 , 2021
5	Ex Ante Forecast	Enrollment forecast	February 5, 2021
		Draft ex ante load impacts	March 1, 2021
		Final ex ante load impacts	March 5, 2021
6	Reporting	Draft ex post load impacts presentation	February 19, 2021
		Draft ex ante load impacts presentation	March 5, 2021
		Draft evaluation report	March 10, 2021
		Final evaluation report	March 19, 2021



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